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Taking Them Into the Field: Mathematics Teacher Candidate Learning About Equity-Oriented
Teaching Practices in a Mediated Field Experience

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Abstract

Taking Them Into the Field: Mathematics Teacher Candidate Learning About Equity-Oriented
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Teacher education programs have been criticized as too theoretical with university courses disconnected from the practical realities of classrooms. This single case study investigates a model of teacher education that worked to bridge the coursework-fieldwork gap in teacher education. The Mediated Field Experience (MFE) is a field experience within a secondary mathematics methods course in a university-based teacher education program. Teacher candidates spent approximately one day each week observing two urban Algebra 1 classrooms that were taught by partner teachers who were implementing equity-oriented teaching practices. University methods course instructors accompanied the teacher candidates into the field and, together with the partner teachers, engaged in a cycle of planning, observing, debriefing, and reflecting. This cycle was conducted weekly for approximately seven weeks.

Drawing on theoretical insights from Cultural-Historical Activity Theory, I examined how the structures and activities of the MFE supported teacher candidates in learning about equity-oriented teaching practices. Guiding questions framed this research:

- 1) What is the Mediated Field Experience? How do the structures and activities of the MFE draw on practitioner and academic knowledge?
- 2) What are the experiences of the teacher candidates within the MFE?
- 3) What do teacher candidates learn about equity-oriented teaching practices within the MFE?

To capture these relationships, I analyzed videotape of the MFE debrief sessions, notes taken from classroom observations, post-MFE reflections completed by the teacher candidates, and interviews with teacher candidates, partner teachers, and university instructors.

Results indicate that the structures and activities of the MFE positioned the partner teachers as teacher educators. This enabled the teacher candidates to draw on partner teacher knowledge as a way to learn about equity-oriented teaching practice. Teacher candidates were able to notice “invisible” aspects of classroom practices, especially practices that were interactive and responsive to student thinking. The results of this study indicate that coursework that is closely tied to and purposefully draws on teacher knowledge supports teacher candidates in reframing their ideas about teaching and learning mathematics. Partnering with and positioning teachers as teacher educators allows teacher candidates to connect the practices promoted in their teacher education programs to the realities of implementing those practices in school classrooms.

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DEDICATION

To Deacon and Merrick, my best creations.

And to my husband Rob, who always understood that, for me, this was much more than a Ph.D.

Preface

This is a case study of a model of teacher education designed to support candidates as they negotiate their university coursework and fieldwork experiences. I focus on the Mediated Field Experience (MFE), a school-based field experience directly connected to a methods course in a university Teacher Education Program (TEP). The Mediated Field Experience is a response to the perennial problem in teacher education: the coursework-fieldwork gap. This study explores the structures, activities, and tools of the MFE, which aimed to support secondary teacher candidates as they learned about equitable teaching practices in mathematics.

This study's genesis lies in my own experiences as a teacher and teacher educator. I am the product of a university-based teacher education program and during my first few years of teaching, I experienced the coursework-fieldwork gap. I often wondered if there was a way I could have been more prepared to meet the needs of my students, especially students who had experienced so much failure in mathematics in the past. In my teacher preparation program, I was introduced to practices such as learning mathematics for understanding and learning in collaborative groups. However, in my first year of teaching, I was unprepared for the frantic and overwhelming experience and struggled to implement the practices I was so passionate about. During the nine years of teaching mathematics and mentoring novice teachers that followed, I wondered about how we might better prepare teachers for the complex work of teaching mathematics in ways that enabled all students to learn.

With my interest in both how to improve teacher education and how to better support students in learning mathematics, I decided to start graduate school and was hired as a teaching assistant for the secondary mathematics methods course. This was the first year the Mediated Field Experience was implemented. I found myself "joining the conversation" about teacher

education and how to better support candidates as they negotiate what they learn in the university with what they learn in the field. My hope is that this study represents the passion I share with many teachers and teacher educators as we all strive to figure out ways to support student success in mathematics through improving the field of teacher education.

Chapter 1

A Problem in Education, A Problem in Teacher Education

Why do so many students from marginalized populations struggle to succeed in mathematics? Students of color and students living in poverty are often far under-achieving in mathematics compared to their white and more affluent counterparts (Lubienski, 2002; Secada, 1992; Tate, 1997). International assessments such as the PISA (Programme for International Student Assessment)¹ and U.S. assessments such as the NAEP (National Assessment of Educational Progress)² and the SAT (Scholastic Aptitude Test)³ all demonstrate this gap. An examination of these data shows a clear and undeniable pattern: the inequitable achievement of students in mathematics by race and social class⁴.

To many, the disproportionate numbers of students who are proficient in mathematics, or mathematically literate⁵ (Gutstein, 2006) is a civil rights issue. Bob Moses, civil rights activist and mathematics educator wrote “...the most urgent social issue affecting poor people and people of color is economic access”, which can be achieved through mathematical literacy (Moses & Cobb, 2001, p. 5). Our society is rapidly changing, leaving behind the need for assembly-line workers and forging into a new technological territory where mathematics and science will dominate the workforce. As our country becomes increasingly technological, mathematics becomes a gatekeeper, allowing some people access to academic achievement, careers, and the

¹ <http://www.pisa.oecd.org>

² http://nationsreportcard.gov/math_2011/summary.asp

³ <http://professionals.collegeboard.com/data-reports-research/sat/data-tables>

⁴ I acknowledge the problematic nature of assessing student learning with standardized tests. However, test scores are not the sole evidence of the disparity in mathematics literacy between white affluent students, poverty-impacted students and students of color. Evidence such as drop-out rates and the number and type of mathematics courses taken (Lubienski, 2002) also demonstrates the inequity in mathematics education.

⁵ Gutstein (2006) makes the distinction between *functional literacy* (the skills and knowledge needed to function in society and which serves to reproduce the dominant interests of society) and *critical literacy* (the knowledge and skills needed to critically examine relationships between ideas and to “examine one’s own and others’ lives in relationship to socio-political and cultural-historical contexts” (p. 5). For the purposes of this study, mathematical literacy refers to Gutstein’s conception of critical literacy.

power to transform their own lives, while others remain powerless (Ladson-Billings, 1997; Schoenfeld, 2002, 2004). The dominant pedagogy in public school classrooms, commonly referred to as the Pedagogy of Poverty (Haberman, 1991), uses white, middle-class discourse, contexts, and norms. Students whose home worlds differ from their school world often find it impossible to cross these boundaries (Ladson-Billings, 1995; Phelan, Davidson, & Cao, 1991; Walkerdine, 1990). In order for students of color and students of poverty to become actively engaged citizens empowered to “understand and critique the existing social order” (Ladson-Billings, 1995, p.474), they must become mathematically literate through access to high-quality mathematics educational experiences.

Past teaching practices are not adequate to address differences in student achievement in today’s public schools. Teachers of mathematics must enact effective, equity-oriented teaching practices that support *all* students to learn rigorous mathematics. However, new teachers struggle to gain and apply skills that can positively impact historically underrepresented students in mathematics. While new teachers seem to take up equity stances towards teaching all children, it is often difficult for them to recognize, implement and sustain some important instructional strategies in order to truly affect the learning outcomes of all students (Edwards & Protheroe, 2003; Nolen, et al., 2008).

In order to frame my study, which centers on learning to teach equitably, I begin by elaborating what it means to teach using equity-oriented teaching practices. I then identify a significant problem in teacher education that often limits new teachers’ abilities to enact equity pedagogies in their classrooms: the coursework-fieldwork gap. I describe three issues in teacher preparation that contribute to the coursework-fieldwork gap and I identify the ways in which

institution of teacher preparation have attempted to deal with these issues, often with limited success.

Finally, I introduce a model of teacher education, the Mediated Field Experience (MFE) that promises to elevate the value of practitioner knowledge more than traditional university-based models do. Collaborating teachers in the MFE, who practice equity pedagogies, may offer greater opportunities for new teachers to take up equity pedagogies in mathematics. The following literature review establishes the groundwork for this case study that examines the structures, activities and tools that the MFE affords to prepare new teachers to teach all students rigorous mathematics.

Equitable Teaching Practices in Mathematics

What does it mean to teach mathematics using equity-oriented teaching practices? As Rochelle Gutierrez (2002) states, this is a challenging task:

...because equity is a value-laden term and requires human judgment, we have had fewer examples of what equity might mean empirically. That is, how might we know it if we saw it? Although we are not likely to come to a clear consensus, very little is outlined in the *Principles and Standards* document to give teachers, administrators, or researchers an idea of what might count in terms of equity (p. 148).

Three themes emerge across the work of those who examine equity pedagogies. First, Esmonde (2009) explains that teaching mathematics equitably must address two important aspects of learning: *what students learn* (mathematical topics and processes) and *how students learn* (the pedagogies teacher use to teach students mathematics). In considering how students learn, she draws on Flores's (2007) notion of "opportunity gaps" in education. That is, many groups of

students do not have opportunities to learn high-quality mathematics⁶. Esmonde argues that opportunities to learn occur:

- a) through participation – learning the ways of speaking, acting, and interacting in a mathematics classroom while ensuring that all student participation is central and competent
- b) in context or in relation to a social ecology – taking into account the historical, social, political, and immediate contexts and how they act in relation to one another.
- c) through processes of identity development – students’ ways of being and participating are valued
- d) through communicating about mathematical content – the talk, writing, gestures that allow students to make sense of one another’s ideas in ways that support their mathematical participation.

These teaching practices provide all students access to rigorous mathematical experiences.

Allestaht-Snyder & Hart (2001) define equity by looking toward the end result of learning: equity has been achieved when learning differences among sub-groups of students have become negligible or disappear altogether. They argued that those who work to help students learn mathematics “must become aware of the social, economic, and political contexts of schooling that can either hinder or facilitate mathematical learning for underrepresented students” (p. 93). They define equitable teaching practices as those that

- 1) promote belongingness
- 2) require engagement through active participation

⁶ Framing the achievement gap as an opportunity to learn gap shifts the focus from examining measures of educational outcomes to what students actually experience in classrooms and schools (Flores, 2007). Also see Martin, 2011.

- 3) hold students to the expectation that all can succeed

Drawing on Esmonde, Allestaht-Snyder and Hart, I define equitable teaching practices as those that aim to:

- 1) provide students opportunities to become active participants in rigorous mathematics by broadening meanings of participation and valuing students' variation in participation
- 2) hold students accountable to participation through mathematical communication

Research in mathematics education reveals several teaching practices that share these aspects. I review these here.

Learning through participation.

Research has shown that creating classroom cultures that broaden the range of participation practices allows more students to gain access to the material (E. Cohen, 1994; Hand, 2003; Jilk, 2007). Hand's study (2003) examined how the participation structures in the classrooms of three mathematics teachers impacted student engagement. She found that the teachers' use of multiple entry points in the curriculum allowed the students to become "authors" of the mathematical ideas generated in class; students engaged in more equitable participation with each other in groups as they learned to be accountable to and for each others' mathematical understanding; and students shifted their views of mathematics from something that needed to be memorized to something that needed to be "figured out." Creating classroom cultures that broaden the range of participation practices allowed more students to participate and therefore engage in learning opportunities.

Gutstein's (2006) work in a mathematics classroom with mostly Latino students from poverty-impacted communities demonstrated a relationship between attending to ways in which

students participate and student success. Gutstien communicated explicitly what it meant to “do mathematics” in the classroom and supported students in learning to enact the sociomathematical norms (Yackel & Cobb, 1996). This meant attending to the students’ social and academic resources, the ways in which students interacted with each other and with the mathematics; and the tacit rules of the classroom and school so that students might gain access to the “culture of power” (Delpit, 1995, 2006).

In study focused on student experiences in a mathematics classroom, Jilk (2007) examined the stories of four Latina students who had attended mathematics classes in which teachers drew on equity pedagogy as their primary pedagogy. As students, these women were English Language Learners and had successfully completed four years of college preparatory mathematics. Jilk found that these young women were able to bring their own identities as participants into the mathematics classroom in ways that fundamentally supported their participation and engagement. One of the women in Jilk’s study, Amelia, identified herself as “liberal” – not in the political sense but by her ability to have authority over her own ideas, decisions, and opinions. This salient “liberal” identity was useful because Amelia’s strength in explaining her ideas and opinions was a valued mathematical practice and resource to other students. The teaching practices at Amelia’s school were able to draw on Amelia’s intellectual resources, which provided Amelia ways to participate in the mathematics classroom while not being forced to give up her identity.

Across each of these studies, teachers have structured their classrooms in ways that provided students opportunities to learn. This occurred by broadening what it meant to participate or “do” mathematics and by valuing students’ varying ways of participating in mathematical learning.

Holding students accountable through communicating about mathematical content.

Providing opportunities for students to participate in mathematical learning is one aspect of enacting equity in the classroom. In addition, teachers must hold all students accountable for participation. In the research literature, this is often linked to teachers holding high expectations for all students.

Esmonde (2009) found that particular groupwork structures afforded and limited equitable group interactions. Students took up activities such as group quizzes and presentation preparation in ways that impacted the groups' opportunities to learn through accountability in participation. She found that group structures that emphasized group interdependence, where students must rely on each other and hold each other accountable to understanding the material, have the potential to support greater student learning.

Boaler & Staples (2008) found that the teachers' promotion of mathematical communication between students, characterized by justification and making convincing arguments based in reasoning, supported student learning. They argued that requiring justification created equity by attending to the needs of the individual and at the same time enhancing mathematical discussions through surfacing new ideas and requiring students to defend those ideas. This practice not only pressed students to clearly articulate their understanding, it also provided other students access to the ideas.

One particular pedagogical framework that encompasses a variety of aspects of equity pedagogy is "Complex Instruction". Complex Instruction uses cooperative learning and group work to support academic access and success for *all* students in heterogeneous classrooms (E. Cohen & Lotan, 1997). Complex Instruction acknowledges that students enter the classroom with differences in mathematical preparation, support, and knowledge, which often result in an

assumed hierarchy of competence. Complex Instruction practices aim to eliminate these hierarchies and promote equal-status interactions amongst students by addressing status, providing students with multiple-ability curricula, and holding students to high expectations for group behavior while attending to group and individual accountability (Featherstone, et al., 2011). This approach to teaching mathematics provides all students with opportunities to participate in rigorous mathematics. Studies of teachers using Complex Instruction showed that teachers posed longer, conceptual problems within a multiple-ability curriculum (Boaler & Staples, 2008); asked a higher percentage of conceptually-oriented questions (Boaler & Brodie, 2004), focused on effort over ability (Horn, 2006) and held students accountable for each others' learning (Boaler, 2008).

In this section, I defined equity-oriented teaching practices as the term is used in this dissertation. I now turn to the literature that describes how teachers might go about this work.

Equity Pedagogy as Teaching Against the Grain

In order to enact equity-oriented teaching practices, teaching for equity requires teachers to understand the relationship between teaching practice and student learning, and accept their role as a change agents. Cochran-Smith (2004) described this role as teaching against the grain:

Teaching against the grain is embedded in the culture and history of teaching at individual schools and in the biographies of teachers and their collaborative efforts to alter curricula, raise questions about common practices, and resist inappropriate decisions. These relationships must be explored in schools in the company of experienced teachers who are themselves engaged in complex, situation-specific, and sometimes losing struggles to work against the grain (p. 25).

Teaching against the grain means that teachers recognize teaching as a political activity and that they knowingly take on the role of activist based on a commitment to eliminate the inequities that exist in classrooms, schools, and the broader community (Cochran-Smith, 2004; Freire, 1998; Gutstein, 2006). In mathematics education, this means resisting the traditional structure of

teaching mathematics that has led to the inequitable mathematics achievement among certain subgroups of students. It means learning ways to teach that provide access to *all* students, regardless of their prior experiences and the difference in resources they bring to the classroom. The decisions teachers make as they enact curriculum, pedagogy, and instruction strongly impact students opportunities to learn (Stigler & Hiebert, 1999; Stipek, Givvin, Salmon, & MacGyvers, 2001; Zohar, Vaaknin, & Degani, 2001).

Teacher preparation programs can play an important role in the work of preparing teachers to teach against the grain. Teacher candidates must have opportunities to collaborate with experienced teachers who understand the socio-political contexts in which they teach and work to enact transformative school practices. Cochran-Smith (2004) argued that teacher candidates must work “in the company of experienced teachers who are themselves engaged in complex, situation-specific, and sometimes losing struggles to work against the grain” (p. 25). Those who teach against the grain reflect critically, raise questions about standard school practices, and commit to social change in their local school community. This preparation involves providing teacher candidates field experiences in which they work closely with teachers who are teaching against the grain. We know that when candidates are able to observe experienced teachers who are teaching against the grain, ask questions that may not have answers, and critically examine the assumptions and consequences of particular teaching practices, beginners are provided a more critical view into teaching and learning (Cochran-Smith, 2004; Darling-Hammond, 2006). Unfortunately, many teacher candidates are not provided opportunities to work closely with such teachers during their teacher preparation (Borko, et al., 1992; Valencia, Martin, Place, & Grossman, 2009; Zeichner, 2002) and struggle to implement equity-oriented teaching practices.

Mathematics is a gatekeeper, allowing some students opportunities to participate as active citizen while limiting the participation of others. Teachers who take on equity-oriented instructional approaches are working to provide all students opportunities to pass through the gate. They are working to reform mathematics teaching and learning and are taking a stand as both an educator and an activist. Given the crisis in mathematics literacy in the country, teacher education must find ways to support new teachers to teach against the grain. In Chapter 2, I provide several examples of how the partner teachers in this study implemented equity pedagogy and mathematics instruction against the grain.

In this chapter, I frame the problem in mathematics education in relation to a significant problem in teacher education: teacher candidates struggle to take equity-oriented practices learned in university programs and implement those practices in field experiences and during their first few years of teaching. This gap between university and field has continued to plague teacher education. In the next section, I define the coursework-field work gap in teacher preparation and describe how traditional structures of teacher education perpetuate this gap. I then describe how teacher preparation programs have attempted to address the coursework-fieldwork gap, I argue that, although these attempts have helped in some ways, the gap remains an expanse teacher candidates must navigate on their own.

A Problem in Teacher Education

In mathematics education, there is a gap in some groups of students' opportunities to learn. Research has identified that instruction aimed at increasing opportunities to participate can increase students' success. However, supporting teachers, and especially novice teachers, in learning how to do this work has yet to be adequately addressed.

Teacher preparation failed to provide public schools with effective and qualified teachers who are capable of reforming classroom practice in order to meet the needs of a diverse group of students. This is particularly true in the case of mathematics education. Although there has been a recent focus on improving the quality of mathematics teaching in schools by improving the quality of teacher preparation, the call for the re-examination and redesign of teacher education has spanned decades (Conant, 1963; Darling-Hammond, 2006; Dewey & Archambault, 1964; Goodlad, 1991; Levine, 2006; Zeichner, 2011). Recent reports from groups such as the National Research Council (2010) and the National Council for the Accreditation of Teacher Education (2010) voice concern for the current state of teacher education. In a speech at Teachers College, Secretary of Education Arne Duncan (2009) stated:

Yet, by almost any standard, many if not most of the nation's 1,450 schools, colleges, and departments of education are doing a mediocre job of preparing teachers for the realities of the 21st century classroom. America's university-based teacher preparation programs need revolutionary change—not evolutionary tinkering.

Most stakeholders, both inside and outside of teacher education, agree that there is room for improvement in teacher education. However, the country is deeply divided about how to accomplish the “revolutionary change” (Levine, 2006; Zeichner, 2010). While some argue for the re-structuring of university-based teacher education (Darling-Hammond & Bransford, 2005) others make a case for the elimination of university-based teacher education altogether (Hess, 2002; Walsh, 2001).

This debate questions the effectiveness of university-based teacher education, which certifies approximately 75% of our nation’s teachers (NRC, 2010). This is particularly true for teachers of mathematics where, year after year, teaching practices deny access to mathematics to marginalized groups of students (Stigler & Hiebert, 1999).

Although the critique of teacher preparation has been around since teacher education was moved from Normal Schools to universities and colleges in the late 1800s (Fraser, 2007) it has steadily grown from the *A Nation At Risk* report in 1983 to the *No Child Left Behind* act (2001). The controversial yet influential *A Nation At Risk* report drew attention to supposed declines in student achievement in U.S. public schools, particularly in mathematics and, almost two decades later, the *No Child Left Behind Act* asserted that little has changed. These reports directly critique teacher preparation and, as a result, attention has turned to how teacher education prepares teachers to enter our increasingly diverse public schools and hold high expectations for all students.

The recent focus on teacher preparation has led some critics to claim that teacher education does not matter in the preparation of new teachers and that teacher preparation does not impact student achievement (Paige, 2002). Others have claimed that what one needs to know in order to effectively teach can be learned on the job (Walsh, 2001); that teaching does not require any specialized skills beyond high verbal ability (Steiner & Rozen, 2004) and that regulatory barriers such as certification requirements should be removed in order to allow an expansion of a pool of talented teachers who are dissuaded from enrolling in teacher preparation programs due to substantial investments in time and money (Hess, 2002). Still others argue that rather than replacing university-based teacher education we must instead embrace the challenges faced in teacher education, find what works, and build on such practices and structures to better prepare future teachers (Darling-Hammond, 2000; Wilson, Floden, & Ferrini-Mundy, 2001; Zeichner, Payne, & Brayko, 2012).

Rather than debate the evidence for or against the need for university-based teacher preparation, I choose to take up the challenge to examine how to improve college- and

university-based teacher education. I do so because university-based teacher education prepares the majority of teachers and, as a university-based teacher educator and researcher, I am most interested in how to improve an institution that produces so many of our country's future teachers. My interests lie in how teacher education can prepare teachers of mathematics to implement equity-oriented practices to support all students' mathematical literacy and achievement.

The Coursework-Fieldwork Gap in Teacher Education

A prevalent and persistent problem in teacher education is the over-emphasis on academic coursework that is unrelated to the realities of the classrooms and communities that new teachers enter (Goodlad, 1994; Tom, 1997; Zeichner, Melnick, & Gomez, 1996). In a 4-year study of 28 schools of education, Levine (2006) found that more than half of the teacher education graduates reported their teacher preparation did not adequately prepare them for their work in the classroom. Forty-eight percent of the teachers reported that their preparation did not meet the needs of students from diverse cultural backgrounds and twenty-six percent said their preparation did not use a variety of pedagogical approaches in their teaching practice. The results of these studies are no surprise since beginning teachers often report that their teacher preparation was of little use and that their programs were too theoretical with university coursework contributing little practical knowledge teachers needed (Feiman-Nemser & Buchmann, 1985; Lortie, 1975). When asked to choose three of the most important reforms for teacher preparation, principals, education school professors, and teacher alumni chose balancing subject matter preparation with field experience (57%, 49%, 69% respectively). From this study of over 1,200 teachers, it is clear that a gap exists between teacher preparation programs and the realities of schools.

Several research studies have found that novice mathematics teachers struggle when trying to implement reform-based teaching practices in their student teaching and first year of teaching (Borko, et al., 1992; Britzman, 2003; Zeichner & Tabachnick, 1981). In one study, researchers found that novice mathematics and social studies teachers transferred particular teaching practices into their student teaching and first two years of teaching but in problematic ways. (Horn, 2008; Nolen, et al., 2008). They found interactive teaching practices altered for two key reasons as they traveled across settings. First, candidates often inadvertently altered the intent of the practices because they did not *coordinate* them with other practices. For instance, one novice teacher, working to set up cooperative norms for groupwork, also frequently used competitions as an activity in his classroom. By failing to coordinate the goal of competition with that of cooperation, he unintentionally undermined what he tried to communicate to his students during the less familiar and more challenging groupwork. A second recontextualization challenge involved the *adaptation* of interactive teaching practices to specific students and contexts. A candidate in the study, for instance, learned a question-listen-question routine in methods class, yet when she brought it into her classroom, her questions did not fully mine the students' mathematical contributions. Her focus remained on her own image of the lesson and she struggled to take up students' thinking, a challenge in any interactive teaching practice. During her first year of teaching, her question-listen-question practice became indistinguishable from traditional elicitation discourse.

Both coordination and adaptation, when done well, require teachers to consider many dimensions of the classroom simultaneously — especially students' thinking and their affective experiences of teaching and learning. To coordinate practices well or to adapt them effectively to particular contexts, teachers need to understand students' perspectives on learning. Yet this

understanding of students' perspectives is often difficult for teacher candidates to learn in their teacher preparation programs, creating a gap in transferring practices from teacher preparation to classroom practice.

This gap in teacher preparation has been called the theory-practice gap, the “two-worlds pitfall” (Feiman-Nemser & Buchmann, 1985), the university-school divide (Anagnostopoulos, Smith, & Basmadjian, 2007), the “abyss between theory and practice” (Levine, 2006), and the Achilles heel of teacher education (Darling-Hammond, 2009). Although the names are different, the problems are similar: teacher preparation occurs in two distinct settings, university and field, and it is left to the novice teacher to navigate the gap between coursework and fieldwork (Britzman, 2003). Novices must then make sense of abstract ideas within the concrete particulars of classrooms, which is highly complex work. Research study after research study has shown that teacher candidates struggle to successfully recontextualize teaching practices in the field.

Related to the coursework-fieldwork gap⁷ is what Kennedy (1999; 2005) calls the Problem of Enactment, which describes the difficulty new teachers experience when they attempt to apply what they learned in the university to their field experiences, particularly their initial years of teaching. Kennedy explains that all teachers possess a particular frame of reference for interpreting what it means to teach and learn and that these frames often determine how they implement practices in classrooms. Even if new teachers subscribe to the frame of reference promoted in the teacher preparation program, they many not know what to do in actual classroom practice. The structure of most teacher education programs assumes that new teachers

⁷ Although the term “theory-practice” gap is used in research literature to describe this problem, I find this term problematic in several ways, which will be discussed in Chapter 3. Instead, I use the term coursework-fieldwork gap to describe the difficulty many teachers face as they attempt to take what they learned in their university coursework and apply it in their classrooms with actual students.

graduate from their teacher education programs and successfully transfer the reform teaching practices they learned in the university to their classrooms. Unfortunately, many teachers eventually succumb to the dominant practices of their particular schools or the practices in which they themselves experienced as students (Borko, et al., 2000; Brouwer & Korthagen, 2005; Peressini, Borko, Romagnano, Knuth, & Willis, 2004; Zeichner & Tabachnick, 1981). In mathematics education, this is especially problematic given the disparity in achievement. In order for teachers to be able to provide all students equitable opportunities to learn, they must prepare to challenge the dominant practices in mathematics teaching. This means shifting their conception of teaching and learning, which is often based on their own, traditional educational experiences (Goodlad, 1994; Kennedy, 1999; Lortie, 1975).

Educational researchers have examined the coursework-fieldwork gap, recognizing the structural limitations of university-based teacher education and how these structures can prevent teachers from making these shifts. Research has also brought to light how teacher education programs marginalize and discredit practicing teacher knowledge even as public schools take on increasing responsibility for teacher preparation (Cochran-Smith & Lytle, 2009; Cope & Stephen, 2001).

This study examines how a specific model of university teacher education addressed these limitations. In the section that follows, I review some of the limitations and critiques of teacher education, how these limitations have perpetuated the coursework-fieldwork gap, and some of the ways in which teacher education has responded to these critiques. Finally, I argue that university-based teacher education must examine the specific practices and structures that connect coursework and fieldwork in order to prepare teachers to educate the increasingly diverse population of our public school students.

Limitations in the Structure of University-Based Teacher Education

Teacher education began as schools and school districts trained teachers to work. In the 19th century, many large urban school districts created vocational normal schools to train their teachers (Fraser, 2007). Normal schools became teachers colleges and, in the early part of the 20th century as the need for teachers increased with the exploding secondary school population, colleges and universities formed teacher preparation programs and departments of education. However, universities did not become primarily responsible for teacher preparation until the middle of the century. Between the 1960s and the 1990s, university-based teacher education programs prepared the vast majority of teachers (Fraser, 2007).

When colleges and universities began educating teachers in the early 1900s, critics lamented that these schools would place academic knowledge above pedagogical training. Proponents of university-based teacher education argued that quality teaching entailed a need for scholarship and expertise in academic content areas. Throughout the 20th century, the debate about content knowledge and pedagogical knowledge continued as universities and colleges took control of teacher preparation (Tom, 1997).

Although university-based teacher education has changed since the shift from Normal schools to colleges and universities, certain characteristics persist over time and characterize traditional university-based teacher education. In general, these traditional programs assume a hegemonic stance in which the university is responsible for teaching learning theory, foundations of education, and methods of teaching while the schools are responsible for providing space for candidates to practice what they learned in the university. In these programs, expertise about the field of teaching resides solely in university professors' and not in practicing teachers' knowledge. University faculty are often not aware of the practices of schools and teachers are

not aware of the practices in the teacher education program. Although many teacher preparation programs draw on field supervisors to connect the university and field, these supervisors are typically temporary staff such as graduate students or retired teachers and not university professors responsible for teaching content-specific practices rooted in equity (Zeichner, 2002). This creates an immense fracture in the experience teacher candidates as they move between the disparate contexts of university and field.

Extensive research on the coursework-fieldwork gap in university-based teacher education identifies several structural and epistemological orientations within traditional teacher education that have contributed to novice teachers' struggles to enact reformed teaching practices. In the next section, I review three problems in the structure of teacher education, describe how the field of teacher education has addressed these problems, and how this study responds to the gaps that remain in the research on the coursework-fieldwork gap.

The acquire-apply approach to teacher education. The coursework-fieldwork gap arises out of structural limitations of traditional university-based teacher education. Because courses take place in an academic setting, the practices of that setting — reading books and articles, writing papers — tend to dominate activities. Even when teacher education programs support beginning teachers to enact teaching activities or critically examine limitations in traditional schooling, these approaches are also inadequate. For example, enactments are not typically done in the complex environment of the classroom, with the often-unpredictable responses of students, leaving critical aspects of teaching unrepresented. Likewise, critiquing traditional schooling practices may motivate novice teachers to learn new practices, but it does not guarantee effective implementation.

Structural aspects of teacher education programs create a pedagogy in which candidates learn ideas and practices in a university setting and then apply the ideas and practices to a field setting. It is as if teaching practices can be picked up and carried from the university classroom and directly applied in any classroom, regardless of students or school context. Although more university-based teacher education programs are adding more clinical experiences as part of their program, the university continues to be a place to learn theory while the clinical experience continues to be a place to apply theory. This common acquire-apply practice stems from a cognitive view of learning that frames knowledge as a discrete or fixed unit that can transfer linearly to a classroom (Lampert, 2010). This model promotes the idea that theory and practice are separate components in which the university provides theory and the classroom provides the setting where candidates apply theory. Candidates are left to negotiate this transfer, an unrealistic expectation for a novice (Britzman, 2003; Feiman-Nemser & Buchmann, 1985; Kennedy, 2005).

Addressing the acquire-apply problem: University-school partnerships. One model that addresses the acquire-apply problem is the creation of a tighter alignment between university and field through university-school partnerships. University-based teacher preparation programs team with K-12 schools to create a cohesive teacher preparation program focused on classroom practice where schools and teacher preparation programs mutually benefit from the partnership. This “simultaneous renewal” (Goodlad, 1994) allows school and university expertise to improve one another.

Many university-based teacher education programs have created university-school partnerships with the goal of placing teacher learning within the context of the field (Wilson, et al., 2001) and several variations have come into existence in the last few decades. Programs

have partnered with a few schools or even entire districts. Some programs teach university courses on-site at local schools. For example, in a recent issue of *Teacher Education Quarterly*, which was entirely dedicated to models of university-school partnerships, Stairs (2010) details a program in which teacher candidates spent one day each week on site completing both coursework and fieldwork. Others formed after-school programs with local schools or partnered with community-based organizations as a way for candidates to gain experience in the field (McDonald, et al., 2011; Onore & Gildin, 2010). Jeffery & Polleck (2010) describe a university-school partnership in which teacher education courses are taught entirely at the various urban partner schools. Courses are co-taught by university faculty and teachers within the school and much of the class time is spent observing classrooms. Observations are used to launch discussions in which “co-instructors and students work together to reconcile the pedagogical theories that they read about in class with the concrete realities of urban schooling they are observing” (p. 86). In order to connect these pedagogical theories to realities of schools, candidates, cooperating teachers, and university instructors examine the research on effective teaching practices and center their conversation on common problems teachers face in their classrooms.

University-school partnerships assume that changing the location of university coursework may provide candidates a greater opportunity to make connections between theory and practice (Grossman, Hammerness, & McDonald, 2009); candidates may benefit from direct experiences within urban schools; and that candidates may develop alongside practicing teachers who are also learning (Jeffery & Polleck, 2010).

Professional Development Schools. Professional Development Schools (PDS) are a specific model of a university-school partnership. PDSs developed from the 1986 Holmes Group

Report, *Tomorrow's Teachers* which called for a re-design of university-based teacher education. Part of this redesign included faculty from both university and public school institutions working together to create clinical contexts to serve multiple functions. These functions included laboratories of exemplary practice, experiments in restructuring educational roles, models of ongoing professional development, venues for research into problems of practice, and sites for preparing pre-service teachers (Labaree, 2004).

The Holmes Group recognized the need to draw on the expertise of schools while simultaneously giving back to the schools through professional development and research support. Notably, the sole purpose of PDSs was not to solve all education problems or narrowly focus only on preparing teachers, but to bring together two institutions, building on their mutual needs in order to bring about change (Goodlad, 1991). During the 1990s, PDSs became an essential component of many teacher education programs even though there was little research to demonstrate the structure's success in preparing teachers.

Since then, several studies have supported the effectiveness of many different variations of PDSs. In a review of research on the characteristics of exemplary university-based teacher education programs, Darling-Hammond (2006) noted that several of these programs had created Professional Development Schools. Other research found that PDS have the potential to raise test scores for K-12 students and create more coherence between field and university contexts for pre-service teachers (Clift & Brady, 2005). Levine (2006) wrote that PDSs can “offer perhaps the strongest bridge between teacher education and classroom outcomes, academics and clinical education, theory and practice, and schools and colleges” (p. 105). While acknowledging the potential of PDSs, it is important to emphasize the high degree of variability in how PDSs are

defined. Due to the variation in the design and implementation of PDSs, to claim that all PDS produce more effective teachers is problematic (Zeichner, 2009).

Although university-school partnerships such as PDSs aim to bridge universities and public schools, there often remains a disconnect between what teacher candidates learn in their university program and their opportunities to enact these practices in the partner schools. Bullough and colleagues (1999) noted how the university faculty involved in the PDS partnership had an understanding of the practices taking place in the cooperating teachers' classrooms but that the cooperating teachers themselves were not always aware of university faculty expectations.

Although the intention is to create a true partnership where both university instructors and practicing teachers are given equal responsibility to educate teachers, the hegemony of the university often prevails. PDSs are sometimes created through a top-down arrangement in which teachers are the last to know about the partnership, effectively disempowering those who the partnership intends to empower (Duffy, 1994). Once the PDSs are set up and functioning the devaluing of teachers' knowledge may continue as the prevailing practice of the university is to "go out to the schools to help teachers become better at their work" (Duffy, 1994, p.597). Although PDSs intend to draw on academic and practitioner knowledge in more democratic ways, what often happens is the university maintains power and control as the institution attempts to "fix" the field to meet its own needs.

Marilyn Cochran-Smith (1991b) uses the metaphor of *consonance* to describe the university-school partnership model of teacher education because the model aims to insure that teacher preparation programs and partner schools affirm one another. Programs built around this model achieve their goals of preparing teachers to be skilled decision-makers and reflective

practitioners through the creation of “a high degree of consonance between theory and practice and by providing coordination between the language and messages conveyed by the university and the school” (p. 105). However, the way this is accomplished is often by university teacher educators training experienced teachers to think about and enact teaching in ways the university considers effective. Rarely are experienced teachers regarded as contributors to the theoretical knowledge base about effective teaching.

Although partnership programs based on the consonance model claim to build on both knowledge from research and knowledge from practice, in actuality these programs may do little to encourage teachers and teacher candidates to draw on their own knowledge about practice to generate theories, treating teachers and candidates as receivers of information rather than generators of knowledge (Cochran-Smith, 1991b; Zeichner, et al., 1996). This model of teacher preparation sends significant messages about power and knowledge in learning to teach, specifically that the knowledge base for effective teacher education is generated almost exclusively by university-based researchers and teacher educators while teachers and student teachers are not regarded as potential contributors (Cochran-Smith, 1991). Zeichner and colleagues (1996) refers to this as the *scientific-application* version of a field experience, where knowledge about teaching resides with university faculty, not with practicing teachers, and candidates are tasked with implementing university-based practices in the field. Messages such as these work to widen the coursework-fieldwork gap by neglecting to draw on experienced teachers’ knowledge about teaching and learning. As Zeichner and colleagues (1996) state,

If we view theory as existing only in the teachers colleges and universities, and practice as existing only in schools, and the task of learning to teach as one of learning how to apply that which is acquired in colleges and universities to the schools, we are missing out on the vast expertise that resides in the practices of teachers and on the potential to generate theory through teaching practice. (p. 221)

University-school partnerships are a promising model in teacher education and research must attend to the ways in which these models draw on both academic knowledge and practitioner knowledge in more democratic ways. However, creating a university-school partnership in which university knowledge continues to be valorized does not allow for a true “egalitarian collaboration” (Duffy, 1994). Research must work to produce a more in-depth examination of the ways in which practitioners’ contributions and expertise can be drawn on and integrated into the ways in which teacher candidates are educated (Zeichner, 2009).

Marginalizing Teacher Knowledge. Teacher education has been criticized for promoting the view that the university has hegemony over what teachers need to know and how teachers should teach. There is an implicit assumption that university academic knowledge counts more than the knowledge and experience of the K-12 teachers with which the candidates are placed for field experiences, perpetuating the view that field placements are sites for *demonstrating* learning rather than sites *for* learning (Zeichner, 2010). This is quite paradoxical given the fact that teacher preparation is in the work of training novices to become teachers. Devaluing teachers’ knowledge as technical rather than intellectual reflects a deficit view of teachers’ practice (Britzman, 2003, p. 55) and this message is communicated to those who aim to become teachers. The perceived message is that universities know what constitutes good teaching and how to best help candidates learn what they need to know to be effective teachers (Feiman-Nemser, 1998).

The marginalization of teacher knowledge is strongly linked to the application theory of teacher learning. Teachers’ classrooms are viewed as a place to provide candidates with “real” classroom experience (Grossman, et al., 2009). Interns are expected to demonstrate what they learned in their university coursework, often in classrooms with mentor teachers who have little

experience with such practices because placements are often made haphazardly rather than intentionally (Hammerness, et al., 2005; Zeichner, et al., 1996). Mentor teachers may not be aware of practices and theories the university programs endorse and are helpless when it comes to supporting candidates to develop these practices (Campbell, 2008). Because there is often little planning to place candidates in setting where they will learn particular practices, most of what candidates do learn is luck of the draw.

At the same time, university instructors may not be aware of the practices used by the mentor teachers or the classroom contexts within the schools. Rarely are mentor teachers provided on-going education and training from the university in reform practices or in effective mentoring even though it has been shown that trained mentors are more effective in supporting student teachers (Dever, Hager, & Klein, 2003; McIntyre & Killian, 1987).

The goal of many progressive teacher education programs is to prepare novice teachers for classrooms of the future and to promote reform-oriented pedagogies, such as teaching for understanding through student-centered instructional practices. Practicing teachers may not have experience using such pedagogies because the field placement or school context differs in what it means to be a competent teacher (Eisenhart, et al., 1993; Nolen, et al., 2008; Valencia, et al., 2009). Although the university may promote reform-oriented pedagogies, the classrooms in which the candidates are placed may be dominated by teacher-centered practices such as direct-instruction. As candidates try to use the practices they learned in their preparation program and do not obtain the expected results, lacking expert scaffolding, they tend to attribute the failure to an ineffective tool or come to the conclusion that the practice simply doesn't "work" (Campbell, 2008). If the cooperating teacher does not have a sense of what the candidates are learning in their teacher education courses, they may be unable to mediate the candidates' experiences

between their university coursework and their field experiences. The candidates are then left to negotiate their own connections between the two distinct contexts. This creates a situation in which teacher candidates experience an identity conflict as they must then choose university practice or classroom practice, just at the moment they are moving away from the former and toward the later. As a result, the candidates struggle to carry these practices into their first year of teaching and beyond.

Classroom teacher knowledge and skill is also devalued by the fact that mentor teachers are expected to supervise candidates in addition to their full-time responsibility of teaching their students, with very little compensation and time to do the work. Feinman-Nemser & Buchmann (1985) argue that classrooms are actually not set up as places for teacher candidate learning because of the limitations placed on mentor teachers. When teacher candidates are placed in classrooms during a student teaching experience, the mentor teacher's first responsibility is to teach their students. Adding onto that responsibility without decreasing the mentor teacher's other duties drastically limits the resources a mentor teacher can provide a teacher candidate. Feinman-Nemser and Buchmann call this the pitfall of "cross-purposes" and state, "The legitimate purposes of teachers center on their classrooms, which generally are not designed as laboratories for learning to teach." (p. 62). They go on to say "the cross-purposes pitfall can be overcome by working toward a closer fit between the purposes of classroom life and those of learning to teach. This will require structural and normative changes in schools, including an expansion of the teacher's role" (p. 64). If we are to educate teachers who can successfully implement equity-oriented teaching practices, we must not marginalize teacher knowledge but instead, draw more intentionally on their wealth of experience and skills.

Teaching and learning to teach requires multiple perspectives on what constitutes good teaching practice. When the knowledge and expertise that exist in schools is not utilized, opportunities to learn to become effective teachers are limited. In essence, mentor teachers are not positioned as teacher educators who can provide valuable knowledge about teaching and learning. Instead, mentor teachers' classrooms are viewed simply as places for candidates to apply what they learned in their university courses, rather than sites for learning through an examination of teaching practice.

By marginalizing teacher knowledge and positioning field experiences as places to apply what has been learned, learning to teach becomes something that happens prior to becoming a teacher rather than something that happens across one's teaching career. These conceptions of how one learns to teach are extremely problematic because they effectively strip the power from teachers to learn from the examination of their own practice by collaborating with each other to take an "inquiry stance" on their teaching practice (Cochran-Smith & Lytle, 2009). This model does not allow novice teachers the opportunity to learn how to generate local knowledge through the work of integrating theory and practice, the real work of learning to teach.

Addressing the teacher knowledge problem: Practice-based teacher education. As a result of recognizing the importance of drawing on practitioner knowledge as a way to learn about practice *in* practice (Ball & Cohen, 1999) many teacher preparation programs are shifting to models that work to situate teacher education in the context of *practice*. However, those who are working to address the coursework-fieldwork gap through a focus on practice have taken different stances on what it means to focus on practice. While some view this as helping teacher candidates focus on the practice that takes place in school classrooms by shifting the work of teacher preparation into classrooms, others have focused on helping teacher candidates learn

about practice by engaging more deliberately in practice in the university classroom. In this section, I first take up the models of teacher preparation that have shifted teacher education into schools as a way to address the coursework-fieldwork gap by drawing on practitioner knowledge. These models of teacher education have produced a variety of “alternative” pathways to teacher certification that attempt to bridge the coursework-fieldwork gap through the structural and epistemological dimensions of their programs. Second, I take up the recent research literature that examines what it means to create a practice-based curriculum in university teacher education. This literature argues that, in order to support teacher candidates as they navigate the coursework-fieldwork gap, teacher preparation must provide opportunities to engage in the practices teacher candidates will be expected to implement in the field.

Teacher Residency Programs. One type of alternative route program, which is gaining attention, is the Teacher Residency Program. These programs aim to “wrap courses around” school experiences thus situating practice as the central focus of the program (Berry, Montgomery, & Snyder, 2008). Often candidates are placed into mentor teachers’ classrooms for a yearlong candidateship and university courses are taken during the summer and in the evenings during the school year. These courses may be taught on-site and include the classroom teacher, who may also teach some of the courses in addition to university faculty. Following the yearlong internship is an induction support program, which varies in length but most often lasts three to five years.

The Boston Teacher Residency Program is a one-year residency program and three-year induction support program. Solomon (2009) describes this as a partnership between the Boston Public Schools and the University of Massachusetts although the role of the university is minimal. In this program, candidates are prepared *by Boston Schools for Boston Schools*.

Cohorts of candidates are placed in participating schools with mentor teachers. Participating schools have part-time site coaches who are partially responsible, along with the principals and mentor teachers, for supervising the candidates. Courses are held in the summers and during after school hours and are taught by instructors “whose careers and experiences represent a blend of theory and practice” (Solomon, 2009, p. 482). The instructors are typically teachers in the Boston Schools. At the end of the program, candidates are placed in Boston Schools for their required 3-year induction.

The intention of programs like the Boston Residency Program, is that candidates spend the majority of their time within the context of the public school classroom, taking on teaching responsibility as the school year progresses. Courses such as content methods courses are often held on the public school site. One of the defining principles of such Residency Programs is how the design of the programs “tightly weave education theory and classroom practice together” (Berry, et al., 2008) thereby addressing the coursework-fieldwork gap. Because the teacher candidates are prepared by the schools in preparation to become teachers within the schools, many Teacher Residency Programs link coursework and fieldwork by advancing the teaching practices that currently exist in the schools.

Although the Boston Teacher Residency Program positions itself as a partnership with the Boston public schools, the partnership is not the kind envisioned by the Holmes Group. In studies and reports of this particular program, the role of the university is greatly minimized in favor of drawing heavily on classroom experience (Papay, West, Fullerton, & Kane, 2011). There appears to be little evidence of the “simultaneous renewal” Goodlad (1994) and others described. Practitioner knowledge may be a central resource for teacher candidate learning in Residency Programs like Boston’s Teacher Residency Program but research has yet to reveal

how teacher knowledge is utilized in ways that support teacher candidates to take on reform practices.

There is great variability in the structure of Teacher Residency Programs and some programs have developed a partnership with schools or school districts that more accurately resemble the partnerships described in the Holmes report. One such program is the Newark Montclair Urban Teacher Residency program (NMUTR). As Klien and colleagues (Klein, Taylor, Onore, & Strom, in press) pointed out, university teacher educators and school representatives collaboratively designed and created this program. What sets the NMUTR program apart from other Teacher Residency programs is the nature of the collaboration between the university faculty and the P-12 educators, creating a “third space” for teacher preparation.

NMUTR

“employs both the P-12 educator and the faculty supervisors in intensive roles: the P-12 classroom educator serves as mentor and co-teacher, receiving professional development and taking part in resident learning; and university faculty not only provide coursework on site, but also mentor and guide resident field experiences. Thus a third space teacher education reorients learning toward an “and/both” experience, with university and school-based faculty playing key, integrated, and equally valuable roles” (p.8-9).

Research on Teacher Residency Programs such as NMUTR reveals that academic and practitioner knowledge are used as resources for learning to teach. By creating true partnerships between universities and schools, these programs create an “and/or” context where both knowledge bases are necessary and valid.

Fast-Track Routes. Another teacher education structure that has increasingly gained attention is an alternative route often called a “fast track” route. Such programs typically place novices directly into classrooms as full-time teachers of record with minimal or no coursework preparation (Grossman & Loeb, 2008). Practitioner knowledge is paramount (Hess, 2002) while coursework is a-theoretical, often focusing on “tricks of the trade”. Fast track routes assume that

most of what one needs to become a teacher can be learned on the job in schools; that college and university teacher education is a barrier that keeps competent people from becoming teachers; and that through deregulation, many talented and academically competent individuals who normally would not choose to enroll in a university teacher preparation program would enter teaching (Grossman & Loeb, 2008; Stoddart & Floden, 1996). This model, often called the Deregulation Agenda (Zeichner, 2003) associates the work of teaching with that of trades such as electrical work or carpentry, where training takes the form of apprenticeship (Stoddart & Floden, 1996).

Some examples of fast-track programs are Teach For America, New York City Teaching Fellows, and Troops to Teachers. These programs remove the “barriers” (i.e. university coursework) of training so that teachers are able to gain the “real” experience needed for teaching. Teach For America recruits graduates of top-rated colleges and universities, provides minimal training, and then places them in schools impacted by poverty as the teacher of record. During this time, TFA teachers work toward their certification by participating in coursework that may or may not be provided by university faculty. TFA requires a two-year teaching commitment and bills the program as a stepping stone to graduate school. In fact, research shows that many TFA-trained teachers leave the profession after the initial two-year commitment (Kane, Rockoff, & Staiger, 2006).

The effectiveness of teacher preparation programs that minimize or eliminate the role of the university has been the focus of many recent research studies examining alternative certification pathways. Some studies have supported the claim that teachers who received their preparation and certification while a teacher of record, such as TFA-trained teachers, are less effective compared to teachers who received their preparation and certification through programs

that provided some degree of university coursework before assuming full-time teaching responsibilities (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Glazerman, Mayer, & Decker, 2006). Darling-Hammond, Holtzman, Gatlin, and Casquex-Heilig (2005) found that alternatively⁸ certified teachers actually have negative effects on student achievement. These studies argue that there is much novice teachers need to learn about the work of teaching that simply cannot be learned on the job.

On the other hand, several reviews of studies have shown inconclusive findings (Johnson & Birkeland, 2008; Zeichner & Conklin, 2008). Some studies demonstrated that teachers from fast-track programs produced students who scored higher on mathematics and reading assessments as compared to teachers with similar experience but who were university prepared. Decker, Mayer & Glazerman (2004) examined the outcomes for two groups of students in the same school and same grade level, those who were taught by TFA teachers and those who were taught by teachers who did not gain their certification through TFA⁹. They found that students of TFA teachers scored significantly higher on the ITBS (Iowa Test of Basic Skills) mathematics assessment compared to the students of certified teachers. Still other studies have shown no significant differences between teachers certified through non-university programs and traditionally certified teachers when examining how well-prepared they felt (Cohen-Vogel & Smith, 2007) or scores of tests on content knowledge (Hawk & Schmidt, 1989).

In light of these countervailing findings, reviews of studies have determined the effectiveness of such programs as unclear (Zeichner & Conklin, 2008). Zeichner and Hutchinson (2008) warn against generalizing the benefits or limitations of broadly characterized programs

⁸ In this study, alternatively certified teachers were those who began teaching as teachers of record without their certification, including teachers in the TFA program.

⁹ These teachers were traditionally certified, alternatively certified, and uncertified.

because many of these programs that share a name, including TFA, vary widely in structure, length, quality, and relationship or partnership with a university.

Fast-track programs and Teacher Residency programs aim to draw on practitioner knowledge by moving the majority of teacher preparation into the field. However, no research exists on the differences that emerge from the variation in structural supports in programs like Fast-Track or Teacher Residency Programs. For example, research has yet to demonstrate how methods courses taught at public school sites support teacher candidates to enact equity-oriented teaching practices. It is not yet clear how increasing the time teacher candidates spend in schools supports teacher candidate learning. Recent designs of teacher education have begun to locate courses and programs in schools as a proxy for situated learning. The assumption is that schools and classrooms provide more situated knowledge than do university classrooms. However, the research has yet to address the particular ways in which situating teacher education in the context of schools supports what and how teachers learn (Kennedy, 1999; Zeichner, 2010). Kennedy (1999) argues:

Videos, case studies, and other representations of practice could support the development of situated knowledge for teacher candidates but at the same time, teacher candidates might not be interpreting the situations in terms of the important ideas of reform-oriented teaching. What is more important is whether the situations teachers see or hear about are interpreted in terms of important reform ideas. If they are not, teachers will surely interpret these situations with the frames of reference they already have. A popular proxy for situational knowledge is the location of the program: programs located in schools rather than universities are often presumed to provide more situated knowledge. The problem with location, however, is that we cannot know the extent to which programs attach important ideas about teaching and learning to the many behaviors that novices observe. Some programs in schools might give teachers a great deal of situated understanding, all of which is consistent with the frame of reference they already had. Others might give teachers a new frame of reference for interpreting the classroom situations they see. (p.75)

It is not necessarily the case that teacher candidates need more time in schools. Instead, we need to know *what happens* when coursework is moved to schools. What do teacher candidates see?

What do they notice? And how do structures and activities within teacher education programs support teacher candidates in learning reform-oriented or equity-oriented teaching when they are in schools? In order for teacher education programs to create learning environments for candidates in which field experiences and coursework are highly coordinated and in which academic and practitioner knowledge is effectively used (Zeichner, 1996), we must examine the ways in which the participants within both university and school settings interact and move between and within contexts.

What the university offers teacher preparation. Although alternative teacher education programs such as Teacher Residency Programs and fast-track programs are gaining attention in terms of frequency and enrollment, we are beginning to learn that university-based teacher preparation can make a difference in the quality of teachers. In her review of research studies examining various pathways to teaching, Darling-Hammond (2000) found that teachers who have a greater knowledge of teaching and learning were rated as more effective by their principals and students, stated they were more satisfied with their preparation, were able to adapt their instruction to meet the learning needs of their students, and stayed in teaching longer. University-based teacher preparation can offer novice teachers the space to develop their ability to see beyond their own perspective. One of the most essential aspects of becoming an effective teacher is the ability to see the perspective of one's students in a learning context (Ball & Cohen, 1999; Darling-Hammond, 2000).

In mathematics, being able to anticipate and respond to different strategies students develop to solve problems requires teachers to anticipate student thinking and respond in-the-moment. Mathematics teachers must learn how to convey material that they may have never struggled with, and they must learn to do it in a way that engages a variety of students with a

range of interests and motivations. Mathematics teachers must also learn how to resist resenting their students for their struggles but instead to see the difficulties from their students' perspectives and restructure the learning experience to meet those students' needs (Darling-Hammond, 2000). This requires teachers to be highly reflective about their teaching practice and to have the skills to identify and adjust appropriately. The ability to view the learning experience from the perspective of the student is perhaps the most essential skill a mathematics teacher must learn and requires knowledge about the content, knowledge about the students and how they learn, and the ability to connect this knowledge across different schooling contexts and situations.

While the marginalization of practitioner knowledge has limited teacher candidates' access to important knowledge needed for teaching, simply shifting the location of coursework to the field does not necessarily address this problem. I contend that the structures and activities that take place in the schools and classrooms and how those structures and activities draw on practitioner knowledge and work to connect academic knowledge to practitioner knowledge are the foundations on which teacher candidates will learn to enact reform practices in their future classrooms. Research must explore the structures and activities that support this type of learning. Some research has focused on specific activities that aim to support teacher learning of reform teaching practices by focusing on enacting practices in the context of the university. I review this set of literature in the next section.

Focusing on practice in the university context. Another way in which the coursework-fieldwork gap is currently addressed is to focus attention on the practice of teaching itself. Rather than moving teacher education to schools as a way to focus on practice *in practice*, this model takes a different stance on the meaning of "in practice." In traditional models of university

teacher education, the pre-active and reflective aspects of teaching are a focus of university course work, such as methods courses, but learning the interactive aspects of teaching practice is often left to the field placement (Grossman & McDonald, 2008). In mathematics education, many of the practices that support equitable mathematics teaching are highly interactive in nature and depend upon teachers' ability to respond to student thinking in ways that advance mathematical ideas.

Ball & Cohen (1999) propose that teacher education must work toward a practice-based curriculum that would center professional education *in* practice allowing teachers to learn *in* and *from* practice. They argue for a professional education that is centered on the study of teaching practice. Grossman, Hammerness, and McDonald (2009) similarly propose that the field of teacher education develop what they call Pedagogies of Enactment or providing teacher candidates opportunities to carry out the work of teaching in their university methods courses. The intention is that by intensively working on the interactive aspects of practice while in the university context, teacher candidates will be able to then more easily transfer these practices into classrooms, thereby connecting university practice to classroom practice.

Those who are currently engaged in developing a practice-based curriculum of teacher education (Ball & Forzani, 2009; Grossman, et al., 2005; Kazemi, Franke, & Lampert, 2009; Lampert, Beasley, Ghouseini, Kazemi, & Franke, 2010) argue that the careful analysis of the core tasks of teaching can provide teacher candidates the opportunity to actually practice the work of “ambitious teaching.” Ambitious teaching practices are defined as “teaching that deliberately aims to get all kinds of students – across ethnic, racial, class, and gender categories – not only to acquire, but also to understand and use knowledge and to use it to solve authentic problems” (Lampert & Graziani, 2009). Preparing teachers to teach ambitiously has been a

challenge for the field of teacher education. Lampert and Graziani note that such ambitious practices are not easy to implement and that even experienced teachers find themselves in novice terrain when it comes to learning to teach ambitiously. In order to learn to teach ambitiously, novices must be given opportunities to “practice carrying out the interactive work of teaching” (Ball & Forzani, 2009).

Practice-based teacher education represents a shift from a focus on what teachers know and believe, and from the rich repertoire of pedagogies of investigation already developed in the field of teacher preparation, to centering on the work of teaching itself, or what teachers *do* (Ball & Forzani, 2009; Grossman, et al., 2009). The work that teachers do is often seen as highly contextual and improvisational, making the notion of narrowing in on specific practices seem difficult if not impossible. In fact, some might argue that because the work of teaching is so context-dependent and situated in meeting the needs of a wide variety of students, novices cannot be adequately prepared for such complex work.

Lampert and Graziani (2009) investigated domains in which improvisation was a key aspect of enacting the domain such as jazz and theatre. Through this investigation, they found that what appeared on the surface to be skilled improvisation actually involved a significant amount of structure and practice. This led the researchers to investigate language instruction, another highly interactive domain often characterized by improvisation and interaction. They studied a teacher education program in Italy situated within a school for language learners. The program involved its teachers in structured investigations of problems of instructional practice through a focus on a set of instructional activities. For example, one of the instructional activities was “Conversation Rebuilding”, an activity that novice teachers of Italian learned during the beginning of their program. This activity was focused on supporting students who are

language learners to focus on the linguistic aspects of a conversation set in a context by building on what they know in order to construct new knowledge. This instructional activity required novice teachers to elicit student thinking and to have a clear way of responding to students' ideas. Lampert and Graziani note that this instructional activity brought together the complexity that exists in the practice of teaching while limiting the demands on a novice teacher through the pre-determined content that might "come up" in the conversation. By reducing the amount of demands a teacher might need to attend to in an actual classroom while enacting a practice, this model limits those demands and allows the novice to focus on the core aspects of the practice.

As another example of how a focus on a core set of instructional activities is used to support candidates as they learn how to enact ambitious teaching practices is the work of Kazemi, Franke, and Lampert (2009). These researchers and teacher educators have taken up the examination of ambitious teaching practices in the context of elementary mathematics methods courses in university-based teacher education. They recognized their success in supporting teacher candidates to develop an ability to analyze depictions of practice but were dissatisfied with the candidates' ability to effectively use that knowledge in their direct interactions with students. They have developed a model of teacher education using pedagogies of practice that entail cycles of planning, rehearsal, enactment, and reflection within their methods courses. Novices learn to enact ambitious teaching practices through a set of instructional activities focused on mathematics learning. For example, teacher candidates learn how to enact a choral count as an instructional activity in an elementary mathematics classroom (Kelly-Peterson, 2010). Within this choral count are opportunities for teacher candidates to draw on ambitious teaching practices such as teaching toward a goal, eliciting students' ideas and positioning students competently.

To begin the cycle, teacher educators first rehearse the activity, with the candidates as students, in a way that surfaces the ambitious teaching practices for further investigation and refinement. Following this rehearsal and the refinement of the activity using a protocol, the candidates plan and rehearse the instructional activity with their peers acting as students and receive in-the-moment feedback from the teacher educators. In the final stage, the candidates enact the instructional activity with a group of elementary students at their practicum sites and bring back records of practice, such as video and student work, for further analysis and refinement. This can occur during the candidates' student teaching placement, a practicum placement, or in a field experience that is part of the methods course. The goal is to become "skilled in the routine elements of participation structures so that it is possible to interpret and respond to the non-routine information generated by students engaged in mathematical work" (Kelly-Peterson, 2010, p. 6). If novices are able to routinize an instructional activity rooted in ambitious teaching practices, their cognitive load is then reduced which allows them to attend to the more unexpected or non-routine aspects of teaching.

Focusing on practice within the context of the university allows novices an opportunity to take on "contained" aspects of practice under the support of university instructors who are responsible for teaching the practices to the novices. Instructional activities then become containers in which ambitious teaching practices can be surfaced, investigated, and practiced. Ball and Cohen (1999) argue that by focusing on the practice of teaching in the university classroom, teacher candidates are not limited by the practices enacted in a particular classroom. Further, by locating this work outside of the classroom, novices don't have to contend with the "rush of minute-to-minute practice".

These studies argue that placing practice at the center of teacher preparation has the potential to support novice teachers to develop ambitious teaching practices. However, what is missing from this research is the identification of the structures that support how these practices actually transfer to classrooms. How are novices supported in taking these practices into classrooms, are they recontextualized in ways that support P-12 student learning? For example, how do novices take ambitious practices into field experiences where the mentor teacher does not have knowledge of such practices? It is not clear how practitioner knowledge is utilized as a resource for learning. In this model of teacher preparation, it appears that novices must negotiate their own experiences from the university within the context of the field.

One promising structure that addresses these issues is the elementary mathematics methods course at the University of Washington. Elham Kazemi and colleagues have developed a modified approach to instructional activities by incorporating field experiences (Campbell et al., 2011). Rather than sending candidates out into their practicum experiences, enacting the instructional activities, and then bringing back records of practice for examination, Kazemi and her colleagues bring the candidates to a partner school and work closely with two elementary teachers. During the students' mathematics class, candidates have opportunities to enact instructional activities with small groups of students while being coached by both the classroom teacher and the university instructors. This is significant because the classroom teacher is used as an important resource for teacher candidate learning. The partner teacher also participates in the methods course, which is also held at the school site. This is a promising example of a teacher education pedagogy that draws on both academic and practitioner knowledge in more democratic ways.

The apprenticeship of observation. The acquire-apply pedagogy of teacher education and the marginalization of practitioner knowledge are two significant problems that contribute to the coursework-fieldwork gap. However, the most widely cited reason for teachers' difficulty in enacting reform practices in their classroom is the "apprenticeship of observation" (Lortie, 1975). Teacher candidates enter their teacher education programs with ideas, or frames of reference, about teaching and learning based on their own experiences as students. The drawback to this is that prospective teachers were not provided the opportunity to witness the behind the scenes act of teaching: the hidden intentions, decisions, and thoughts teachers have and make on a daily basis. Their experience as students is both limited and biased but rarely do people recognize this on their own. In addition, new teachers have limited ways of viewing how people learn differently and often use their own experiences of learning a particular content area, such as mathematics, to determine how that content should be taught (Korthagen & Kessels, 1999; Stofflett & Stoddart, 1994). The consequence is that prospective teachers carry misconceptions of what it means to teach based on their own experiences as students into their teacher education program and a tendency to mimic the practices of teaching which are most visible (Feiman-Nemser & Buchmann, 1985; Hammerness, et al., 2005; Kennedy, 1999). This frame of reference for teaching and learning creates an overly simplistic view of a deeply complex activity and impedes teachers' ability to reform practice.

When novice teachers bring a frame of reference for deciding what is appropriate for the work of teaching, a frame that is based on their own apprenticeship of observation, teacher education programs must work to alter these frames of reference and expand what it means to learn and to teach (Kennedy, 1999). If teacher education programs cannot effectively shift this frame then novice teachers' own schooling experiences will guide their decisions about practice

and, in turn, unfamiliar practices learned in the university become difficult to enact in their classrooms and are often abandoned (Feiman-Nemser & Buchmann, 1985; Kennedy, 1999). The result is the continual perpetuation of existing teaching practices in schools, contributing to the claim that teacher education has little impact on reforming classroom practice.

Shifting frames of reference for teaching. Kennedy (1999) argues that all teachers start from their own experiences of schooling. However, if these frames of reference are not challenged, then reforming education will be doomed. Practices will be carried forward as teachers are not provided a space for examining alternatives to their own experiences. Drawing on one's own frame of reference is essential in the practice of teaching because this is how teachers interpret what is happening in the classroom and how they make decisions about actions. However, teachers must also develop *situated knowledge*, so that they may interpret events in context, not just abstractly, and be able to act on those interpretations (Kennedy, 1999). Therefore, if reform is to take place, teacher education must work to change or shift the initial frames of reference novice teachers bring with them. Kennedy argues that university teacher education is the ideal location for this shift to take place because it is "located squarely between teachers' experiences as students in classrooms and their future experiences as teachers in classrooms" (p.57).

Conclusion

The coursework-fieldwork gap in teacher education stems from numerous issues related to the acquire-apply structure of teacher education where teacher preparation takes place in the university and in the classroom but is not integrated across these two spaces. Within this structure, university knowledge is valorized while practitioner knowledge is marginalized and little headway is made to shift teacher candidates' conceptions of what it means to teach and

learn. In light of the extensive research on the coursework-fieldwork gap in teacher education, the structural aspects of teacher preparation have begun to shift, most notably toward longer field experiences and less time at the university. However, research has yet to address the ways in which increased time in the field supports teachers to develop reform teaching practices.

Recognition of the critical importance of weaving together field and university experiences has created new pathways into teaching which attempt to draw more heavily on clinical experiences. However, similar to the debate about teacher education itself, the effectiveness of these pathways is hotly contested in the teacher education research community.

Good clinical experiences have been identified as one of the most important factors in learning to teach and some educational researchers have argued that field experiences must be central to any teacher preparation program (Ball & Forzani, 2009). In addition, there is a growing body of empirical evidence which claims that when teacher candidates are provided opportunities to study what they will be doing during their first years of teaching, and when those opportunities are strongly connected to both university coursework and field experiences, teachers are more successful (Boyd, et al., 2009; Darling-Hammond, 2000; Darling-Hammond, et al., 2005). If it is the case that field experiences are a necessary component of any teacher education program, and that novice teachers must be supported in developing the situated knowledge necessary when learning to teach, then a closer examination is needed of the types of field experiences that effectively draw on university-school connections and the ways in which school-based practices within field experiences support teacher learning. It is apparent that research on teacher education, both traditional and alternative, must continue to uncover how to prepare effective teachers. Levine (2006) makes this clear when he says "The bottom line is that we lack empirical evidence of what works in preparing teachers for an outcome-based education

system. We don't know what, where, how, or when teacher education is most effective" (p. 18). The purpose of this study is to continue working towards uncovering the practices within university-school partnerships that make a difference for teacher and student learning.

A review of the existing literature suggests that in order to more effectively address the coursework-fieldwork gap in teacher education and to actively work to support teachers to reform teaching practice, we must attend to the activities and structures of field experiences. It seems clear that the teacher education community would benefit from research that seeks to determine how particular structures and activities in field experiences draw on practitioner and academic knowledge more democratically, and how this might support teachers to reform their teaching practice. Cochran-Smith (2004) argues that "The power to reinvent teaching and learning is located in neither the university nor the school but in the collaborative work of the two" (p.27). When teacher preparation programs work collaboratively and democratically with teachers who are teaching against the grain, and create opportunities for candidates to engage in "deep intellectual discourse" with classroom mentors and university instructors, candidates can begin to see themselves as responsible for the academic success for all children, regardless of socioeconomic status or ethnicity. These teacher preparation programs, utilizing an approach Cochran-Smith calls *collaborative resonance*, work to link what candidates learn in their preparation programs with what they learn in their field experience by providing candidates with both the analytical skills they need to think critically about school practices and the resources to function as social agents.

Learning to teach should mean confronting uncertainty, negotiating constraints, and becoming an inventor. It means learning to be responsive to students' needs in the classroom. Learning to teach does not happen in isolated moments of time such as teacher preparation or in-

service teacher professional development, but instead happens across time. Learning to teach should not be prescriptive but interactive; learning to teach does not happen by receiving knowledge from experts and applying it in classrooms but instead requires working with others collaboratively to ask critical questions, investigate practice and generate local knowledge. Some teacher education programs have taken up the challenge to find ways to provide teacher candidates with opportunities to work with experienced teachers who are reforming their own teaching practice. However, as a research community, we don't know how particular structures that aim to connect coursework to fieldwork support teacher candidate learning. While it is important to design such structures and activities within teacher preparation, it is also important to investigate these structures and what they afford teacher candidates with respect to implementing equity-oriented teaching practices.

Cochran-Smith (2004) uses the term “working the dialectic” to refer to the process of simultaneously theorizing practice and “practicizing” theory. Practicizing theory is the act of generating local knowledge that is useful for the immediate context but may also be useful and relevant beyond the local context. Working the dialectic happens as teachers learn about practice by examining practice and this happens not only in teacher preparation but also across teachers' careers. If we are to “educate” teachers, we must support them in developing the skills that will allow them to “work the dialectic” as they move across their teaching career. Feiman-Nemser & Buchman (1985) argued that teacher education must position the work of teaching as a place to learn how to teach:

If schools became places where teachers studied their own practice together and were rewarded for doing so, future teachers would be inducted into a professional community where collegiality and experimentation were norms. In such a setting, observation and conversation among persons at different career stages would expand the alternatives available to the novice and dramatize the limits of personal and local experience. Future

teachers would get the message that learning from teaching was part of the job of teaching (p. 64).

By drawing on practitioner teacher knowledge in ways that give novices access to critical conversations about teaching practice, novices can themselves learn to generate local knowledge to support their own practice.

Current reforms in teacher education are working to deepen the quality of teacher preparation by increasingly situating teacher learning in the context of practice (Zeichner, 2010) as a way to support teacher candidates in developing local knowledge. Such school-focused teacher preparation aims to create a context in which academic and practitioner knowledge interact more collaboratively and democratically to educate future teachers. However, little research examines the specific practices of these collaborations. I argue that by shedding light on how particular practices work to allow teacher candidates to build their theoretical and experiential knowledge, we can move away from a theory-practice “gap” and toward a more dialogic view of theory and practice. Britzman (2003) argues that this relationship must hold in teacher education.

We can consider the process of theorizing not as an isolated activity separate from the experience of teaching, or as a grand truth one attempts to impose, but rather as a lived relationship, grounded in the practical existence of persons and dependent upon the process of interpretation and change... The sources of theory, then, are in practice; in the lived lives of teachers, in the values, beliefs, and deep convictions enacted in practice, in the social context that encloses such practice, and in the social relationships that enliven the teaching and learning encounter. (p. 64-65)

It should no longer be the case that university academics seek to take sole responsibility for “teaching the theory” to candidates. We know now that learning to teach requires the integration of both academic and practitioner knowledge. If the sources of theory are in practice, and if learning to teach happens across time in collaborative inquiry with others (Cochran-Smith & Lytle, 2009) then teacher educators must partner with classroom teachers to support candidates

as they learn to examine, question, reframe, and enact equitable teaching practices as part of their teacher preparation.

The Study

The goal of this study is to add to the research on university-based teacher education, specifically to identify the practices evident in school-based teacher education that support candidate learning in both fieldwork and coursework. The study aims to surface the particular features of the Mediated Field Experience and the ways in which these structures and activities support teacher candidate learning of equity-oriented mathematics practices. To investigate this gap in the research literature, this study addressed the following questions:

- 1) What is the Mediated Field Experience?
 - What is the nature of the structures and activities of the MFE? How do these structures and activities draw on academic knowledge and practitioner knowledge?
 - What roles do teacher candidates, partner teachers, and university instructors take on during the MFE?
- 2) What are the experiences of the teacher candidates within the mediated field experience?
 - What do teacher candidates find salient within the MFE?
 - What do teacher candidates struggle with or find problematic?
- 3) To what extent does the MFE support teacher candidates' learning about equity-oriented teaching practices in mathematics?
 - What do teacher candidates learn about particular equity-oriented teaching practices?

Overview

In the next chapter, I begin by introducing the partner teachers and their classroom teaching practices as a way to demonstrate how these teachers were “teaching against the grain”

by working to implement equity-oriented teaching practices. I provide the history and context of the university-school partnership in which the Mediated Field Experience is situated and explain how the partner teachers came to develop their mathematics teaching practices through this partnership. I then explain how the university secondary mathematics methods course instructor used this partnership to re-structure the methods course in order to incorporate a “mediated” field experience.

Chapter 3 describes how I draw on Cultural-Historical Activity Theory (CHAT) to conceptualize field experiences in teacher education programs that utilize an acquire-apply pedagogy. I use CHAT to examine how this structure produces conflicts such as the marginalization of practitioner knowledge and the perpetuation of the apprenticeship of observation. The framework is particularly useful because it allows me to examine how learning to teach in the MFE is historically and culturally mediated.

In chapter 4, I defend my choice of qualitative research methods, situating my study in the constructivist paradigm. I outline my data collection methods and the ways in which I analyzed my data. I then address issues of “trustworthiness.”

Chapter 5 begins the first of three findings chapters. This chapter describes how the structures and activities of the Mediated Field Experience worked to position the partner teachers as teacher educators. By providing the teacher candidates access to practitioner knowledge, they were able to more effectively connect teaching and learning through their observations of students.

In chapter 6, I describe how my analysis of the MFE debrief discussions and the teacher candidate reflections reveals the ways in which the teacher candidates were “noticing” classroom interactions. I briefly describe the teacher professional noticing literature and then describe the

interactions the teacher candidates noticed and how the structures of the MFE provided them opportunities to notice many “invisible” aspects of teaching and learning.

Chapter 7 details a third finding of the study where I examine more closely two particular classroom interactions noticed by the teacher candidates, the student-student interaction and the teacher→student-mathematics interaction. I describe what the teacher candidates learned about equity-oriented teaching practices rooted in these two classroom interactions and the structures of the MFE that supported their learning.

Finally, chapter 8 brings together my research questions, the conceptual framework, and the findings to describe how the activities and structures of the MFE center on teacher candidate learning. I provide limitations of the study and implication for future research and implications for practice.

Chapter 2

The History and Context of the Mediated Field Experience

The focus of this study is to examine the structures and activities of a field-based methods course in a university Teacher Education Program and to determine the ways, if at all, the structures support teacher candidate learning of equity-oriented teaching practices. The model under examination is a secondary mathematics methods course and the field experience connected to the methods course, the Mediated Field Experience (MFE). In this chapter, I describe the history of the partnership between the Septima Clark High School mathematics teachers and the university Teacher Education Program, specifically, the instructors of the mathematics methods course, and how this partnership led to the creation of the Mediated Field Experience. First, I briefly describe how the Mediated Field Experience came into existence as a way to support teacher candidates in making sense of practice as they moved between their university coursework and field experiences. I then describe the Clark High School mathematics teachers who participated as partner teachers in the Mediated Field Experience. Finally, I briefly describe the secondary mathematics methods course for the purpose of highlighting the goals the methods course set out to accomplish and the degree to which these aligned with the goals the Clark mathematics teachers had for their Algebra students.

From Acquire-Apply to Bridging the Gap

The methods course was a two-quarter course within a four-quarter graduate Teacher Education Program (TEP) located within a large Northwest research university. This particular TEP led to state certification at the completion of the program and a Masters degree at the end of the induction year. According to the website, the program is dedicated to preparing teachers for urban schools in culturally diverse and poverty-impacted communities.

Prior to the re-design of the secondary mathematics methods course to include a mediated field experience, the teacher candidates began their first quarter of the teacher education program by attending their university coursework during the day. The methods course spanned two quarters and during the first quarter, the course met two days each week at the university for three hours each day. During week five and six of the ten-week quarter, the candidates left their university coursework and participated in their first full-time field experience. As is typical with field experiences, candidates were placed in separate classrooms and most often in different schools. The schools were located in many different communities – some candidates were placed in urban settings while others were placed in suburban communities. The university instructors gave the candidates assignments during the two-week field experience, but other than that, the university instructors themselves had no connection to the field experience classrooms. At the conclusion of the two-week field component, the candidates then returned to the university to complete their remaining coursework for the quarter.

This model of field experience within the teacher education program assumes an acquire-apply pedagogy of learning to teach (Korthagen & Kessels, 1999; Zeichner, 2010) in which candidates were expected to acquire teaching practices in one context (in this case, a mathematics methods course) and apply the practices in another context (a student teaching placement). This model of teacher education did not take into account how teacher candidates learn within and across the multiple contexts of teacher education. In fact, some of the contexts in which candidates were expected to learn were in direct conflict with one another. During the two-week field experiences held during the quarter, some candidates were placed with partner teachers who primarily utilized teacher-centered, direct instruction pedagogies. The candidates were then left to mediate for themselves the relationship between what they were learning in the

university and what they were learning in the field. The conflicting nature of university and field limited the ways in which candidates could make sense of equity-oriented teaching practices in mathematics.

Evidence from a research study that followed a group of secondary mathematics and social studies candidates as they progressed through this teacher education program and into their first two years of teaching found that candidates were recontextualizing practices in problematic ways. The practices that were the most difficult for the candidates to successfully enact in their classrooms were the practices that were highly interactive and depended on making sense of student thinking (Horn, 2008). For example, a mathematics teacher candidate named Dania struggled with coordinating the practices of high-press questioning with the demands of her teaching context. In her TEP, high-press questioning was a significant focus of the mathematics methods course and Dania identified this practice as a strategy she wanted to develop in her teaching practice. However, as Dania moved into her first year of teaching, she had to then adapt this practice within her teaching context – an alternative public high school geared toward helping students recover credit for graduation requirements through individualized instruction. Dania struggled to maintain the high-press questioning strategy, as her instructional goal became moving students through their worksheet packets as quickly as possible. Her questioning practice came to resemble the traditional elicitation discourse pattern with little press for justification.

In another example, a mathematics candidate named Abe demonstrated a skilled ability to enact high-press questioning in his methods course. However, as he began his first year of teaching, he struggled to coordinate his high-press questioning with the small groupwork structure in his classroom. Because Abe tended to become “too focused” on the work of

individual groups and struggled to manage multiple groups at once, his goal of high-press questioning was met at the expense of making his questioning available to all students in his classroom.

Based on these findings, Lani re-designed the course in an effort to create greater coherence across the various contexts in which candidates learn to teach. The re-design was geared to create a more practice-based methods course by partially situating the course within an urban and culturally diverse high school setting. This was accomplished by partnering with the Clark HS mathematics teachers who were engaged in critically examining the relationship between teaching practice and student success and who were working to change their teaching practice and support their students' success, particularly in the first year Algebra courses. These teachers were engaged in an intense focus on increasing student participation and access to rigorous mathematics through their involvement in a research study and professional development program. This program was lead by Lani and Jim King, a mathematician. Through this project, the teachers at Clark High School received support in adopting a new standards-based curriculum and they participated in professional development in equity-oriented mathematics teaching practice. In addition, the participating mathematics teachers were released from one class period so they could collaboratively engage in professional conversations aimed at supporting their students who struggled the most in mathematics. This daily meeting time was called the Collaborative Planning Period.

The practice-based part of the methods course was a field experience that was attended by all of the teacher candidates and the university instructors¹⁰ who taught the course. This field

¹⁰ Instructors included the primary instructor - in this case, Lani – and the teaching assistants who were Ph.D. students in mathematics education. These teaching assistants were also former mathematics teachers. During the first year of the MFE, I was one of the doctoral students and served at a teaching assistant. In the following four years, I was the primary instructor of the secondary mathematics methods course, including the MFE.

experience was named the Mediated Field Experience (MFE) because the intended goal was to mediate the candidates' experiences within the methods course and the field by partnering with teachers who were generating local knowledge by critically examining their teaching practice.

In general, the Mediated Field Experience was comprised of three sequenced activities. First, candidates attend a university methods class held on campus. The following day, the candidates and the University Instructors traveled to Clark HS and observed an Algebra 1 class. Immediately following the class observation, the partner teachers, the candidates, and the University Instructors met together in one of the classrooms to discuss the observation. This cycle is repeated on a weekly basis for the duration of the first quarter of the methods course.

In order to understand how the Mediated Field Experience functioned as a context for teacher learning, it is first important to take into consideration the teaching practices of the partner teachers at Clark high school. Their practices developed in part through a professional development partnership that had previously been established between Clark high school and the University. It is also important to understand the relationship between the teaching practices of the partner teachers and the practices promoted in the secondary mathematics methods course in the TEP. In the next section, I will introduce the partner teachers, detail the history of the partnership between Clark High School and the University, and explain how the Mediated Field Experience grew out of this partnership. I then provide a brief description of the secondary mathematics methods course, including the activities of the Mediated Field Experience. I conclude by describing how the two learning contexts, the mathematics methods course and the Clark HS partner teachers' classrooms, shared a particular perspective on teaching and learning that positioned them to create a new learning-to-teach context.

Clark High School: A Context for Reforming Teaching Practice

The history of the university-school partnership began with the Clark HS mathematics teachers and their struggle to support their Algebra 1 students to be successful in mathematics. In this section, I describe how the Clark HS mathematics teachers decided to reform their teaching practices, curriculum, and the ways in which they supported each other to provide their students opportunities to be successful in mathematics.

Clark High School is located in the same large Northwest city as the university. However, unlike the university, it is located in a poverty-impacted and racially diverse part of the city. At the time of this study, 60% of the students at Clark identified as an ethnicity other than white; 28% of the students were African-American, 25% Asian, 7% Latino, and 1% Native American. In addition, 34% of the students qualified for free or reduced lunch¹¹. It is one of 12 high schools in the district and, although it draws much of its population from the surrounding neighborhood, it also houses the district's Accelerated Learning program¹². Approximately 25% of the students who attended Clark HS were in this program, creating a situation in which institutionalized tracking segregated the mathematics classes by race and class. At Clark HS, the Algebra 1 classes were almost exclusively composed of students who were not in the Accelerated Learning program. Students in the Algebra 1 classes were primarily students from the neighborhood while the upper-level mathematics courses were composed primarily of white students bussed in from more affluent parts of the city. The Algebra 1 courses were racially diverse but with very few white students. This was in contrast to the overall demographics of the school where 40% of the students were white.

¹¹ These data come from the 2009 school district statistics, found on the school district website.

¹² This program tests students in early elementary school and segregates students into an accelerated learning program.

In general, many of the students who enrolled in the Algebra 1 course came to high school having variable levels of success in their previous mathematics courses. In addition, some of the students in the Algebra 1 classes were taking the course again because they were not successful the first time they took the class. The Algebra 1 courses had experienced significant failure rates, in some cases reaching 80%.

Approximately five years prior to the current study, some of the mathematics teachers at Clark HS asked Lani Horn, the TEP university faculty member who also taught the secondary mathematics methods course, to support them in re-structuring their curriculum and teaching practices. Because the teachers had experienced extremely high failure rates in their Algebra 1 courses they were looking for ways to support their students in being more successful in mathematics. Lani and another researcher from the university mathematics department, along with a few graduate students including the author, worked with a core group of Clark High mathematics teachers to provide grant-funded professional development in research-based, equity-oriented teaching practices centered on Complex Instruction (E. Cohen, 1994; Featherstone, et al., 2011; Horn, 2012). The teachers were also supported by grant money in selecting a new standards-based, integrated curriculum.

With the financial support of university grant money, the Clark HS mathematics department was able to hire an additional mathematics teacher which then provided four other Algebra 1 teachers a second planning period, the Collaborative Planning Period (CPP). Together, these five teachers met four times each week during this allotted time to plan for their Algebra 1¹³ course. During the Collaborative Planning Periods, they centered their conversations

¹³ When the teachers adopted a new curriculum, they chose an Integrated curriculum. This was a school adoption and not a district-wide adoption. This meant that their “entry-level” mathematics course was called Integrated 1 and not Algebra 1. However, at the time this study was conducted, the district had just adopted a new district-wide

on how to support more equitable student participation in their mathematics classrooms. They worked together to create multiple-ability tasks and activities, planned lessons that aimed to hold students accountable to both groupwork and individual understanding, co-created assessments, and discussed how to better support their students who struggled the most in mathematics (Bannister, 2009; Horn & Kane, under review). Once each week, the research faculty and graduate students attended the CPP and provided curricular and pedagogical support in teaching the Algebra 1 course¹⁴. They also provided long-term professional development support including instructional coaching and video clubs (Sherin & van Es, 2009).

The Creation of the Mediated Field Experience

It is important to recognize that the teachers who partnered with Lani to create the Mediated Field Experience were the same teachers who were working with a team of mathematics education researchers to address issues of equity and access in their mathematics courses. These teachers saw a need in their school and sought support. They had a working knowledge of equity-oriented, research-based pedagogy and were intentionally working to support their students to be successful in mathematics. These teachers intimately understood the social and political context of their inner-city school - located in a poverty-impacted community - that bussed in students from more affluent communities for the Accelerated Learning Program. In the secondary mathematics methods course at the university, Lani was working toward a similar goal: supporting new teachers in learning how to do the highly interactive work of which the Clark HS teachers were engaged. By partnering with the Clark HS teachers, Lani could provide her teacher candidates with concrete and real examples of teachers enacting this type of pedagogy while the Clark HS teachers could continue to work on improving their practice with

mathematics program and required all schools to use this curriculum. This meant the Integrated I class was re-named Algebra 1. For the sake of simplicity, I will refer to the entry-level 9th grade mathematics class as Algebra 1.

the support of the observation and discussion with the teacher candidates and their university instructors. The Mediated Field Experience was an opportunity to hit a “sweet spot” where all participants – teacher candidates, partner teachers, university instructors and classroom students – were engaged in learning in ways that transcended what was possible prior to the MFE (Bier, et al., in press).

Two years after the partnership between Clark HS and the University began, Lani collaborated with this core group of teachers to create the Mediated Field Experience. These teachers were working to improve their teaching practice, in part by adopting practices associated with Complex Instruction. With the support of the university faculty and research assistants involved in the professional development project, the mathematics teachers at Clark had spent a great deal of time critically examining the relationship between teaching practice, curriculum, and student success in mathematics.

Complex Instruction was also the pedagogical framework Lani introduced in the methods course in the university TEP. Lani saw an opportunity for her teacher candidates to observe first-hand how equity-oriented teaching practices can be coordinated with other practices and adapted within a particular context – in this case, “entry-level” college preparatory Algebra 1 classrooms where many of the students had a history of failing mathematics. Many of the teacher candidates had never seen a mathematics classroom in which students worked collaboratively to learn mathematics. This was also an opportunity for the teacher candidates to get to know some of the students who struggled in mathematics. Lani recognized the importance of teachers building relationships with their students, especially students who experienced mathematics in ways different from the teacher candidates. The teacher candidates typically possessed limited understandings of the multiple reasons and ways in which students struggle in mathematics, most

likely because they were themselves very successful in mathematics. Building positive relationships with students is not something that can be learned in a university classroom devoid of actual students and partnering with these teachers seemed to be a way to address the issue of understanding students' mathematical experiences. As mentioned earlier, many of the practices of Complex Instruction are highly interactive in nature and therefore depend on the teacher building positive relationships with their students if teachers are to take up such practices.

I have provided a description of the history of the Mediated Field Experience and how it began as a collaborative partnership between the university TEP and Clark High School. In the next section, I describe the classroom context and university context during the particular iteration of the Mediated Field Experience that is the focus of this study. I begin by introducing the four partner teachers, two of which were observed during the MFE. I provide relevant history about their own pre-service teacher education, their teaching experience, and their prior work with this particular Teacher Education Program. Then I describe their classroom practice by drawing on particular pedagogical examples that represent their teaching practice. Finally, I describe the mathematics methods course by identifying the key activities, assignments, and goals for the course.

The Clark High School Partner Teachers

Four teachers participated in the MFE as partner teachers, Zoe, Vanessa, Tanya, and Wendy¹⁵. Wendy and Tanya were the primary Partner Teachers for the MFE, which meant that Wendy and Tanya's classrooms were where the observations took place. Vanessa and Zoe, who also taught Algebra 1, were not observed but participated in the debrief sessions with Wendy and Tanya. During the first two MFE sessions, Ms. G., a mathematics coach for another high school

¹⁵ For the ease of the reader, I have given the partner teachers pseudonyms from the last part of the alphabet, V-Z. The teacher teacher candidates have pseudonyms from the beginning of the alphabet, A-M. The university instructors all have pseudonyms that begin with the letter S.

in the district and a former Clark HS mathematics teacher, also participated in the observation and debrief session. Vanessa, Wendy, Tanya, and Zoe all taught Algebra 1 and they all participated in the Collaborative Planning Period (CPP) for their Algebra 1 classes. This created a situation in which the Algebra 1 lessons and instruction were similar on a day-to-day basis. For the most part, these teachers started units on the same day, implemented co-planned activities and lessons on the same day, and assessed their students using similar, often co-created, tools. Additionally, all four of these teachers were working toward a common instructional goal in their classrooms based on the lessons they had co-planned during the CPP.

Vanessa. At the time of this study, Vanessa was in her 5th year of teaching, all of which had been completed at Clark HS. Vanessa attended the same Teacher Education Program (TEP) and was in Lani's secondary mathematics methods course before Lani began the MFE. Vanessa was hired during the first year of the university-school partnership to release a group of teachers from an additional teaching period so that the Collaborative Planning Period could be formed. She also participated in the Collaborative Planning Period during her first year of teaching and in subsequent years. Vanessa had participated as a partner teacher in prior MFEs, including the very first MFE when she was in her first year of teaching. In her fourth and fifth years at Clark HS, Vanessa agreed to mentor two student teachers for the TEP. During the MFE in this study, Vanessa elected out of participating as a primary Partner Teacher because she was working on her National Board Certification but she agreed to attend all of the debrief sessions.

Wendy. At the time of this study, Wendy was in her 4th year of teaching at Clark HS. Like Vanessa, she had graduated from this TEP and was hired by Clark HS as a first year teacher. During her TEP, Wendy participated as an candidate in the first MFE, of which Vanessa participated as a Partner Teacher. In fact, Wendy was assigned to observe in Vanessa's

classroom. During Wendy's time as a teacher at Clark HS, she had participated as a Partner Teacher for the MFE for three consecutive years. At the beginning of the MFE that is the focus of this study, Wendy had just finished mentoring her first student teacher from the TEP.

Zoe. Also a graduate of the TEP, Zoe was in her first year of teaching at Clark HS at the time of this study. Zoe had participated in an MFE as an candidate in the TEP and was placed in Wendy's classroom for her observations. As a first year teacher, Zoe agreed to participate in the MFE debrief session in preparation to become a partner teacher in subsequent years.

Tanya. Tanya was the only partner teacher who had not attended the TEP. At the time of this study, Tanya was in her 18th year of teaching and her fourth year of teaching at Clark HS. Similarly to Wendy, she had just finished mentoring a student teacher through the TEP when the MFE began. This was also Tanya's first year participating in the Collaborative Planning Period. Although Tanya did not come to the MFE with the same pedagogical preparation and background as the three teachers who received their teacher education from the TEP, she was working to implement many of the same practices that Vanessa, Wendy and Zoe had first learned in their TEP, specifically the practices of Complex Instruction. This instructional approach was a fundamental aspect of these Clark HS mathematics teachers' practice.

The Partner Teachers' Instructional Practices

All four participating teachers taught mathematics using a groupwork, cooperative learning model based on Complex Instruction. This pedagogy was a major focus of the TEP mathematics methods course, which Vanessa, Wendy, and Zoe all attended as teacher candidates. In addition, all of the teachers, including Tanya, had participated in professional development in Complex Instruction through summer workshops and mentor-coaching during the school year.

In these classrooms, students worked collaboratively in groups, publicly shared their mathematical understanding with other students, and were assigned competence when they were successful. These classrooms shared many of the practices advocated by current mathematics education researchers. Students worked collaboratively in small groups while teachers closely attended to issues of status amongst the students (Cohen, 1994). Teachers frequently pressed students for mathematical justification (Brodie, 2010; Kazemi & Stipek, 2001) by asking questions that focused on students' understanding of important mathematical ideas (Herbel-Eisenmann & Breyfogle, 2005). Teachers required students to explain both how and why they solved mathematics problems and encouraged and facilitated high-level mathematics talk (Hufferd-Ackles, Fuson, & Sherin, 2004) between students. In addition, the teachers worked to broaden students' ideas of what it meant to be good at mathematics by encouraging students to find multiple methods and representations for solving problems (Boaler & Staples, 2008; Featherstone, et al., 2011).

During the MFE observations a few key practices emerged that were common across the two classrooms in which I observed and were also often the focus of conversation during the debrief sessions. In order to more fully understand what the teacher candidates learned about teaching with equity-oriented teaching practices, it is important to understand some of the specific practices that were observed during the MFE. In the next section, I describe a few of these key practices as a way to shed light on the practices of the Clark HS mathematics teachers.

Learning in groupwork. In the two classrooms I observed during the Mediated Field Experience, Tanya and Wendy's Algebra 1 classrooms, the students were seated in groups of four and were provided an activity they were expected to complete together, usually a set of problems to solve on a worksheet created by the teachers during their CPP. Often times this was

a groupworthy task (Lotan, 2003) where students needed to work collaboratively to solve the problems. Sometimes the task was structured so that students had to find multiple ways to solve a problem which, combined with the norms the teachers had established in their classrooms, encouraged students to use each other as mathematical resources. Other times, the teachers implemented a teaching practice that required the groups to work collaboratively. One example of this was a Shuffle Quiz¹⁶. The students were expected to complete a few problems together, making sure that everyone at the table understood how to solve the problem correctly. When the group decided they were ready, they called the teacher over and she collected all four students' papers. She shuffled them behind her back and then pulled out one student's paper. That student was then asked to explain in words how he or she solved one of the problems on the paper chosen by the teacher. If that student was unable to explain, the teacher handed back the papers to each student and said, "Your group is not ready. Call me back when you are ready." The students then had to work together to make sure everyone could explain how each problem was solved. A grade was assigned to the entire group, which created both a high-stakes situation and required that the students work together so that everyone understood the mathematics.

It was clear from observing these teachers that particular norms were in place as the students worked together to solve mathematics problems. Students were expected to work collaboratively with the students in their groups to solve problems and not "talk outside" their groups. Students were also expected to ask questions of their group members before the question was posed to the teacher. I often observed the teacher say to the group, "Is this a group question?" before allowing the student to ask the question. When the question was not a group

¹⁶ This practice is attributed to the Railside teachers (Boaler & Staples, 2008). Although the Railside teachers did not develop the name 'Shuffle Quiz', the practice of randomly holding students accountable for being able to explain how to solve the problem was developed by the Railside teachers through their work with Elizabeth Cohen and Complex Instruction (see Jilk, 2008).

question, the teacher told the group that the question had to be a group question, and then the teacher would walk away. The expectation was that the students needed to pose the question to the group first because someone in the group might be able to answer the question for the group. In this way, students were expected to be mathematical resources for each other.

As students worked together on the problems in their groups, the teachers circulated the classroom, periodically intervening in groups. Often times I observed the teachers moving the manipulatives or the worksheet a student was working on to the middle of the table so all students could see and have access to the work. I also observed the teachers posing questions to either individual students or to the group, sometimes walking away without waiting for an answer – wanting the groups to “hash it out” on their own. During the first debrief session of the MFE, Wendy described different ways the partner teachers “intervene” in the groupwork and the purpose behind the interventions:

We are really thoughtful about how we go to our groups...by getting the paper in the middle, we are trying to get kids to show what they know, we will elicit what they know and get them to talk about what they know and get them to be the experts on the content. So when I go to groups, I try to figure out who knows what, poke some kids to share some ideas and let them be the ones doing most of the talking...we try to facilitate group conversation and it's really cool to see kids demanding other kids to put their paper in the middle and talk about what they did. Or demanding for an explanation because an answer is just not going to help them. (*Wendy, MFE debrief, 4.6*)

The partner teachers were very intentional about how they intervened in the groups and when they did intervene, they continued to be mindful of the ways they were encouraging their students to contribute to the mathematical thinking of their group members.

The teachers also paid close attention to the participation within the groups. One of the norms in the classrooms was for students to “stay together” in their groups, meaning the students were to work together on the same problem and not move on until everyone was ready. This meant the teachers needed to pay attention to who was talking in the groups and making sure the

students were staying together as they worked through the problems. During one of the last debrief sessions of the MFE, one of the candidates asked Tanya what she paid attention to as she circulated around the classroom and observed the groups. Tanya responded:

For those of you that have been in my class, any group with Desiree, Justina, or Tamika is vocal and I fear that the other people are left behind – like everyone else is just overshadowed. And I want to check in and make sure that Maria isn't being left behind, you know? So what Wendy was saying about looking at all the papers – “Are you guys all on the same page?” I hope to hear Maria's voice as I walk by. For me, it's a lot more about making sure I'm not making kids – or groups aren't or somebody's not leaving kids behind who I know are struggling with this stuff. (*Tanya, MFE debrief, 5.11*)

This quote from Tanya demonstrates the intentionality of the partner teachers as they monitored and interacted with the groups. Their goal was to get the students talking about the mathematics, to encourage the students to rely on each other and work together to solve the problems, to encourage equitable participation, and to get the students to see their own ability – and the ability of the students in their groups - to be mathematical problem solvers. It was important for the teachers to establish self-efficacy in their students around mathematics. They felt that if the students saw themselves as capable of being successful in mathematics, this would increase their participation in groups and thereby increase their mathematical understanding. Their goal was to get all of their students to participate intellectually in the groupwork.

Student discourse characterized by justification. Another common practice was to have individual students or groups of students come to the front and present their work. Toward the end of the class period, after students had an opportunity to complete their group worksheet, the teachers asked students to present their work at the front of the room, either at the board or on the document camera. Although students were often told at the onset of the activity that someone would be randomly chosen to present a problem, sometimes these students were in fact selected randomly and other times the teachers decided to call on volunteers. Still other times,

the students were chosen ahead of time based on their solution strategy or their prior lack of participation in presentations.

When students presented their work, as well as when students were working in their groups, the teachers consistently pressed students to not only explain how they solved a problem but why their solution strategy worked or made sense. What follows is a representative example of an episode in Wendy's class during the first observation. She gave three problems for students to solve in their groups as a warm-up activity and told the students she would randomly select a few students to present their work. Wendy introduced the warm-up as follows:

Everyone [look] up here. We looked at some special types of lines - we are going to look at that more today. Today is Day 2 so you want to walk away today knowing what 'special lines' means. We are going to do a recap of yesterday so if you didn't get it yesterday, today is your day. Make sure you know what is going on with special lines. Someone [in your group] will need to read directions out loud. I don't want you to do too much work so read the directions! They change - see what is expected of you. I will pick a random student to present. (*Wendy, Lesson Observation, 4.6*)

As the students were working, Wendy walked around the classroom, observing the groups, sometimes intervening and other times just quietly observing and then walking to the next group. After about 20 minutes, Wendy brought the class back together again. She began by asking for a student volunteer to present problem number one on the warm-up. This problem required students to examine a graph of two linear equations that have the same slope but different y-intercepts and explain what they know about the two equations.

Wendy: I was going to draw names but I am going to call on a volunteer.
 A male student, Ramel, raises his hand and Wendy selects him to go up to the document camera. Wendy moves to the back of the classroom.
 Wendy: Before you start, can I say something? So, everyone?
 She waits until the students are quiet.
 Wendy: I want to use this time to make sure people are clear about this stuff. I want a respectful audience. If you want to share ideas, Ramel will call on us. Let's make sure we get our questions answered about number one.
 Ramel: I just did, for this line, I stared at four so I put four, so rise over run so it goes across 2 times – across the x axis.

Wendy (to Ramel): You have a question back here.

Ramel calls on Takeesha.

Takeesha: I get it, you are right, but I don't think that's what we were supposed to do.

Ramel: Well it says describe what you know about the equations so how do you do that if you don't know what the equation is?

Wendy: Ramel, will you tell us what you know about those lines?

Ramel: Since the slope is the same, they are parallel. Two straight lines that never touch.

Wendy: Oh! Tell us that again – that is *super* important!

Takeesha: They have the same rate!

Wendy: Oh! That is super important! Parallel – same rate of change. Those are the big ideas for number one.

Ramel says something inaudible about how the lines don't start at the same place on the y-axis.

Wendy: Excellent! Right – so you should also have written down that they have different starting points. Excellent Ramel, you are modeling exactly what I want students to be doing when they go up there.

This episode is indicative of how the teachers structured student presentations. The students who presented their work were expected to explain how they solved the problem and justify their thinking while the teacher, as well as other students, were expected to ask questions of the student presenters. The teachers used these student presentations as an opportunity to both highlight the intellectual work of individual students and to “get out” some of the big conceptual ideas the students were working to learn.

Tanya commented how, over the course of the school year, her students transitioned to feeling more comfortable about presenting in front of the class: “I have kids who want to come up to the front of the room to do stuff – not all of them. But I didn't have any on day one. Or day 20. And I think that's pretty amazing that they are willing to come up and be wrong and that's OK.” It was clear that the partner teachers had established particular norms around student presentations, indicating to students that doing mathematics means justifying their thinking. In addition, because the students felt comfortable enough to share possibly incorrect thinking, students understood that making mistakes was a necessary part of learning. Tanya indicates that this was an expectation that was developed over the course of the school year.

During the third MFE debriefing session, one of the teacher candidates, Luke, noticed how the teacher he observed reinforced holding the groups accountable to each other during a student presentation. Wendy had asked a student, Marisol, to come to the front and present a problem and Marisol struggled to communicate her thinking. Luke commented on this interaction by stating:

Marisol – she was unprepared but she went up to the board...and Asheed said “She messed up, huh Ms. Meyer?” and Wendy said “You’re in her group! Why aren’t you – you should be keeping track of this and helping out!” So really putting the responsibility back on the students and making sure they are focused on their groups. (*Luke, MFE debrief, 4.23*)

Holding students accountable to their groups for understanding and being able to explain the mathematics was a major theme that permeated most all of the practices in the teachers’ classrooms. Holding students accountable for understanding created group interdependence; the students were required to participate in the co-construction of mathematical understanding. Often in groupwork, some students are left out or choose to not participate, resulting in inequitable participation and inequitable learning opportunities. By requiring that all students understand and placing that responsibility on the students by calling on a group members to present the thinking of the group, students were less likely to disengage or take over the thinking for the group, thereby providing opportunities for all students to learn and understand the mathematics.

The practice of asking students to publicly present a solution method provided students opportunities to learn in at least two ways. First, because the norms in the class required students to support their ideas with mathematical justification, other students in the classroom had access to additional ways to solve or think about the mathematics problems. Boaler & Staples (2008) argue that this is a teaching practice that promotes equity because the practice of justification

makes “space for the mathematical discussions that might not otherwise be afforded” and that given the broad range of students’ prior knowledge, “receiving a justification that satisfied an individual was important as explanations were adapted to the needs of the individuals and mathematics that might not otherwise be addressed was brought to the surface” (p. 631).

Second, by asking students to make public presentations of their thinking and by requiring that the presentation be rooted in mathematical justification, the teachers modeled how they wanted students to interact when they were working in their small groups. Often times the partner teachers and the students in the audience would pose questions to the presenter. The asking and responding to high-press questions that narrowed in on justification and sensemaking supported the students to learn how to make their thinking accessible to the other students in their groups, thereby increasing opportunities for students to access the mathematics.

Mathematical representations as learning tools. During the seven-week period of time in which the MFE observations took place, the Algebra 1 partner teachers introduced and taught a unit about quadratic functions. The first MFE took place just before the beginning of the unit. At this time, the students were finishing up their unit about linear functions. The teachers had previously used a manipulative called Lab Gear¹⁷ to teach students how to solve linear functions and the teachers continued to use Lab Gear as they introduced the unit on quadratic functions. Lab Gear is a manipulative that uses a geometric representation of “terms” of a polynomial in order to visually demonstrate algebraic symbolic manipulation. The rectangular area of the top face of a Lab Gear piece represents a term in a polynomial expression. Pieces can represent 1, 5, x , x^2 , y , y^2 , and can also represent 3-dimensions or polynomials of the third degree such as xy^2 or x^3 by using the volume of a piece. For example, the x -piece is a rectangle with a length of “ x ”

¹⁷ Henri Picciotto, Wright Group/McGraw Hill – Creative Publications: https://www.wrightgroup.com/launch/wright_group.html. For more information on using Lab Gear in a mathematics classroom, please see <http://www.mathedpage.org/manipulatives/lab-gear.html>

and a width of 1 (see Figure 2.1). The length is static but is thought of as having a variable length. Lab Gear is most often used to teach operations (addition, subtraction, multiplication, and division) of algebraic expressions, factoring, the distributive property, and solving linear, quadratic, and cubic functions. Figure 2.1 shows one way that Lab Gear can be used represent both area and perimeter of a figure.

The primary goal for the partner teachers was that students would gain a conceptual understanding of quadratic functions, such as understanding that a quadratic equation can be represented as the area of a rectangle with an unknown length and/or width. The teacher also wanted to develop students' ability to manipulate symbols that represented abstract concepts such as variables. For example, when students are given an expression such as $(x+2)(x-3)$, students understood that they could represent this as the length and width of a rectangle and the use multiplication of the parts of the rectangle to find the total area. Procedurally, this would be equivalent to applying the distributive property to find the product. Using the Lab Gear was one way to meet the partner teachers' learning goals because the visual representation allowed both conceptual and procedural skill and knowledge development.

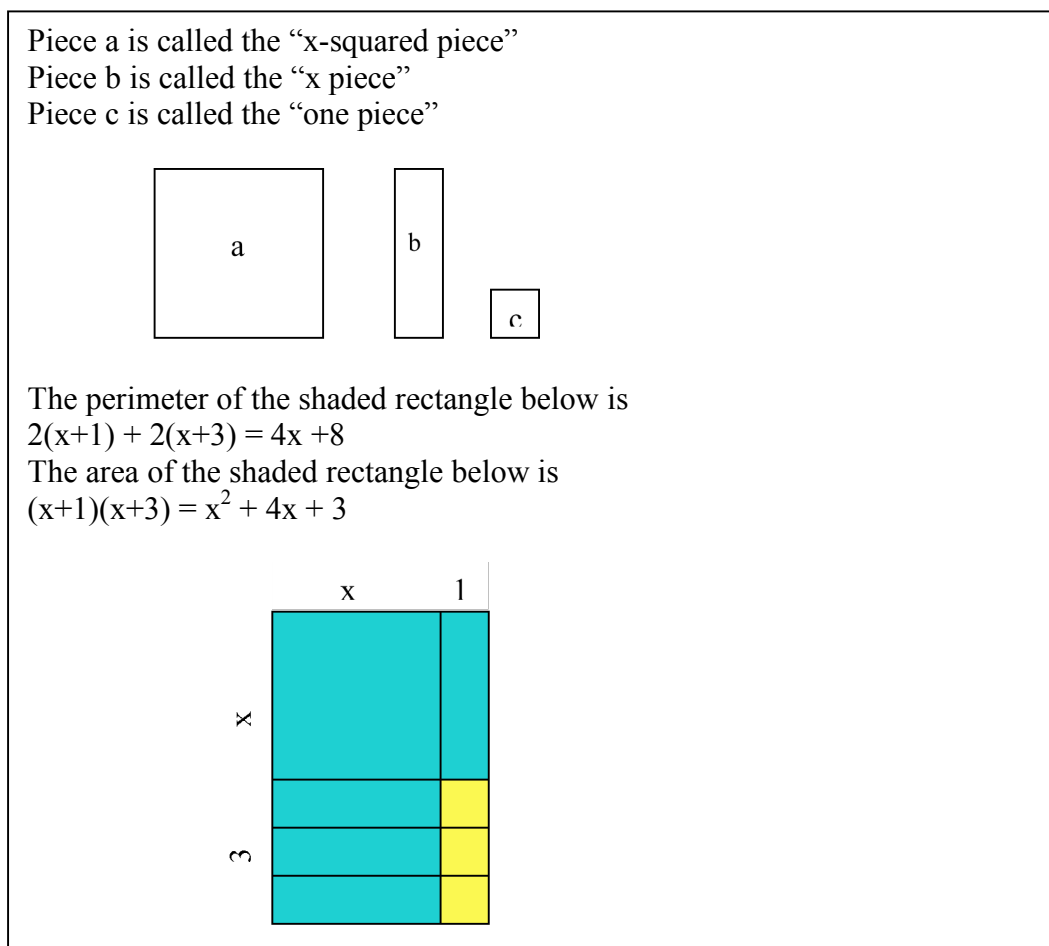


Figure 2.1: A Representation of Perimeter and Area using Lab Gear

During the MFE observations, students used the Lab Gear to work through ideas such as combining like terms, solving equations, and simplifying expressions using the distributive property. Although all of the Algebra 1 students had experience with the Lab Gear before the MFE observations began, they continued to develop their understanding of the affordances and limitations of the manipulative: specifically that the rectangle-shaped pieces that represent “x-squared” or “x”, although static in length, were supposed to be viewed as a variable length. During the second MFE debrief, three of the partner teachers described the learning benefits of using the Lab Gear in their Algebra 1 classes and how they intentionally created situations in the

lesson where students were required to geometrically represent the algebraic expressions and work through the limitations of the Lab Gear.

Wendy: ... we make these worksheets to force them to build (with the Lab Gear). And that's because when they are doing *this* (she makes her fingers move as if she is moving the Lab Gear around on the table) they seem to remember better. And even when kids pull out the x piece - even when they have it on their homework, have it on the diagram - when they actually physically see it, they won't label this side ' x ' anymore (pointing to the width of the x -piece which has a length of 1), they are going to label it 'one'. So there is so much memory and understanding that happens here...how do we give them this information where we *make* them use the Lab Gear? Where they *have* to pull out? It's very intentional.

Tanya: And it's such a great tool - and this is my first year using it - it is such a great tool for strengthening skills that they needed for the last couple units - like terms, what are they? When are they? When are they not? So they have a kid holding the ' x -squared' piece and an ' x ' piece and they go '*see?*' (pretends she is holding up two tiles, indicating they look different).

Zoe: It fixes all those common mistakes that I see my Honors Geometry kids make. This year in Algebra, Algebra 1 kids don't make [those mistakes] when they are using Lab Gear because they know, like Tanya was just saying, you don't combine an ' x -squared' with an ' x '. Those two are different sizes so ' x -squared' plus ' x ' is not ' $3x$ '. (*MFE debrief, 4.16*)

The partner teachers placed value on the depth of understanding that resulted from teaching students how to use the Lab Gear to represent algebra concepts. When student made common errors algebraically, such as adding x^2 and x to get $3x$, because they had to visually justify their procedures with the Lab Gear, they were often able to correct their own errors. The teachers also placed importance on physically manipulating the Lab Gear as a way to make abstract ideas more concrete.

Lab Gear was a tool the teachers utilized in order to provide students with multiple representations of mathematical ideas. It is important to note that the teachers made efforts to push students beyond manipulating the Lab Gear as an algorithmic procedure. Ball (1992) warns against the rising idea that using manipulatives will cause students to magically learn the mathematics that underlie the representation. Instead, she argues for a focus on student reasoning

and sensemaking through the use of manipulatives. Asking students to both procedurally manipulate the algebraic symbols, while also supporting the algebraic rules with a visual representation, allows students to access mathematical ideas they might not have been able to access without the visual representation. This supported the Clark teachers in their efforts to teach mathematics for understanding. It was also a tool the teachers used to provide students access to the mathematics and treat status as described in the next section.

Attending to status. The use of Lab Gear in the partner teachers' classrooms also served another purpose: it shifted the status of the students during groupwork. Status is recognized as a major threat to the working dynamics of groupwork (E. Cohen, 1994) which was the participation structure used in the Clark classrooms. Members of small groups have the tendency to form hierarchies or status-ordering and those who have high rank are seen as more competent. Students who hold the higher status tend to be those that talk and interact with the teacher and therefore have more learning opportunities than others. Status impacts students' perceptions of competence of themselves and of others. These perceptions can negatively impact student participation in groupwork as students who perceive themselves as incompetent at the given task often refrain from sharing their ideas. Likewise, other members of the group may perceive a student as incompetent and refuse to integrate that student's ideas into the groupwork. Low-status comes not only from perceptions of ability but students can also be perceived as less competent based on physical factors such as gender, race, and age.

In order to allow all students, and especially low-status students, access to learning opportunities, the partner teachers use the Lab Gear as a way to elevate the status of low-status students. By providing students access to multiple representations of quadratic expressions and

equations through the use of Lab Gear, more students were then able to demonstrate their competence.

In traditional mathematics classrooms, demonstrating competence in mathematics is often accomplished by finding the right answer and calculating quickly (Schoenfeld, 1988). Research has also shown that teachers may view the learning ability of low-income students and students of color as limited and the makers of their own academic problems (Delpit, 2006; Valenzuela, 1999). In the Clark HS mathematics classrooms, being good at mathematics was defined by being able to explain your thinking, justify how and why you solved a problem in a particular way, represent your thinking in more than one way, and being able to explain why your answer makes sense. As an established norm in the classroom, all students were expected to be able to do this work. The Lab Gear supported students in meeting these expectations, thus shifting who was good at mathematics.

Doing math in our classroom is a little bit different from what these kids have seen...we use Lab Gear to solve equations and it really just flipped the status in our classrooms about who was good at math and who could achieve math. So I've got students who say "I'm not really good at math and I really *get* this stuff." ... The Lab Gear has really turned the status upside down in our groups because students who are really good with the manipulatives and hands-on and are very visual will be the ones to figure out that rectangle. (*Wendy, MFE Debrief, 4.6*)

The Lab Gear provided students a different "way into" the algebraic concepts and allowed students to demonstrate their understanding of the concepts both geometrically and algebraically. This allowed more students to gain access to the important ideas and to demonstrate their mathematical understanding.

The use of Lab Gear also allowed the partner teachers more opportunities to "treat" status problems in groupwork. When students demonstrated their understanding of the mathematics concepts using the Lab Gear, the partner teachers often "assigned competence" (Cohen, 1994) to

the students by publicly acknowledging their intellectual contribution. This was a common practice in the teachers' classrooms. I observed teachers assign competence to students as they were working individually, in their groups, and as they presented in the front of the classroom. Wendy demonstrated this in the example above when she publicly praised Ramel for the way he explained his thinking when she said "Excellent Ramel, you are modeling exactly what I want students to be doing when they go up there". This public comment communicated to both Ramel and the rest of the class that Ramel had contributed something intellectually important; Ramel attended to the slopes and the y-intercepts of the graphs and explained that because the slopes were the same, the lines were parallel. It also let the students know that the way in which Ramel explained his thinking was the way Wendy wanted all the other students to explain their thinking.

The practice of assigning competence seemed to be primarily directed at students perceived to have low status. Tanya discussed how she often assigned competence to some students but not others:

Calling a kid out for something that is awesome – I think you guys were here last week when Maria was brilliant. I don't need to do that with Tamika, you know, up here in the front. I don't need to do that with Desiree or Justina. I mean I hope I give them something positive in a *different* way, but absolutely you can impact status by doing that...But calling her out in front of the whole class, I hope, lets everybody else see how cool she is too. (*Tanya, MFE debrief, 4.27*)

Publicly assigning competence to students worked to shift how students perceived themselves and how others perceived that student. It was important that the other students in Bella's class knew that she had particular mathematical abilities and that if Bella were to be placed in their group, they could benefit from her knowledge by considering her ideas and engaging her in the mathematical learning.

The partner teachers noted that they often intentionally look for ways to assign competence to students whether it was during student presentations, groupwork, or while students were working individually. Wendy described how she purposefully looked for ways to assign competence to students as they are working in their small groups:

What I would *like* to think that I am doing most of the time is looking for opportunities to assign competence...So if I can hover and see that, make a comment about it and then leave, or say “Oh my God that’s amazing, say more about that!” and then leave. (*Wendy, MFE debrief, 5.14*)

Evidence suggests that students are able to find more meaningful ways of participating in classrooms where there exists a broader understanding of competence (Hand, 2003; Jilk, 2007). Assigning competence was one way the teachers worked to alter students’ perceptions of competence of themselves and others. The teachers knew that if they did not address status problems, some students would dominate the groupwork and keep other students from gaining access to the mathematical learning while other students would not participate because they felt they had nothing intellectual to offer the group. They worked to intentionally create classrooms where all students could see themselves and others as competent and therefore participate, engage, and learn in a way that would support their understanding of the mathematics.

Teaching Mathematics Against the Grain at Clark High School

The Clark mathematics teachers actively worked to reform traditional conceptions of teaching and learning mathematics through their teaching practice and recognized that this type of reform was embedded in the culture and history of Clark HS. The Algebra 1 classrooms enrolled a disproportionate number of African-American, Latino/Latina, and African students compared to the higher classes such as Geometry and Advanced Algebra, which enrolled many more White and Asian students. In addition, when the failure rates of the Algebra 1 classrooms were at 60-80%, the teachers knew that what they were doing was not working and was, in fact,

preventing students from accessing the higher-level mathematics courses. These teachers collaboratively raised critical questions about the relationship between traditional teaching practices in mathematics and the outcomes for their students. They altered their curricula and have since continually worked to resist traditional practices that have repeatedly marginalized their population of students. I draw on Cochran-Smith's (2004) work of studying teachers who collaboratively and critically question the existing condition of teaching and learning, and argue that these Clark mathematics teachers were teaching mathematics against the grain:

To teach against the grain, teachers have to understand and work both *within* and *around* the culture of teaching and the politics of schooling at their particular schools and within their larger school systems and communities. Unlike researchers who remain outside the schools, teachers who are committed to working against the grain inside their schools are not at liberty to publicly announce brilliant but excoriating critiques of their colleagues and the bureaucracies in which they work. Their ultimate commitment is to school lives and futures of the children with whom they live and work. They have to be astute observers of individual learners with the ability to pose and explore questions that transcend cultural attribution, institutional habit, and the alleged certainty of outside experts. They have to see beyond and through the conventional labels and practices that sustain the status quo by raising unanswerable questions. Perhaps most importantly, teachers who work against the grain must wrestle with their own doubts, fend off the fatigue of reform, and depend on the strength of their individual and collaborative convictions that their work ultimately makes a difference in the fabric of social responsibility. (p. 28, emphasis is the author's)

The teaching practice of the Clark HS mathematics teachers was by no means perfect. In fact, the teachers themselves struggled on a daily basis to plan lessons and enact practices that would meet the needs of every student in their classroom. These teachers were personally and emotionally invested in helping their students succeed in mathematics and were acutely aware of the consequences for their students if they did not succeed in this "gatekeeper" course. In addition, these teachers understood that not all teachers in their department shared their vision but forged on together to reform and restructure students' mathematical learning experiences.

It is important to note that the Clark partner teachers were continually working to improve their own teaching practice by learning *in and from* their practice and the work of their colleagues. They met together in the Collaborative Planning Period to think critically about the tasks they created for students and how the tasks might get implemented in ways that would provide more students access to the mathematics. This time was also spent reflecting on prior lesson and thinking about how to better support their students in learning the mathematical ideas they were teaching. During the first debrief session, Tanya mentioned how she was working on her teaching practice:

I think it's important for you to know, this is my first year making a commitment to Complex instruction. Or, making a commitment to trying to learn how to even *think* about *maybe* doing a part of Complex Instruction (everyone laughs). And so I try a few things rather than 20 things because I can only remember a few. (*Tanya, MFE debrief, 4.6*)

In this excerpt, Tanya, who had been teaching 18 years at the time of this study, demonstrates her commitment to reforming her practice in ways that might better support her students. During the MFE, these teachers were openly demonstrating their ability to learn in and from their practice and willing to make this learning transparent to the teacher candidates during the debrief session.

The teaching practices and pedagogical concepts that were evident in the Clark HS teachers' classrooms were also a central aspect of the secondary mathematics methods class. In the next section, I describe the secondary mathematics methods course as it was implemented during the time of this research study. As a former instructor of this course, and as a Teaching Assistant during Wendy and Zoe's time in the TEP, I can say that the general focus of the course was much the same as it had been in years past. Although some of the activities, assignments, and readings changed or were modified over the years, the general goals did not differ much from when Wendy and Zoe were enrolled in the course.

The Secondary Mathematics Methods Course

As a graduate student, I was included in the initial design and facilitation of the Mediated Field Experience and, after two years of working with Lani Horn, began teaching the methods course on my own. Over the span of the next few years, I made modifications within the Mediated Field Experience but, for the most part, the core structure and activities reflected the original goal: to connect university and field experiences by providing the teacher candidates an opportunity to observe equity-oriented teaching practices mediated by the university instructors and the partner teachers¹⁸.

The secondary mathematics methods course is a two-quarter course. At the time of this study the Teacher Education Program (TEP) content methods courses were taught in the first and third quarters of the five-quarter program. The two quarters of the secondary mathematics methods course do not have the same focus. The first methods course aimed to shift how new candidates think about teaching and learning mathematics while the second course aimed to support candidates in implementing the ideas and practices learned across the first two quarters of the program. For the purposes of this study, I will only describe the first quarter of the method course, as this is when the MFE occurs.

The first quarter of the methods course occurred at the beginning of the TEP meaning the candidates generally had relatively little classroom experience¹⁹ that was directly tied to the university program aside from a required 60-hour observation period in a classroom of their choice²⁰. The methods course met twice each week, once on campus and once at Clark HS. During the first and last week of the 10-week quarter, the methods class met on campus twice

¹⁸ I will further detail my role as a researcher and former instructor in Chapter 4.

¹⁹ Some teacher candidates entered the program with a great deal of prior experience in public school classrooms while others had no experience in classrooms prior to entering the TEP.

²⁰ This is a requirement to enter the TEP.

during the week and did not meet at Clark. The course was centered on four “Essential Questions” that guided the activities, readings, and discussions throughout the quarter. These Essential Questions were:

- *Why do some students struggle in mathematics?*
- *What does it mean to teach mathematics for understanding?*
- *What is equitable mathematical learning?*
- *What kind of classrooms, curricula, and teaching practices optimally support equitable mathematical learning?*

The activities that took place within the methods course could be described as what one might imagine typical of a university-based methods course. The candidates engaged in mathematics tasks meant for secondary students and then explored the mathematical ideas within the task. For example, the candidates would read papers and discuss research on effective teaching practices, view case study videos of these practices, analyze tasks for high cognitive demand (Henningsen & Stein, 1997), practice high-press questioning strategies (Herbel-Eisenmann & Breyfogle, 2005; Kazemi & Stipek, 2001) with their peers, and put these ideas together into a lesson they enacted during an end-of-quarter “microteaching” assignment, with their peers acting as students.

Complex Instruction was the primary equity pedagogical pedagogy of the methods course. Concepts and practices such as recognizing status differences and practices to address status, creating multiple-ability and cognitively demanding mathematics tasks, and utilizing groupwork roles and norms were taught, practiced, and discussed throughout the quarter (E. Cohen, 1994; Featherstone, et al., 2011; Jilk, 2007). These ideas were surfaced in the methods course through model lessons facilitated by the University Instructors, reading research and case studies, watching videos of classroom practice, and planning lessons and designing activities.

The following is an example of how the University Instructors modeled practices as candidates engaged in mathematics tasks. This lesson occurred on the first day of the methods course. The university instructor, Savannah, modeled a lesson using “The Beams Task” using toothpicks as a manipulative. The task was to determine the number of “rods”, or toothpicks, needed to build a “beam” with a specified length measured by the number of toothpicks across the bottom of the beam. The task required the candidates to determine this relationship in more than one way. Savannah randomly assigned the teacher candidates into groups of three or four and provided groupwork roles for each person to enact in their small groups. Savannah launched the task by reading a list of “Multiple Abilities” (E. Cohen, 1994; Featherstone, et al., 2011) needed for the task. Some of these abilities included building, justifying your strategy, visualizing, and finding patterns. She then said to the teacher candidates “In order to do this task, we need people in your groups who are good at some of the things that are up here on the board. So not everybody will be good at all of these things – excuse me – *nobody* will be good at all of these but everybody will good at some of these things” (Methods, 3.30). The teacher candidates were given a few minutes of private think time to get started on the task and then they worked together in their small groups. The final product was to create a poster of the groups’ thinking and to “Be prepared to present your poster – as a group – to the rest of the class.” While the teacher candidates worked on the task, Savannah and the two other University Instructors, Spencer and Silvia, walked around the room, listening to the groupwork discussions and kept a record of the various strategies the teacher candidates were using to solve the problem. A few of the groups then took turns presenting one of their solution strategies, selected by Savannah prior to the presentations, using the poster they created. As they did this, the University Instructors pressed the teacher candidates to make connections between their strategy, their rule, and the

pattern in the beam representation. After the teacher candidates completed the task, the University Instructors (UI) asked the teacher candidates to reflect, in writing, on the lesson they just experienced using the question “What choices do you think I made as a teacher about how the task was structured?”²¹ In the following class, Savannah asked the teacher candidates to generate a list of teacher moves and then asked each candidate to share one teacher move from their list. These goals and intentions of the teacher moves were then discussed in light of the research the teacher candidates had read in preparation for the discussion.

Activities such as the one just described occurred three times over the course of the quarter (3.30/4.1, 4.8, 4.22). The UIs modeled a task and the teacher candidates engaged in the task as students. Then, as a class, they unpacked and explored the relationship between the teaching practices, student experiences, and student learning. In addition to engaging in mathematics tasks, the teacher candidates also read research articles and book chapters that supported, described, and explored many of the practices the UIs were modeling. The UIs facilitated discussions around these readings. This activity occurred in all but three of the university sessions.

Lesson planning and microteaching were two other activities in which the teacher candidates engaged during the university portion of the methods course. During the last two weeks of the quarter the teacher candidates planned a lesson they selected from a unit in a textbook assigned by the UIs. The teacher candidates worked in pairs to plan the lesson. The lesson planning framework provided to the teacher candidates required that they attend to student participation and learning in ways that aligned with the pedagogical framework of Complex Instruction. For example, the teacher candidates had to design a task that had multiple entry

²¹ The Instructors had intended to hold a discussion around this question in class but they were running out of time and ended up having the discussion the following class session.

points and was accessible by students with a broad array of skills and knowledge. They had to anticipate several different ways students might go about solving the problem and where students might have difficulties or misconceptions. The teacher candidates needed to identify the norms they felt would best support the student groupwork during their lesson, and they had to attend to how students were engaging and participating in the mathematics task. During the last week of class each candidate taught ten minutes of their lesson to the other teacher candidates in the class, who participated as students. The lessons were videotaped and the taped lesson was reviewed and discussed, in class, by the teacher candidates and UIs with a focus on strengths and areas for growth regarding the implementation of a few teaching practices learned during the quarter.

These activities were just a few of many that occurred within the methods course. However, these were the most prominent activities; they occurred with the most frequency or with the most class time dedicated to the activity.

Alignment Between Learning-to-Teach Contexts

It is important to note that both the methods course and the Clark HS mathematics classrooms shared many of the same features. First, the two contexts worked on similar practices but in different ways. The pedagogy of the Clark HS mathematics teachers centered on providing Algebra 1 students greater access to the mathematics through understanding and sense-making. The mathematics methods class highlighted and investigated teaching practices that work to press students to reason and make sense of mathematics. Many of the practices overlapped across the two contexts such as the idea of status, creating groupworthy tasks, holding students accountable during groupwork, maintaining the cognitive demand of mathematics tasks, and pressing students to justify their thinking. The common practices across

the two contexts allowed for a shared language among the teacher candidates, partner teachers, and university instructors during the MFE. Although the goals of the practices may not have been understood in the exactly same way, the three groups of participants could share this language and develop their understanding around it at the same time.

Second, the type of pedagogy that was used by the practicing teachers and taught to the teacher candidates in the methods class was equity-oriented, based on recent research, and sought to provide all students access to mathematical ideas in classrooms. Clark teachers were “teaching against the grain” which included continually examining and improving their teaching practice. Similarly, the university methods course was attempting to teach the teacher candidates how to teach in a similar way.

Third, the university instructors were responsible for teaching candidates the methods and practices of teaching mathematics. Rarely are university instructors also responsible for supporting teacher candidates in making sense of these practices in the complex and dynamic context of K-12 classrooms (Zeichner, 2010). It is more typical to put that responsibility onto the mentor teachers and university supervisors. Unfortunately, these people often do not share knowledge of the practices and concepts taught in the methods classes. The fact that the university instructors and the partner teachers shared an understanding of the context, goals, and practices of each other’s learning contexts created a situation in which the two groups could create a partnership that drew on and expanded the learning opportunities for everyone involved, but especially for the teacher candidates.

Typical field experiences often place teacher candidates into classrooms where the primary goal of the activity that is taking place is to support K-12 student learning. Teacher candidate learning is always a secondary goal in K-12 classrooms. This of course makes sense,

as a teacher's primary responsibility is to teach the students in her classroom. What a teacher candidate may learn from a field experience is often a by-product of what happens in the K-12 classroom. Too often, teacher candidates are not provided many opportunities to enact equity-oriented practices in their field experiences or have significant discussions with their mentor teacher about teaching, learning, or about improving one's own practice (Su, 1992). However, I claim that the MFE is a field experience that allows for both K-12 student learning and teacher candidate learning as the primary goals. Additionally, these two goals can happen simultaneously within the MFE structure.

In the next chapter, I conceptualize both a typical field experience and a K-12 classroom as activity systems that work toward two different goals, teacher candidate learning and K-12 student learning. I then describe how the MFE intends to construct a new activity system that brings both of these goals into alignment.

Chapter 3

Conceptual Framework

The aim of this chapter is to provide an overview of the theoretical groundings for this study. In this chapter, I present an overview of how I conceptualize the coursework-fieldwork gap within a socio-cultural framework, drawing on Cultural-Historical Activity Theory (CHAT).

In the first section of this chapter, I provide a brief explanation of CHAT including its origins in Activity Theory, and how CHAT can be used to examine the phenomenon of learning. I then review the ways in which researchers have attempted to address the coursework-fieldwork gap in teacher education using Cultural-Historical Activity Theory as an analytic lens. In the following section, I take up the lens of CHAT and use it to provide an analysis of how two typical teacher education contexts, field experiences and K-12 classrooms, function as “activity systems.” Using the construct of activity systems, I frame the coursework-fieldwork gap as a contradiction across those two activity systems in terms of a difference in the object of each system. In the final section of this chapter, I conceptualize the Mediated Field Experience as a new activity system that attempts to address the contradictions in the learning-to-teach context of a field experience and centers the object of the activity system on teacher candidate learning.

A Cultural-Historical View of Learning

Cultural-Historical Activity Theory (CHAT) stems from socio-cultural theories of learning, which conceptualize learning and development as a socially mediated activity (Edwards, 2005; Engestrom, 1999; Roth & Lee, 2007). That is, people learn through participation in cultural contexts and through their use of cultural artifacts, or tools, which support their actions and help to interpret what is culturally relevant (Edwards, 2011). As we engage in situated practices we interpret and act upon our world through our use of these conceptual and material tools. Our actions and tools change our world so that we continually

shape and are shaped by our worlds (Edwards, 2005; Roth & Lee, 2007). Essentially, learning is an act of simultaneous transformation. In learning, we transform our world by acting upon it, which in turn, our world transforms us.

Research on human development reveals a tension between learning as an internal process and the role of society on learning. Activity Theory, from which CHAT originates, addresses the long-standing tension between the individual and society through the development of the “activity system” as the unit of analysis (Roth & Lee, 2007). Rather than examining the individual as the unit of analysis, which has been the focus of cognitive and behavioral perspectives of learning, Activity Theory focuses attention on the thinking, or learning, that is revealed by an individual’s (the subject) use of conceptual and material tools (socially, culturally and historically situated mediating resources), which are used to direct activity toward the problem space (the object). This primarily represents the work of Vygotsky who took the unit of analysis as the individual’s cognitive process as one mediates learning through tool use (see Figure 3.1).

Leont’ev expanded on Vygotsky’s work with the notion that the individual cannot be separated from the collective and social systems in which humans interact. For Leont’ev and others, the focus was not on the individual’s use of mediating artifacts but the activity of the system, which was the unit of analysis. Leont’ev is also credited with developing the notion that activity systems are goal-directed, that the goal of an activity system is its object, and that the object distinguishes one activity from another. Activity Theory holds that human action can only be understood in the context of the motive of a collective activity system. Figure 3.1 is often used to depict Activity Theory.

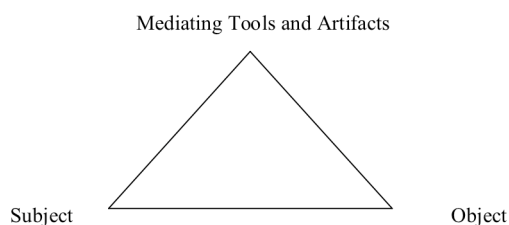


Figure 3.1: A common representation of Activity Theory

In what is often referred to as the third generation of Activity Theory, Vygotsky's work being the first generation and Leont'ev and Luria's work being the second generation, Engestrom (2000) proposed three additional, unobservable components of an activity system (see Figure 3.2). First, Engestrom saw that communities formed the basis of any activity system since activity systems are a collective activity. The community represents the participants in the activity system. Second, the relationship between the subject (who is doing the work) and the community is mediated by rules – norms, expectations, or conventions that are both historical and social. Third, the community is implicitly and explicitly organized by a division of labor, which determines the work different community participants are expected to do. The division of labor then mediates the transformation of the object into the outcome. Engestrom proposed that rules and division of labor determine how the work should get done and how individuals within the system are expected to behave in order for the object to be achieved. This framework views the act of learning as situated within cultural and historical contexts where interactions between subject (learner) and community are mediated by rules and artifacts and by the negotiation of power and responsibilities (Anderson & Stillman, 2012). This framework has come to be known as Cultural-Historical Activity Theory and is commonly used to represent the collective notion of learning and human activity.

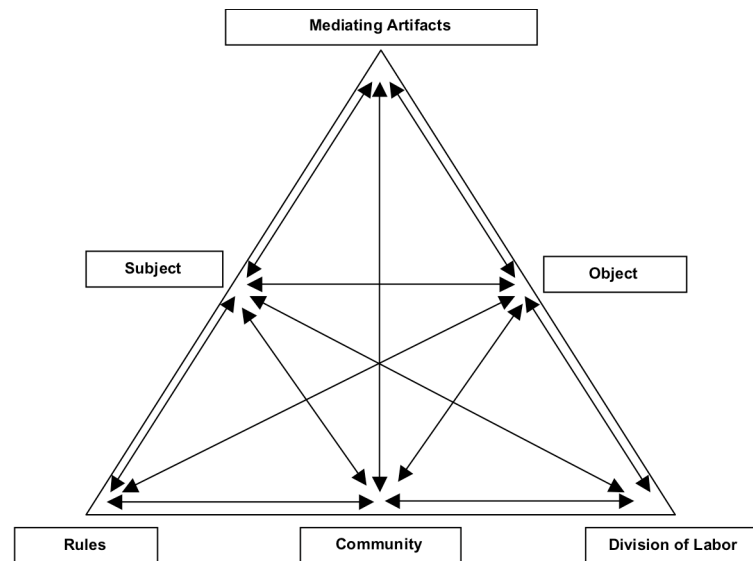


Figure 3.2: A representation of an activity system using Cultural-Historical Activity Theory

In an activity system, the subject(s) work toward a common goal, or the object of the activity system. This is accomplished through the mediating tools the subject(s) selects in order to achieve the object. In a simple example, we might consider an elementary student (the subject, or the person who is doing the work) who wanted to solve the problem of $7+8$ (the object, or what is being worked on). Rather than simply looking at learning as the subject being able to accomplish the object (the child correctly identifying the answer as 15), activity theory allows the examination of the way in which the child went about solving the problem (mediating tool use). Perhaps the child would count out 7 blocks and 8 blocks and then count the collection one-by-one. Or the child might use an already-known fact (such as $7+7=14$, $14+1=15$) to find

the answer. Each of these strategies is considered a tool the child might use to “work” on the problem and the use of the tool reveals the child’s mathematical thinking (Edwards, 2005).

In addition to examining tool-mediated behavior as learning, CHAT considers the social, cultural, and historical aspects of activity (Engestrom, 2001). Again using the example of a child solving the problem of $7+8$, CHAT allows an interpretation of the object itself - the child’s motivation for solving the problem and how that is related to the tool she uses. For example, the child may see the problem as a way to reveal to her teacher her skills in addition, demonstrating a relationship between object (solving the problem) and rules and community (demonstrating a skill from the classroom). This may motivate her to employ a strategy such as using an already-known fact to solve the problem because she knows she is in school (community) and expected to demonstrate what the teacher taught her (rules and division of labor). On the other hand, she may see the problem as a way to help her determine how many marbles she has in her collection. This may motivate her to employ a strategy such as direct counting (mediating tool) because she knows she is at home (community and rules) and has the physical objects in front of her. From a CHAT perspective, the object is viewed as giving direction to or determining the activity that is taking place, a concept called *object motive* (Leont’ev, 1978 as cited in Edwards, 2005).

The activity system works to integrate the participants in a given context, the conceptual and materials tools they use, and the object-oriented actions representative of human behavior. CHAT extends beyond a cognitive definition of learning (“with-in person changes which modify the way in which we interpret the world”, Edwards, 2005, p.50) by bridging the individual and their social world through the process of mediation (Edwards, 2005; Engestrom, 2001). This theory of learning ‘takes into account’ the multiple contexts which learners experience.

Cultural Historical Activity Theory in Teacher Education

CHAT has become a useful way to inform analyses when examining the phenomenon of learning in teacher education, especially the process in which learning occurs across multiple contexts such as courses and field experiences. CHAT focuses attention on learning as a social process which takes place “within social systems that have evolved culturally and historically and that offer participants in those systems certain physical or psychological tools with which to work on a shared object or societally significant goal” (Douglas & Ellis, 2011, p. 467). The ability to examine the *interaction* of activity systems as they shape participants’ experience (Engestrom, 2001) is a particularly useful aspect of CHAT since teacher education itself is comprised of multiple different, but interacting, activity systems. Teacher education is a social system that shapes and is shaped by participants as they engage in tool-mediated activity, making CHAT a useful analytical framework for examining the dialectical interaction between both individuals and activity systems (i.e. teacher candidates within a field experience) and between activity systems themselves (i.e. university course and field experience).

The core work of research in the field of teacher education is to reveal the ways in which teachers, at various stages in their careers, conceptualize their work as teachers. Some researchers have utilized CHAT as a way to understand the coursework-fieldwork gap by examining the problem through the lens of teacher learning in activity systems (Smagorinsky, Jakubiak, & Moore, 2008; Tsui & Law, 2007). Douglas and Ellis (2011) examined the ways in which a course handbook mediated teacher candidate learning in a university-school partnership teacher education program. Using CHAT, the authors found that in one case, the course handbook became a tool to initiate discussions around questioning practice - discussions that

could potentially lead to changing practice. In another case, rather than a mediating tool for learning about teaching, the handbook became a rule within the community; the handbook was used by the university mentor to demonstrate compliance which shifted the object away from learning and toward an alternate object, in this case the mentor's relationship with a school-based tutor within the hierarchical social structures of the school-university partnership. In the first case, there was a strong, shared focus on the student teachers as learners yet in the second case, it was difficult to determine whether there was a focus on student teacher learning that could be seen as a shared object. The authors conclude that the course handbooks, intended to draw tighter connections between coursework and fieldwork, might be understood as a mediating tool for student teacher learning if they could be regarded as "a part of a process of meaning-making; requiring continual attention not so much to the handbook's "content" but for what it potentially signifies within the activity systems within which it circulates" (Douglass & Ellis, 2011, p. 474).

In another example, Anderson & Stillman (2012) investigated an example of one student teacher's experience teaching as she recounted a teaching episode in an interview as part of a larger qualitative study. The researchers use this recounted experience as a way to draw out the contextual factors that appeared to mediate her teaching practice and to propose ways in which teacher educators might implement practices that could potentially mediate teacher candidates' learning. This particular student teacher was considered capable and committed by her university instructors and she considered herself a social justice teacher. Yet, as she recounted how she had used a practice in her classroom that she had learned in her teacher education program, it was apparent that she only had a vague understanding of how to teach for social justice. The researchers used CHAT to surface the features, actors, and artifacts of both the student teaching context and the university teacher education program context that mediated this

student teacher's learning. The authors then took up the complexities and challenges that CHAT illuminated to propose ways teacher educators might "re-mediate" this teacher's learning, in relation to her notion of teaching for social justice. Included in their findings was a need to make mentor teachers part of the teacher education community, to bring mentor teachers and teacher education faculty together to "collaboratively define learning goals and work together to meet them" and to encourage TEPs to "support cooperating teachers to develop their capacities as teacher educator who are equipped both to model effective instruction and to mediate and re-mediate student teachers' development" (online). Additionally, the authors raise questions about how teacher preparation might make the intensive work of student teaching more manageable. They suggest placing a stronger focus on practice through structures such as student teaching in pairs, utilizing video of student teachers engaged in practice, and regular reflection on their practice.

Learning has been a mostly invisible phenomenon, difficult to identify and analyze (Lortie, 1975 ; Lewis, 2007). CHAT, and its underlying elements and relationships, allows learning to become visible and available for analysis. Moreover, CHAT takes into account the mediation of activities by participants within a collective. This allows dilemmas that have been examined independently, such as the relationship and interaction of the individual and their social worlds, to be linked (Roth & Lee, 2007).

This study of a Mediated Field Experience in a secondary mathematics methods course examines the structures and activities of the MFE within the context of a partnership between the methods instructors and the classroom teachers. Using CHAT, the Mediated Field Experience is conceptualized as the planned interaction of two activity systems, the K-12 classroom and a field experience, where the common object is teacher candidates learning to teach. Learning to teach

is a collectively motivated activity and the actions that contribute to realizing it cannot be understood apart from the activity as a whole (Roth & Lee, 2007). In the next section, I explain how CHAT can be used to examine two learning-to-teach contexts, the university classroom and a field experience.

The Gap in Teacher Education as Seen Through CHAT

Engestrom's work in the field of CHAT has offered a way to examine the process of learning to teach through conflict that necessarily arises when two activity systems interact. Taking an interventionist perspective, Engestrom was interested in how participants within an activity system might transform the object through recognizing and responding to a contradiction in the system (Edwards, 2005). Contradictions are structural tensions within the activity system that generate disturbances, yet they can also lead to innovative attempts at change (Engestrom, 2001). Using contradictions as an analytical tool, I claim that the coursework-fieldwork gap in teacher education is, in part, a result of contradictions within two learning-to-teach settings, the university and field. In addition, these contradictions shift the object of the activity systems away from teacher candidate learning. In the next section, I use CHAT to describe the activity settings of a university course and a field experience, and how the contradictions in these activity settings contribute to the coursework-fieldwork gap in teacher education.

The university methods course as an activity system. The university mathematics methods course is designed to teach people the practices, strategies, and ideas that can be used to teach children mathematics. From a CHAT perspective, a methods course is an activity system (see Figure 3.3). It is an evolving, complex structure of mediated human behavior, with an object (learning to teach) that contributes to maintaining society and thus individuals (Roth & Lee, 2007). The subjects in this activity system are the teacher candidates and the object is

learning to teach mathematics. The activities and pedagogies the university instructor implements, and in which the candidates engage, can be considered mediating tools that are used toward accomplishing the object. In typical methods courses, this might be the use of video cases to examine and analyze teaching practice in a mathematics classroom; reading and discussing research about the effects of particular teaching practices; completing mathematics tasks that are reflective of the types of tasks being promoted in the methods course or the Teacher Education Program as a whole; or modifying, planning, and teaching a lesson to peers. The above examples are material activities in which teacher candidates might engage in order to learn about teaching mathematics. However mediating tools are not always material or concrete activities. Conceptual tools such as constructivist theories of learning, the concepts of status in groupwork, or equity in the classroom are also mediating tools, which work to bring about a particular way the subject accomplishes the object.

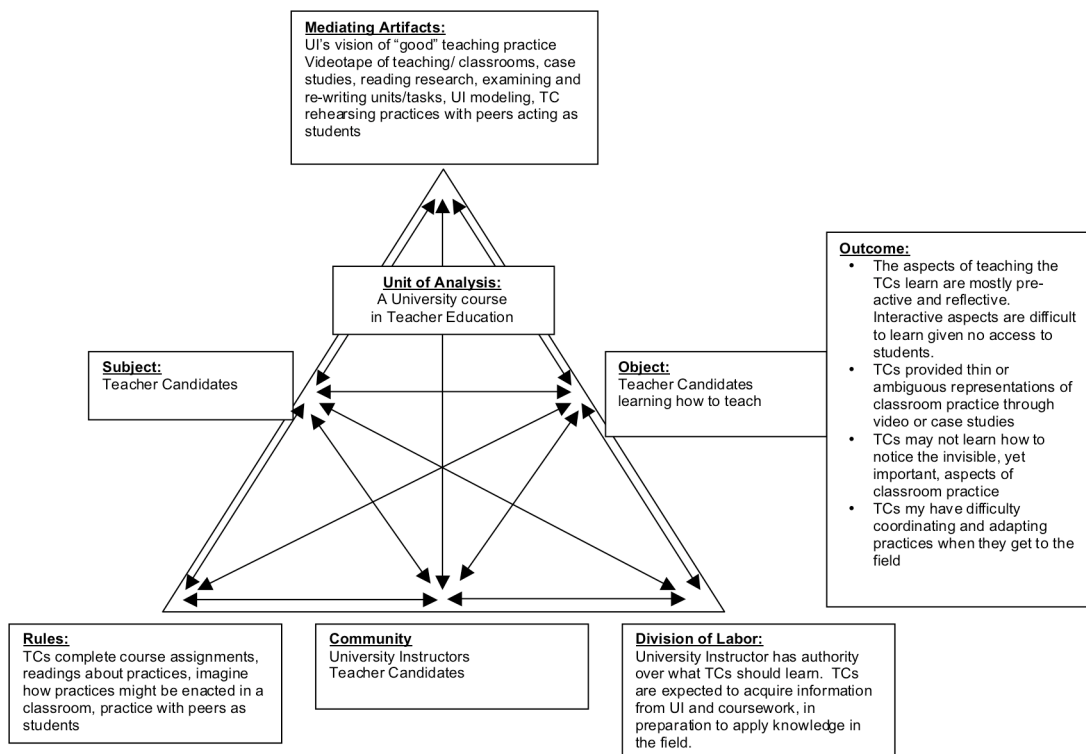


Figure 3.3: University methods course as an activity system

The immediate community, or group of people who share the same object (candidate learning) of a methods course includes the teacher candidates enrolled in the course and the university instructor(s) of the course. The extended community might include other instructors in the teacher education program and possibly the university supervisor, the person responsible for evaluating the teacher candidates in their field assignments. These people all play a particular role related, either directly or indirectly, to the methods course activity system. Classroom teachers are often noticeably absent in this community.

The rules within a methods course are the norms and conventions, both stated and unstated, which determine the way the participants interact. In this system, teacher candidates are expected to learn how to teach and the university instructor's work is to teach them how to

teach. Interns are expected to complete their assignments, participate in class, and “take up” the methods that are taught. The university instructor is expected to plan and enact learning opportunities for the teacher candidates.

The division of labor “refers to both the horizontal division of tasks between the members of the community and to the vertical division of power and status”²². In the methods course activity system, the university instructor has sole authority over what is taught in the methods course. The university instructor determines the practices, methods, and ideas that the teacher candidates should learn in order to be good teachers. The teacher candidates are expected to acquire the methods, strategies, and ideas provided by the university and the university instructor. In this system, the status and power belong to the university instructor. Again, because the classroom teacher is not usually a part of this community, practitioner knowledge has no bearing in this system.

The absence of practitioner knowledge creates a contradiction between the community and the object. This is due to the fact that classroom teachers, those who have situated knowledge about the work of teaching, are not included in this activity system. In CHAT, the object of the activity system mediates the interaction between community and division of labor. When the community of a methods course does not include a particular type of knowledge that teacher candidates need in order to learn to teach (object), the learning relies only on the university faculty knowledge (division of labor). This is related to the marginalization of teacher knowledge, a type of knowledge teacher candidates need in order to learn to teach. Of course, the field experience is often positioned as the place where teacher candidates are able to draw on situated practitioner knowledge. In actuality, because of the contradictions in the field

²² See <http://www.edu.helsinki.fi/activity/pages/chatanddwr/chat/>, Center for Activity Theory and Developmental work Research, Department of Education, University of Helsinki.

experience activity setting, opportunities to draw on practitioner knowledge also become greatly limited. I describe this contradiction in the next section.

The high school mathematics classroom as an activity system. The high school classroom is also an evolving, complex structure of mediated human behavior, with objects that contribute to maintaining society and thus individuals (Roth & Lee, 2007). In the activity system of a classroom, the object is student learning of the mathematics and the subjects are high school students. There are many physical and conceptual tools that mediate activity in a high school mathematics classroom. Some of these include the teaching practices, or pedagogical stance, of the teacher; the curriculum; the teacher's conceptions of student learning; the physical layout of the classroom (groups, rows, pairs); assessments; activities or task students complete; and the school and classroom culture. These material and conceptual tools are only some of the ways the students (subject) might go about learning mathematics (the object).

The immediate community of the classroom is composed of the students and the teacher. The extended community might also include the principal of the school, instructional coaches, other teachers in the school, and parents of the students in the classroom. Each of these groups or subgroups of people might identify themselves as participating, either directly or indirectly, in accomplishing the object.

The rules in a mathematics classroom define expectations for behavior, or how the teacher and students interact. On the most basic level, the teacher is expected to teach mathematics and the students are expected to learn mathematics from the teacher. How this happens depends on the norms, values, and rules set up in the individual classroom. This could include the teacher positioning herself as the sole authority of knowledge in the classroom where students are expected to "do mathematics" the teacher's way. Or, this could include the teacher

positioning the students as mathematical resources in addition to the teacher, and that students are expected to work collaboratively to solve mathematics problems.

The division of labor defines how the work gets done. In a high school mathematics classroom, the vertical division of power is exemplified through the positioning of the teacher and students. The teacher is typically the authority in the classroom while the students are expected to abide by the teacher's direction. This vertical power relationship reveals the horizontal division of tasks; the teacher is responsible for determining and providing learning opportunities for the students and the students are responsible for engaging in those learning opportunities as a way of accomplishing the object, learning mathematics.

The contradictions of the field experience. The high school mathematics classroom is an activity system intentionally designed for high school student learning. When a teacher candidate is placed in a high school mathematics classroom as a field experience, the intended object is candidate learning. After all, this is the purpose of a field experience – for candidates to learn about the practice of teaching. However, from a CHAT perspective, this is not the case. I argue that when teacher candidates engage in a field experience, the object of the activity system does not shift. The object of the mathematics classroom as an activity system remains *secondary student learning*. This is not to say that teacher candidates don't learn when they engage in field experiences. In fact, the physical and conceptual tools, which mediate how the classroom students learn mathematics, may also become mediating tools for the teacher candidate. In addition, the candidate may have other mediating tools that are not shared with the classroom students, such as assignments the candidate must complete for their university coursework while in the field or practices the candidate brings from the university to the classroom and is expected to implement. However, the rules, community, and division of labor remain as they were had the

candidate not been placed in the classroom. This lack of a shift in the object of activity and its relational elements produces at least two contradictions within the activity system.

When a teacher candidate is placed in a high school classroom for a field experience, a tension arises around the object of the activity. Without the candidate, the object of activity is student learning of mathematics. This is natural as the classroom is a place designed specifically for this outcome. Using the classroom as a site for teacher candidate learning would mean shifting the object of the classroom activity system to candidate learning. However, this does not, and cannot, happen. The object of the high school classroom activity system must remain student learning by necessity. In other words, student learning cannot be sacrificed for candidate learning. Feinman-Nemser and Buchmann (1985) identified this tension when they argued that school classrooms are not set up for teaching teachers. The goals of the university teacher education program and the goals of the classroom are at “cross-purposes”; a pitfall the researchers argued must be overcome in order to create successful learning-to-teach contexts (see Figure 3.4).

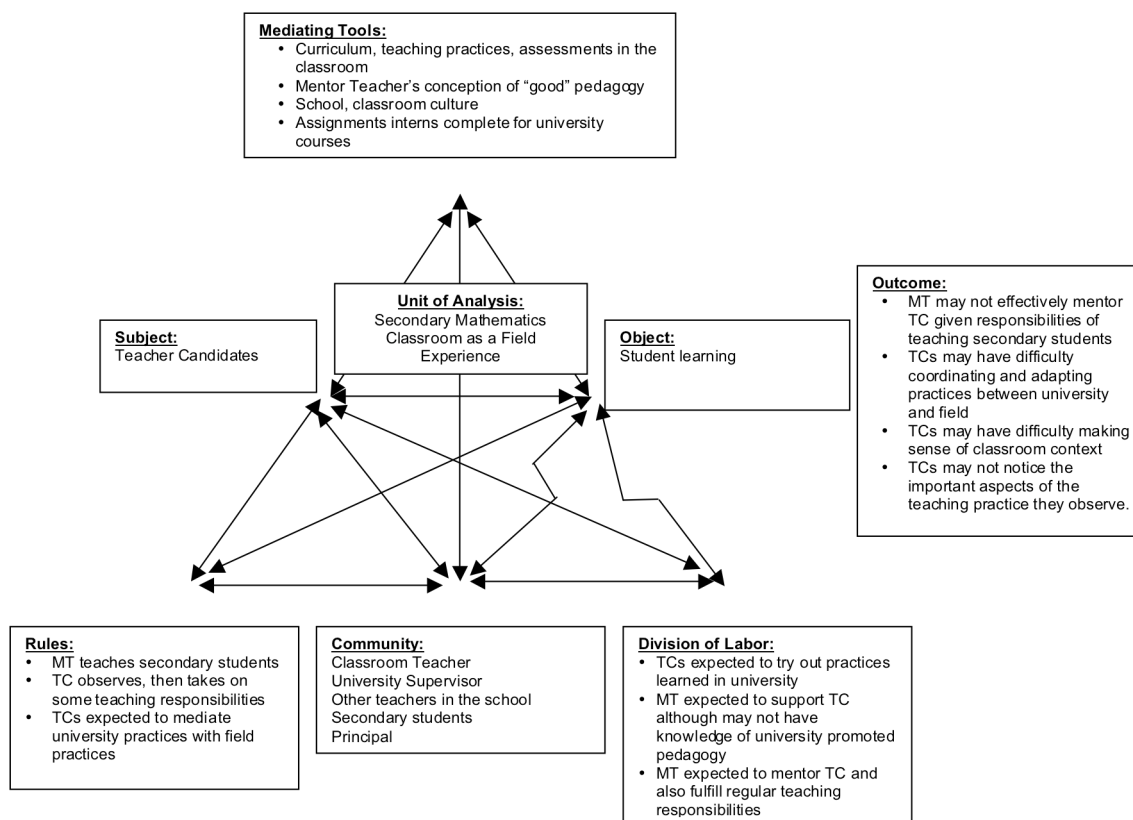


Figure 3.4: A secondary mathematics classroom as a field experience

When placed in a classroom for a field experience, the candidate and the cooperating teacher must work to balance the learning of the candidate with the learning of the students in the classroom. This is a nearly impossible feat to accomplish given that no elements of the system shift to accommodate candidate learning as the object. The contradictions that arise within the classroom-as-a-field-experience activity system describe the problems in teacher education that contribute to the coursework-fieldwork gap.

Acquire-apply structure of teacher education. The coursework-fieldwork gap in teacher education can be conceptualized as a contradiction within and across the two activity systems of university and school classroom. When teacher education programs are set up so that teacher candidates acquire knowledge in the university and are then expected to apply that knowledge in

the field, a contradiction arises between the object (candidate learning) and the division of labor (how the candidate learning “gets done”).

In the university setting, academic knowledge is often prioritized. Interns are provided opportunities to conceptually engage with ideas or practices but are not offered many opportunities to practice these methods with students in an interactive or responsive way (Grossman et al, 2005). This is left to the sites of “practice” or classrooms where the teacher candidates are placed for field experiences. Here, teacher candidates are expected to enact in practice the theoretical ideas gained in the university methods course.

In the acquire-apply structure of teacher education, the division of labor, residing between the university instructor and the classroom teacher who are both expected to support candidate learning, is uneven so that the object of candidate learning cannot be optimally achieved. In order to learn to teach, teacher candidates need to integrate both practitioner and academic knowledge in ways that support teacher candidates to generate knowledge from their practice. However it is arguably not possible for the candidate, a novice, to effectively integrate these two knowledge domains when they are provided in separate contexts. Additionally, the university instructors and the classroom teachers may be unable to mediate the tensions that may exist between the two knowledge domains because neither has an understanding of the other. The classroom teacher may not have access to the ideas promoted in the university while the university instructor may have little, if any, awareness of the practices taking place in the field classroom. The candidate is then left to negotiate the two knowledge domains on her own. This is a massive expanse a new teacher is expected to bridge and often they fall short and abandon the interactive teaching practices that are complex and challenging to learn (Edwards &

Protheroe, 2003; Nolen, et al., 2008). Hence the coursework-fieldwork gap that persists in many university-based teacher education programs.

Marginalization of teacher knowledge. Typical field experiences, situated in the acquire-apply pedagogy, are structured so that teacher candidates learn about practices in the university and are then expected to apply the practices in the field. No one would argue that teacher candidates don't learn by being placed in K-12 classrooms but the research demonstrates that the teacher candidates often do not learn what the university intends for them to learn, for several reasons. First, the division of labor in the activity system does not shift to accommodate the intended object of the activity system. That is, mentor teachers are not released from any of their regular responsibilities nor are they provided time specifically dedicated to the mentoring of the teacher candidate. Mentor teachers are instead expected to supervise and support teacher candidates in addition to their full-time responsibilities of teaching students with very little compensation for the additional time it takes to do this work. The frenetic and fast pace of classroom life leaves little time for reflection and analysis, which are resources novices need for learning how to teach. This greatly limits opportunities for teacher candidates to effectively learn from their mentor teacher.

Shifting frames of reference. As discussed in Chapter 1, when teacher candidates enter their Teacher Education Programs, they bring with them particular ideas about what it means to teach and learn mathematics. Kennedy (1999) argues that it is the important work of teacher education to shift problematic conceptions of teaching and learning and that teacher candidates struggle to learn reform teaching practices, in part, because their frames of reference have not shifted.

When teacher candidates are placed in field experiences, research has shown that they tend to pay attention to the more familiar aspects of teaching, those which align with their own frame of reference which is often based on their own schooling experiences (Kennedy, 1999; Star & Strickland, 2008). This reveals a contradiction between the community and the object. In typical field experiences, the university instructor, who is responsible for teaching the candidates particular practices, is not a member of the community of a classroom field experience. Therefore the university instructor cannot support the candidates as they make particular observations in their field experiences and attempt to interpret those observations by drawing on their coursework experiences. Likewise, the university instructor is not present to support the teacher candidates as they attempt to enact the practices that were taught to them by the university instructor. Although the role of the university supervisor is intended to take up the work of ensuring the practices learned in the university get demonstrated in the field, the university supervisor is not the person who instructed the teacher candidates on the practices and methods which they are expected to learn to enact. Therefore, teacher candidates are left on their own to mediate their learning within the field experience. Typically, teacher candidates will notice what is most familiar and that which aligns with their frame of reference. The contradiction between community and object greatly limits opportunities for teacher candidates to notice aspects of classroom practice, especially aspects that are least familiar, that may cause them to question or alter their frames of reference.

Together these contradictions point to the problematic nature of typical field experiences in teacher education. Using CHAT to surface these contradictions reveals ways that research might begin to address the coursework-fieldwork gap. Research has demonstrated the importance of field experiences in teacher learning, especially when field experiences are closely

tioned to university experiences (Darling-Hammond, 2006). However, the field of teacher education must find ways to create stronger connections between teacher candidates' university experiences and their field experiences. Structures must be created that expand the way learning happens for teacher candidates within the K-12 classroom by creating activity systems in which both candidate and student learning become a shared object. This study examines a Mediated Field Experience and how the structures and activities of the MFE aimed to create a learning context that supported teacher candidate learning through connections between university and field.

Chapter 4

Research Methods and Data Analysis

In the face of strong debates of the worthiness of teacher education, I am most interested in how university-based teacher education programs can structure teacher candidates' learning opportunities in the field in an effort to create a more influential and meaningful experience for learning about equity-oriented instruction. This qualitative, single case study investigated a Mediated Field Experience, within a secondary mathematics methods course, in order to highlight the practices and structures that were developed to support teacher candidates as they learned how to teach mathematics.

The research questions I have posed, and the way I conceptualize learning as a socially mediated process, necessarily guide my choice of research methods. I begin this chapter with a discussion of the research methods that informed this study. I describe the principles of research within the constructivist paradigm and how they were applied in this study. Then, I present single case qualitative research as an appropriate tool for investigating the interactions and processes that occur within the Mediated Field Experience. Next I present general methodological information about the study, including a description of the settings, the process for gaining entrance and selecting participants, data collection, and my role as the researcher. The final section details methods of analyzing data and criteria for establishing trustworthiness.

Research Methodology: The Constructivist Paradigm

In order to address my research questions, I was most interested in exploring the structures and activities of the MFE and the relationship between those practices and candidate learning. My research questions are descriptive in nature and aim to explore the processes by which teacher candidates learn about teaching. I did not look to compare outcomes between two different models of teacher education through an experiment, but instead I set out to examine

interactions within and outcomes for a particular context for learning. For example, a true experiment would not have provided the information on the change process I emphasize in this study, that of learning to teach, because experiments typically rely on comparisons of the different outcomes in the groups studied, such as average achievement scores (Forman, 2003). Instead, I was interested in comparing the various processes that occurred during the Mediated Field Experience, such as how particular structures and activities were implemented and how the participants in the MFE interacted with those structures and activities.

The socio-cultural framework I employ in this study rests on the assumption that reality, and thus learning, is socially constructed through individuals interacting within their social worlds. Learning to teach requires teacher candidates to navigate various social spheres, such as university courses and classrooms, and to make use of the cultural and social tools within these various spheres. Multiple narratives are important because, to understand a process as complex as learning to teach, it is necessary to view the phenomenon from multiple lenses. Therefore, it is important to direct attention toward participation trajectories across these learning spheres to highlight how teacher candidates learn to teach mathematics (Jahreie & Ottesen, 2010).

Both the exploratory nature of my research questions and how I conceptualize learning through a socio-cultural lens necessitated a research methodology that would allow me to examine the process of learning to teach through the experiences of the participants in the study across multiple learning spheres. Qualitative research methods enabled this sort of exploration because of the epistemological (the nature of knowledge) and ontological (the nature of being) assumptions within the constructivist paradigm (Mertens, 2009).

First, this paradigm of research assumes that all knowledge is subjective. Knowledge is socially constructed and multiple constructions can arise, some of which may be in conflict with

each other. Socially constructed phenomenon, such as learning, can mean different things to different people. Thus, research in this paradigm is the product of the values of the researchers and cannot be independent of them. Second, there is no single, objective reality that exists and can be known. Rather, in this paradigm, there are multiple socially and historically constructed realities that are produced and reproduced in the context of social interactions. Third, the understandings that emerge from qualitative studies are co-constructions that reflect the positions, experiences, values and beliefs of both researcher and participants. Each are interlocked with each other in an iterative process; each influences the other (Lincoln & Guba, 1985; Mertens, 2009).

The research methods employed in this study are based on the view that “meaning is embedded in people’s experiences and that this meaning is mediated through the investigator’s own perceptions” (Merriam, 1998, p. 6). The participants in this study ascribed meaning to their experiences in the MFE and my work as a researcher was to interpret that meaning within the socially constructed phenomenon of learning to teach mathematics. The line of qualitative research methods are therefore appropriate for investigating how one learns to teach (Yin, 2006) and such methods allowed me to examine the experiences of the participants as they engaged in the work of learning to teach in the real-life contexts of classrooms.

Single Case Study

In order to answer the research questions of this study, I drew on an exploratory single case-study design and method (Yin, 2006). Case studies are most helpful for investigating people’s lived or firsthand experiences within a bounded system (Merriam, 1998). My choice of a single-case study was driven by necessity. The Mediated Field Experience can be considered a unique case and there was only one opportunity within the data collection timeline that this case

could be investigated. The MFE represents a unique example of a structure that aims to connect university and school experiences for teacher candidates who are learning to teach. In single case-study research, it is critical that data collection and analysis is conducted in a way that adequately deals with issues of trustworthiness (Lincoln & Guba, 1985). In the next section, I describe the data collection methods used in this study and then explain how I used these methods to meet the criteria of trustworthiness.

Data Collection

This study drew on the experiences of participants as teacher candidates learned how to teach during the Mediated Field Experience. In order to examine the processes by which the structures of the MFE supported candidate learning, I generated data from a variety of ethnographic methods. I collected data from multiple sources including observations, videotape, interviews, and course assignments and I collected data from multiple participants including the teacher candidates, the partner teachers, the university instructors of the methods course, and other instructors in the TEP. Table 4.1 provides a mapping between my data sources and my research questions. In the next section, I first detail how I gained entrance through my role as a graduate student and methods instructor and how this impacted my role as a researcher. I then briefly describe the setting of both the university Teacher Education Program, specifically the mathematics methods course, and the Clark HS setting. Finally, I describe my data sources and how these sources provided avenues toward answering my research questions.

Table 4.1

Mapping between research questions and data collection

Research Questions	Observations	Interviews	Course Assignments
	<ul style="list-style-type: none"> ▪ University course ▪ Math classroom ▪ MFE debrief 	<ul style="list-style-type: none"> ▪ Interns (individual and group) ▪ Univ. Instructors (UI) ▪ Partner Teachers (PT) 	<ul style="list-style-type: none"> ▪ Online Reflections ▪ Student Interview Assign. ▪ Reflection 1 & 2 papers ▪ Field Experience Assign.
What is the Mediated Field Experience?			
What is the nature of the activities of the MFE? How do these activities draw on academic knowledge and practitioner knowledge?	University course math classroom MFE debrief	Interns PTs UIs	Online reflections Field Experience Assignment
What roles do candidates, classroom teachers, and university instructors take on during the MFE?	Math classroom MFE debrief	Interns PTs UIs	Student Interviews Assignment Online Reflections
What are the experiences of the teacher candidates within the mediated field experience?			
What do candidates find salient within the MFE?	University course MFE debrief	Interns	Online Reflections Student Interviews Field Experience Assignment
What do candidates struggle with or find problematic?			
To what extent does the MFE support candidates' learning about equitable teaching practices in mathematics?			
What do candidates learn about particular equity-oriented teaching practices?	University course Math classroom MFE debrief	Interns	Online Reflections Student Interviews Assignment Reflection 1 & 2 papers Field Experience Assignment

Gaining Entrance and Role as a Researcher. I began my Ph.D. program with an interest in how one learns to teach mathematics. My first teaching assistant (TA) position was with Dr. Lani Horn, the university faculty member who taught the secondary mathematics methods course. I was the TA for the mathematics methods course during the first year of the Mediated Field Experience. Over the next year, I gradually took over the teaching responsibilities for the methods course, continuing the MFE each year. I was also a research assistant for a study that examined the reform efforts of the Clark HS mathematics teachers. Through this work and instructing the methods course, I was able to forge relationships with several of the Clark HS

mathematics teachers and gain experience in teaching a university methods course. I was the instructor of the methods course for four consecutive years. During all four of these years, I facilitated the MFE along with the Clark HS mathematics teachers.

Savannah, a former high school mathematics teacher and a current Ph.D. student, was the teaching assistant during my 4th year teaching the methods course. Savannah was the TA of the course knowing that she would teach the course as the primary instructor the following year, which is the year this study took place. Savannah participated in both the university instruction and also the MFE. She also assisted me in developing and modifying activities for the methods course and MFE. We agreed that during her first experience teaching the methods course, I would simultaneously collect my research data and also act as her mentor for the course.

In the quarter before the MFE began, Savannah was supervising a teacher candidate in Tanya's classroom. This entailed several observations of both the candidate and Tanya's teaching practice and reflection discussions following the observation that included the candidate, Savannah, and Tanya. In addition, Savannah was also beginning her own research study with Wendy and her students. In addition to the work of the planning and enacting the MFE, Savannah spent time observing in Wendy's classroom and holding discussions with Wendy about both her study and the MFE.

In preparation for Savannah teaching the methods course, I attended several planning meetings between Savannah, Spencer and Silvia, two Ph.D. students and former secondary mathematics teachers who were teaching assistants for the methods course during the time of this study. During these meetings, Savannah, Spencer, and Silvia planned the activities that would take place over the quarter and periodically asked me for suggestions or advice, which I willingly gave.

As the quarter began, I quickly found myself in a situation in which I was collecting confidential data from Savannah's students but I was unable to use this information to support her in teaching the course. Conflict arose between holding to the confidentiality agreement between myself and the teacher candidates and simultaneously supporting Savannah by suggesting improvements she could make in teaching the course. For example, during the first individual and group interview, I asked the teacher candidates what they were struggling with, intending the question to be directed toward particular concepts they were learning about in the methods course. The teacher candidates voiced concern about Savannah's feedback on their first assignment. I was unable to "mentor" Savannah based on this information gained from the teacher candidates through my interviews with them because this information was confidential. A rift developed between my role as researcher and role as mentor. Later, Savannah expressed that she often wondered if my curricular and pedagogical suggestions were initiated because of what teacher candidates shared with me confidentially or because of what I observed on my own.

I began the quarter by participating in the methods course planning sessions with Savannah, Silvia, and Spencer and offered suggestions for structures or activities based on my prior experience teaching the course. As the quarter progressed and the conflict between researcher and mentor arose, I stopped attending the planning meetings thereby minimizing my role as mentor and increasing my role as researcher. At the time, I did not want the information I learned from the teacher candidates to impact how the methods course got played out. In retrospect, I question this decision considering my world-view of the socially constructed learning environment and given I was a participant in that environment. I question my decision to position my role as researcher above my role as a mentor to a colleague and friend.

A second conflict permeated my role as a researcher during this study. Although I was not the instructor for the course during the data collection, my former role as the instructor for the mathematics methods course and the Mediated Field Experience positioned me as an “insider”. I was deeply involved in creating and growing the MFE from its inception. This role brought both limitations and affordances as a researcher of a practice with which I was intimately familiar. As a former instructor of this course, I brought particular assumptions about learning to teach in the context of the MFE. This required that I problematize the practice of the MFE while guarding against any attachments I might have toward the practice. As I enacted my role as a researcher in the methods course and the MFE, I found it difficult to examine a context with which I was so familiar. As a qualitative researcher, I knew that it would be important to “make the familiar strange”. After all, I had taught this course several times and I was heavily invested in the Mediated Field Experience. This made it challenging to examine the methods course and MFE with a fresh perspective.

In the end, what helped me in this process was doing what I was advised against as a qualitative researcher. After data collection ended, I put my data aside for a few months and let it get “cold”. I then re-approached my data with a fresh perspective. Taking this step away from my data allowed me to re-enter as a researcher and not as a former instructor of the MFE who wanted to “show” or demonstrate its benefits. Given the distance of time, I found I was able to examine the data with a more objective view.

Data Sources

Data was collected during the entire duration of the 10-week methods course and the Mediated Field Experience. I collected data from both the university-based methods course and the MFE at Clark HS. I also collected data from several groups of participants. Collecting data

through multiple sources and methods can strengthen the validity and reliability of a research study (Yin, 2009). The data I collected either served as primary or secondary data sources. The description of these data sources follows.

Primary Data Sources

Observations of the Partner Teacher Classrooms. Observations of the Algebra 1 classes were a significant source of data for this study. Each week, I observed either Wendy or Tanya as they taught their Algebra 1 class, switching between teachers' classrooms each week. I positioned myself in the back of the classroom as a way to visually remove myself from the interactions of the classroom. I used a laptop computer and recorded fieldnotes (Miles & Huberman, 1994) of the interactions and activities that took place in the classroom. I tried to record exact conversations between the teacher and her students and between the small groups of students. Periodically, I would listen intently to and record the conversation of a nearby group while they were working together on a mathematics task.

The purpose of collecting fieldnotes of the classroom interactions was to enable an examination of the salient practices that surfaced in the classrooms. This study focused on the way in which teacher candidates learn to teach and it was important to record, in detail, the teaching practices the teacher candidates were observing. Additionally, specific practices or teacher moves that were demonstrated in the partner teachers' classrooms were often called up in the debrief session that followed the observation, in the university methods course, and in the teacher candidates' course assignments including the online reflections. I wanted to be able to make connections between the practices the partner teachers enacted in their classrooms and how teacher candidates were making sense of those practices.

Video of MFE debrief. The debrief sessions were also a significant and rich source of information. Each debrief session, which was held in Tanya's classroom during lunch and the Collaborative Planning Period time (approximately 70 minutes), was video recorded. This provided an accurate record of the dialogue between and among the candidates, the university instructors, and the partner teachers. The video also documented important visual and physical components of their interactions (e.g. where participants were sitting, diagrams that were drawn, body language, etc.).

The debrief session was instrumental to the Mediated Field Experience. This was when the teacher candidates shared their observations and asked questions about practice. During the debrief session, the partner teachers shared their perspectives of the lesson, made assessments about their students' learning, and shared stories and information about their students that were relevant to the discussion. This revealed the ways in which the partner teachers talked about their students, student learning, and their goals for the lesson. These interactions were critical to document and accurate records would not have been possible relying solely on field notes.

In total, there were seven visits to Clark HS for the Mediated Field Experience generating seven taped debrief sessions. All tapes were fully transcribed.

MFE artifacts. During each MFE, Savannah provided the teacher candidates with an observation protocol. This was often emailed to the teacher candidates or given to them on paper during the campus portion of the methods class before the following MFE observation. I collected all observation protocols. These observation protocols directed the teacher candidates to pay attention to different aspects of classroom life and I used these protocols to examine the relationship between the MFE debrief structure and what the teacher candidates decided to share as an observation.

In addition, I collected any student artifacts the Partner Teachers used in their classrooms. This included worksheets or task cards the teachers gave to their students and warm-ups the teachers used at the beginning of the class. I also attempted to record student work when it was made public. For example, when students were chosen to show their work on the board or document camera, I copied the student work into my research journal.

Post-observation reflections. Another significant source of data was the online post-observation reflections. After each MFE classroom observation, teacher candidates were required to post a short paragraph of reflection about their observation at Clark HS. The teacher candidates were instructed to reflect on their experiences in the Clark HS classrooms in light of the focus question of the week. For example, if the focus question of the week was “What do students learn in math class?” then the teacher candidates were to situate their classroom observation reflection within this question. The teacher candidates were also encouraged to draw on methods course texts or text from other courses to support their ideas.

These reflections were posted to an online blog site accessed by the teacher candidates, the university instructors, and myself. The partner teachers did not have access to the reflections because Savannah wanted to create a space for the teacher candidates to bring up ideas or questions they might not feel comfortable surfacing in the presence of the partner teachers. The teacher candidates were instructed to post an initial reflection the same evening of the observation and then comment on a peer’s reflection the following day. Both the initial reflections and comments from each observation were downloaded from the online site and analyzed.

Interviews. Due to the exploratory nature of this study, it was important to determine how the participants were experiencing the Mediated Field Experience. In addition, one of the

goals of this study was to uncover what the teacher candidates learned during the MFE. To this end, I interviewed the partner teachers, the university instructors, and held group and individual interviews with most of the teacher candidates. All interviews were semi-structured and lasted approximately one hour, except for the final interview with Savannah, which lasted two hours. Sample interview questions can be found in Appendix B.

Partner Teacher Interviews. Tanya and Wendy were both interviewed twice during the study because they were the Partner Teachers for the MFE. Vanessa and Zoe were not interviewed because they only participated in the MFE debrief and the teacher candidates did not observe in their classrooms. The first interview was held just after the first Mediated Field Experience. The focus of the interview was to collect information on their teaching history and past involvement with the university-school partnership. I also wanted to get a sense of what the partner teachers expected from the MFE and their ideas of the purpose of the MFE. The second interview was held after the last MFE. This interview focused on the partner teachers' experiences in the MFE - their struggles, insights, and suggestions for change.

Teacher Candidate Interviews. In order to learn more about how the teacher candidates were experiencing the MFE, I held both group and individual interviews. The group interview was held after the first two MFEs. This interview was attended by all but two of the teacher candidates. Interview questions focused on connections the teacher candidates were seeing between their observations at Clark HS and what they were learning in their university courses. I also questioned them about what they paid attention to during the classroom observations, what they found interesting, and what struggles they were experiencing. Questions also focused in the role of each of the participants in the MFE (the partner teachers, the university instructors, the teacher candidates themselves) as viewed by the teacher candidates.

In addition to the group interview, I also held individual interviews with four teacher candidates. I selected these teacher candidates in an effort to gain a diverse perspective of the ways in which the teacher candidates were experiencing the MFE. My selection of teacher candidates was not based on a desire for generalization but on the belief that diversity among participants would assist me in understanding the complex nature of learning to teach mathematics. I chose teacher candidates who represented the diversity of identified gender, race, and prior life experience within the cohort group of teacher candidates. *Emma*, a white female candidate in her early twenties, began the TEP during the same quarter she was finishing her undergraduate degree in mathematics at the university. *David*, a white male candidate in his early twenties, had recently graduated from the university with a degree in applied mathematics. *Mei*, an Asian female candidate in her late twenties, had also recently graduated from the institution with a degree in mathematics. Mei had also received her K-12 schooling in China and had experience teaching mathematics in China. *Hannah*, a white female candidate in her early fifties, had recently graduated from the university with a degree in mathematics. She had prior experience as a teaching assistant in a non-traditional private school.

The individual interviews were held after the sixth MFE (week 7) and at the end of the quarter (week 11). The first individual interview began by asking the teacher candidates to describe their own experiences in mathematics. Questions also focused on connections the teacher candidates made between their observations at Clark HS and their university coursework. They were also asked about ideas or practices they found important and others they questioned. Since the first interview took place toward the end of the sequence of MFEs, the teacher candidates were able to call upon specific events and experiences in the MFE.

The second interview took place after the quarter ended. This interview focused on the two final projects of the quarter: the Microteaching Assignment and the Field Experience Assignment. I reviewed these assignments prior to the candidate interviews, generating my interview questions based on the practices and ideas the teacher candidates discussed in their assignments. The interview focused on what the teacher candidates learned during the quarter through their creation and enactment of the microteaching lesson and the Field Experience Assignment poster. These two assignments along with the teacher candidates' perspectives on the final product of the assignments provided insight into what and how the teacher candidates were learning as a result of the MFE.

University Instructor Interviews. All three university instructors were also interviewed. Savannah was interviewed twice, once at the beginning of the quarter and again after the quarter ended. The first interview lasted about 45 minutes and the second interview lasted two hours. Spencer and Silvia were interviewed once during the study. This interview occurred after the sixth MFE observation and lasted approximately 30 minutes. Questions focused on the university instructors' perspectives on the purpose of the MFE, how they were experiencing the MFE, their views about what the teacher candidates were learning from the MFE, and reflections on their own role in the MFE and the role of the partner teachers. The final interview with Savannah also focused on our shared experience as mentor/mentee and researcher/research participant.

Teacher Candidate Course Assignments. All assignments teacher candidates completed for the methods course were collected before the university instructors assessed the work. This included the MicroTeaching lesson plan and reflection, the Field Assignment poster (digital photos were taken) and written reflection, an assignment in which the teacher candidates

interviewed students while at Clark HS, and an assignment called Reflection 1 and Reflection 2 that asked the teacher candidates to “answer” the Essential Questions of the methods course both before the quarter started and again at the end of the quarter. I used the teacher candidate work samples to examine which aspects of teaching mathematics were salient for the teacher candidates. For example, several assignments allowed the teacher candidates a choice in what they decided to write or teach. In the Field Experience Assignment, teacher candidates were asked to review their notes from their 2-week field experience and the Clark MFE and then create a poster that demonstrated how their conceptions of practices they learned in their various field experiences had evolved or been reinforced. They were also asked to identify practices or ideas they were struggling with, for any reason. This allowed me to see what the teacher candidates found to be important aspects of teaching mathematics and the practices and concepts they intended to use in their first year of teaching, as well as practices they were questioning.

Secondary Data Sources

Methods Course Observations and Artifacts. Observations of the university-based section of the methods course allowed an examination of the ways in which the university course represented mathematics teaching practices. This allowed for a comparison between the practices and ideas surfaced in the methods course and the practices observed in the Clark HS classroom observations. Additionally, having an accurate record of the activities and interactions in the university-based section of the methods course provided data that could be linked to the teacher candidates experiences as they moved between the university methods course and the Clark HS classrooms.

The methods course observations were recorded on videotape. At the time of the study, I assumed that a detailed and accurate account of the activities, discussions, and interactions that

took place in university-based section of the methods course would be necessary to address my research questions. However, the video recordings of the university-based methods classes served as data that triangulated and supported claims generated from other sources of data rather than as a primary source of data.

I also collected all handouts the teacher candidates received during the methods course. This included task cards and group activities the university instructors asked the candidates to solve, handouts, articles to the teacher candidates were asked to read, and written assignments for the teacher candidates. I also photocopied the teacher candidates' daily end-of-class reflections, which they turned into the university instructors as an exit ticket.

Methods of Data Analysis

Data analysis was an ongoing process in this study. In qualitative research methodologies, data generation and analysis occur simultaneously and are inseparable processes that inform one another (Miles & Huberman, 1994). As the researcher and instrument of analysis in this study, I responded to the first available data and immediately began to form initial ideas and hunches, which then caused changes in my interview questions and shifted the focus of my observations (Lincoln & Guba, 1985).

I began with an initial read-through of all transcripts from the MFE debrief sessions, the online teacher candidate reflections, and the interviews with the participants. As I read through the data, I noted insights and potential themes by creating analytic memos (Miles & Huberman, 1994). These memos served as a discussion with myself about my data and what emerged from the data. I recorded thoughts about what might be happening and posed questions to myself as a way to continue to examine the data while holding onto the important insights and potential areas of exploration.

I then began the process of open coding of the data (Miles & Huberman, 1994) using the possible themes that emerged from the initial review of the data. This entailed chunking the data into units that reveal a particular notion or idea and then assigning a label or code that represents the meaning of the unit of data. Because I was interested in what the teacher candidates were learning about teaching mathematics using equity-oriented teaching practices, I tried to use broad codes that represented these practices (assigning competence, student presentations, groupworthy tasks) or pedagogical concepts (status, justification, relationships with students). This deductive approach to generating code labels allowed me to create descriptive categories that were derived from my research questions.

In addition to a deductive approach to analysis, I also took an inductive approach. This occurred as I generated interpretive code labels that reflected more nuanced patterns in my data set. For example, as I attended to what the teacher candidates publicly shared during the debrief session, I created codes that reflected the subtle differences in what they were noticing about various classroom interactions.

As I worked my way through the transcripts of the MFE and the teacher candidate online reflections, a clear coding pattern began to emerge. I found myself focusing on the type of classroom interactions the teacher candidates were paying attention to as they shared what they noticed during the observations. This was because I was attempting to determine what the teacher candidates were learning during the classroom observations through the observations they were sharing during the debrief session. Many of the teacher candidates' comments could be categorized as one of the classroom practice relationships often represented by the Instructional Triangle (Hawkins, 1974). The observations the teacher candidate shared during the debrief and online reflections demonstrated observations that attended to one of several

classroom interactions: a teacher-student interaction (noticing how the teacher interacted with a particular student), a student-student interaction (noticing how the students interacted with each other) or a student-math interaction (noticing how the students engaged in the mathematics) (See Figure 4.1). This pattern allowed me to address my second research question, *What are the experiences of the teacher candidates in the MFE?* by revealing what the teacher candidates “noticed” (Sherin, Jacobs, & Phillipp, 2011). This is elaborated further in Chapter 6 and 7.

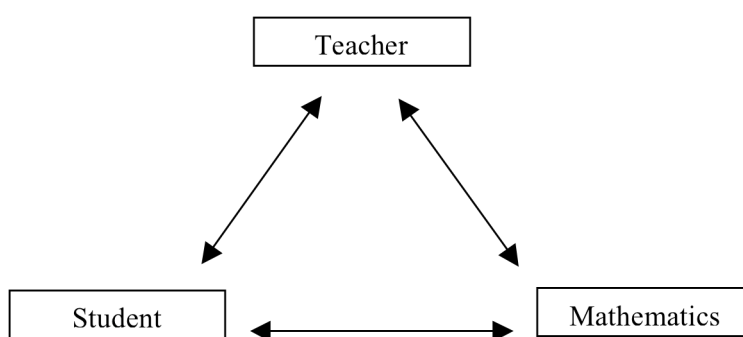


Figure 4.1: The Instruction Triangle, representing three ongoing interactions in a classroom

From this finding, I was then able to address my third research question, which revealed what the teacher candidates learned about equity-oriented teaching practices. The comments that were made by the teacher candidates revealed particular practices they attended to more than others and how they were making sense of those practices. I triangulated this finding by drawing on the data from the teacher candidate interviews and their coursework assignments using a similar process of coding and memoing.

In order to determine the ways in which the MFE provided the teacher candidates opportunities to draw on partner teacher knowledge to address my first research question, I took a slightly different analytical approach. From the results of the analysis of the teacher candidate “noticings”, I began to examine the particular structures of the MFE that may have provided the

candidates with opportunities to make more nuanced observations, and to interpret those observations, in a classroom setting. I began by separating the MFE into its four components: Planning, Observing, Debriefing, Reflection. I then examined the extent to which each component of the MFE supported the teacher candidates in paying attention to the important aspects of the classroom practice.

Criteria for Establishing Trustworthiness

Throughout the process of data collection and analysis, I made efforts to establish “trustworthiness” (Lincoln & Guba, 1985) or the quality of the findings. In naturalist research, trustworthiness can be established by addressing credibility, transferability, dependability, and confirmability. I briefly address each of these criteria for establishing trustworthiness of this study.

Credibility. This aspect of trustworthiness refers to the extent to which the findings of the study match the perceptions of the participants. To ensure that my findings accurately reflected the teacher candidates’, partner teachers’, and university instructors’ perspectives, I employed a variety of member checks (Lincoln & Guba, 1985) both during interviews and after the study was completed. During interviews, I often tried to paraphrase what the participant had said to be sure I understood the meaning they were trying to get across. As the write-up of the study was close to completion, I sent drafts to many of the participants and asked that they provide feedback on the accuracy of my interpretation of the MFE and the events that occurred as part of the course.

In order to further establish credibility, I drew upon multiple sources of data as well as multiple types of data. This allowed me to triangulate themes and patterns within the data. To do this, I reviewed each emergent theme (finding) across multiple sources of data (participants,

contexts) and multiple types of data (interviews, observations, course assignments).

Triangulation of the data added credibility to the study and further supported trustworthiness.

Transferability. In qualitative research methods, generalization does not happen from sample to population. This is not the claim of qualitative research. Rather, Stake (2010) argues that qualitative research is rooted in personal experience and thus serves as a natural basis what he calls *naturalistic generalization*. This type of generalization is described as a partially intuitive and empirical process arrived at by recognizing the similarities of objects, issues, and situations of context. Stake further argues that naturalistic generalization commonly proceed from a single study to a study that is similar rather than from a single study to a population as in research in the positivist and post-positivist paradigms. Because naturalistic generalization is dependent upon situated context, it is essential that the research report is descriptive, or provides what Geertz (1973) calls “thick description”. This requires the researcher to provide enough detail so that the reader is able to make a generalization, or “working hypothesis” (Lincoln & Guba, 1985) to their own context or situation and therefore establish the basis for naturalistic generalization.

To assist the reader in making naturalistic generalisations, case researchers need to provide opportunity for vicarious experience. Our accounts need to be personal, describing the things of our sensory experiences, not failing to attend to the matters that personal curiosity dictates. A narrative account, a story, a chronological presentation, personalistic description, emphasis on time and place provide rich ingredients for vicarious experience (Stake, 1995, p. 87).

In order to provide this description, I presented the reader with original sources of data, such as direct quotes, historical context, and narratives, as an attempt to communicate to the reader through words and illustrations. This is meant to offer the reader a perspective of the situation that is explored in this study, the Mediated Field Experience and the study participants’ own experiences within this activity. I attempted to carefully document the salient features of the

case so that the reader may then apply the knowledge they gain from this study to their already existing knowledge of their own personal context and therefore develop personal understanding.

Dependability

In order to establish dependability, or the transparency of the research process such that another may conduct a similar study, I attempted to describe the context, data collection methods, and analysis methods in detail. My goal was to provide the reader a thorough understanding of the research design, methods of data collection, and methods of analysis.

Confirmability

In order to meet the criteria for confirmability, or the degree to which others can corroborate the results, I kept an “audit trail” or what I called my Analysis Journal. Here, I recorded reductions of my raw data (often tables and charts), categories and codes I used and considered using, memos or summaries, notes, hunches and hypothesis. I also kept detailed records of my data, including transcripts, fieldnotes, and participant artifacts such as candidate assignments.

Conclusion

In this chapter, I discussed single-case study research within the constructivist paradigm of qualitative research methods as an appropriate tool to investigate the phenomenon of teacher learning in the Mediated Field Experience. I reviewed the principles and practices of qualitative research and specifically, single case study research and offered examples of how they were applied in this study.

Additionally, I detailed my primary and secondary data sources and explained how these data sources supported my inquiry. I then elaborated my analysis procedures in order to demonstrate how my claims arose from the data I had collected. Finally, I established the criteria

for trustworthiness within qualitative research and I explained how I attempted to maintain the criteria for trustworthiness within my study.

In the next three chapters, I detail the results of my analysis and address my research questions. In Chapter 5, I describe how the structures and activities of the MFE provided the teacher candidates opportunities to draw on practitioner teacher knowledge. In Chapter 6, I describe how, as a result of the structures and activities of the MFE, the teacher interns were able to “notice” important but often invisible aspects of classroom life. I describe how the structures and activities of the MFE supported the teacher candidates to closely observe these practices. In Chapter 7, I focus on a few of the classroom interactions the teacher candidates noticed to demonstrate what the teacher candidates learned about two teaching practices, recognizing status and using mathematical representations. I describe how the partner teachers implemented these two practices, with equity as the intention behind their practice, and how the teacher candidates made sense of these two practices.

CHAPTER 5

Aligning Learning-to-Teach Contexts to Draw on Teacher Knowledge

Twenty years prior to this study, Marilyn Cochran-Smith first wrote about the ways in which teacher education programs were structured in relationship to partnerships with schools (Cochran-Smith, 1991a, 2004). For Cochran-Smith, there existed three types of university-school partnerships: those of *Consonance*, *Critical Dissonance*, and *Collaborative Resonance*. University-school partnerships based on *Consonance* aim to educate teachers to be professional decision makers and apply effective research-based knowledge to their practice by placing student teachers in classrooms that “speak the same language” as the university. Cooperating teachers and university supervisors are trained to evaluate the teacher candidates based on their competency at implementing strategies and language of effective teaching. Although these programs intend to connect both research-based knowledge and knowledge from classroom experience by aligning these contexts, Cochran-Smith argues that what actually happens is that classroom teachers are essentially told by outsiders, university-based researchers and teacher educators, what their classroom practice and knowledge ought to look like. The message sent is that effective knowledge about teaching is generated solely by university researchers and that classroom teachers and teacher candidates are disregarded as contributors to this knowledge.

Cochran-Smith argued that *Critical Dissonance* is a second approach to university-school partnerships in Teacher Education. This type of partnership is based on the assumption that in order to keep teacher candidates from simply reproducing existing practice, teacher candidates’ views of teaching and learning – which developed over their own 12 or more years of schooling experience – must make a significant shift. This happens as they work to develop a critical perspective that examines issues of race, gender, class, and power and “call into question the

social and political implications of standard policy and practice” (Cochran-Smith, 1991b, p. 108). The dissonance occurs between what the teacher candidates observe in traditional schools and the critical perspectives that are developed in their university program. One of the ways Cochran-Smith critiques this approach is to point out that outsiders – those who do not work within the institution of schooling – hold the agency to transform practice for those on the inside. This approach largely marginalizes the classroom teacher as a user of knowledge rather than a producer of knowledge about effective teaching.

Implicit in the above approaches to university-school partnerships is the hegemony of university-based knowledge. Teachers are positioned as receivers of knowledge rather than generators of knowledge and as perpetuators of the status quo rather than agents of change. This is a limiting stance on what teachers are able to do toward efforts to significantly change the practice of teaching. Cochran-Smith proposes a third approach to teacher education and university-school partnerships that works to position classroom teachers as generators of knowledge through an inquiry stance on teaching and learning (Cochran-Smith, 2004). She calls this approach *Collaborative Resonance*, borrowing from a term used to describe the intensification of sound, and bases this approach on the “co-labor” of learning communities.

University-school partnerships that take a Collaborative Resonance approach work from the assumption that learning opportunities can be created from a collaborative effort on the part of both classroom teachers and university teacher educators. Similar to critical dissonance, learning to teach in a resonance approach is meant to be transformative. However, different from both critical dissonance and consonance, this approach capitalizes on the culture of teaching where teacher candidates, classroom teachers, and teacher educators alike “critique the cultures of teaching and schooling, research their own practices, articulate their own expertise,

and call into question the policies and languages of schooling that are taken for granted” (Cochran-Smith, 1991a, p. 283). This approach is very much centered on leveraging the knowledge of classroom teachers who are themselves actively engaged in transforming their own teaching practice. With this approach, the dialects of theory/practice, research/practice, and local/public knowledge are linked through the acknowledgment that “the power to liberalize and reinvent notions of teaching, learning, and schooling is located in neither the university nor the school but in the collaborative work of the two” (p. 284).

The resonance approach is grounded in the idea that teacher education takes place not only in the time before one becomes a teacher of record but that teacher education is a process that occurs across the entirety of one’s career as a teacher (Feiman-Nemser, 2003). Learning to teach means taking an inquiry stance on teaching, learning and schooling. Cochran-Smith & Lytle (1995; 2009) use the notion of “inquiry as a stance” to recognize the “collective intellectual capacity of practitioners to work in alliance with others to transform teaching, learning, leading and schooling...” (p, 118).

Fundamental to the notion of inquiry as a stance is the idea that educational practice is not simply instrumental in the sense of figuring out how to get things done, but also and more importantly, it is social and political in the sense of deliberating about what to get done, why to get it done, who decides and whose interests are served. Working from and with an inquiry stance, then, involves a continual process of making current arrangements problematic; questioning the ways knowledge and practice are constructed, evaluated, and used; and assuming that part of the work of practitioners individually and collectively is to participate in educational and social change. (p. 121).

Through making their classrooms and schools sites of inquiry and connecting their classroom practices to larger social and political issues, teachers play a critical role in the generation of knowledge of practice. Teacher preparation can support novices in doing similar work – transforming teaching through inquiry as a way to “generate knowledge” from their own practice. This knowledge is both local and formal; what teachers and teacher candidates learn

can both influence local action and become interpretive frameworks and theories of practice that are useful and usable in other contexts (Cochran-Smith & Lytle, 2009). Teacher candidates can learn this important work if they are provided opportunities to both observe and engage in the practice of “generating knowledge” by participating alongside practitioners who collaboratively theorize, study, and act on educational problems in the best interests of their students’ learning and their students’ lives (Cochran-Smith & Lytle, 2009).

In this chapter, I claim that the structures of the Mediated Field Experience provided teacher candidates opportunities to draw on both academic and practitioner knowledge in ways that connected their experiences in their university coursework to their experiences in the Clark HS classrooms. Within these structures, the teacher candidates were provided opportunities to observe and engage in “generating knowledge” through their coursework-fieldwork inquiry into what it means to teach and learn mathematics. Opportunities to generate knowledge collaboratively with practicing teachers occurred in three fundamental ways: 1) through a partnership with teachers who were themselves engaged in transforming their teaching practice; 2) through the nature of the activities prior to, during, and following the MFE observations and debrief sessions; and 3) through a shift in the roles of the University Instructors and the Partner Teachers.

Transforming Mathematics Teaching Practice at Clark High School

The MFE debrief occurred during the Partner teachers’ Collaborative Planning Period (CPP). This was a class period during the school day that was dedicated time for the Algebra 1 team to meet together and talk about how and what they were teaching in their Algebra 1 classes. The CPP was in addition to the teachers’ regular planning period. The teachers met approximately 4 times a week during this CPP and the MFE debrief took place during this period

of time once each week for the 7 weeks the MFE occurred. During the time of this study, the Algebra 1 team included Tanya, Wendy, Vanessa, and Zoe. Wendy and Tanya were the partner teachers who were observed during the MFE while all of four of the teachers participated in the MFE debrief.

The CPP time was spent collaborating to design activities for the Algebra 1 class, to discuss where students might struggle or get “tripped up” with the mathematics, how the teachers would support student understanding, and which teaching practices would best support student understanding. The partner teachers also talked about individual students and brainstormed ways to better meet these students’ needs in the Algebra classroom. The partner teachers were keenly aware that the students in their classrooms were the students who struggled the most in mathematics, and school in general; these were the students who were most marginalized because of their ELL status, level of poverty, or lack of academic resources. These were not the students who were in the Accelerated Learning Program; those students entered Clark HS at the geometry course level.

Because the teachers were working to implement many of the practices associated with Complex Instruction, their CPP time was also spent discussing these practices, how the practices might be implemented, and appropriate times for the implementation of practices such as participation quizzes and student presentations. The teachers essentially shared and collaboratively problem-solved around their particular problems of practice, critically examined their own teaching practices, and focused on ways to best support their students in a mathematics course that is often called a “gatekeeper”. These teachers were researchers of their own practice and the goal was to support all students to be successful in Algebra 1. In Cochran-Smith and

Lytle's (2009) terms, these teachers were "practicizing theory" through the local generation of knowledge:

...we use "local knowledge of practice" to describe the knowledge practitioners generate through inquiry. With this language, we both signal a break with the formal-practical knowledge distinction, and we characterize what practitioners and communities come to know when they build knowledge collaboratively. We also assert, however, that local knowledge is often relevant and useful more publicly. Our local-public conception does not posit two kinds of knowledge analogous in any way to the distinction made between practical and formal knowledge. Rather, it is assumed that the knowledge practitioners need to practice well is generated when they treat both their own practice as the site for intentional investigation and the knowledge and theory produced by others as generative material for interrogation and interpretation. In this sense, practitioners learn when they generate local knowledge by working in inquiry communities to theorize and construct their work and to connect it to larger social, cultural, and political issues (p. 131).

The Clark partner teachers did, in fact, treat their teaching practice as a site for learning. This was evident through the many references the partner teachers made during the MFE debrief and during interviews that suggested their collaborative work toward interrogating the social and political issues that impacted their teaching practice. For example, the partner teachers were aware of the fact that their Algebra 1 students did not accurately represent the socio-economic and racial diversity of the school. The student population at Clark is about 60% white students while the partner teachers' Algebra 1 classrooms had, at most, one or two white students out of approximately 30 students. This was due to the fact that Clark HS was the only high school in the district that housed the Accelerated Learning Program and these students, most of them from more affluent parts of the city, entered Clark with Algebra 1 credit completed.

During the first debriefing session of the Mediated Field Experience, Wendy described Clark HS in this way:

Algebra 1 is the entry-level math class our freshman take. We have quite a few freshman [who are in the Accelerated Learning program] come in at Geometry or Algebra 2. So (they) come in at Pre-Calculus, come in at a sophomore or junior or senior level math class. They are accelerated from 2nd grade on or moved up and took a summer course or whatever. So we don't offer Pre-Algebra or a repeat of 8th grade math – they all come

into Algebra 1. I don't think (the students in Algebra 1) represent the ratio – like the socio-economic status and racial perspective – I don't think it reflects the entire school but being more of the neighborhood kids and the kids that are not bussed in for the [Accelerated Learning program] that is offered here. (*Wendy, MFE debrief, 4.6*)

The teachers recognized that many of their students entered Clark HS with gaps in their mathematical knowledge and many had failed their middle school mathematics courses.

However, the Algebra 1 class was the place where all of these students landed, regardless of past failures and gaps in knowledge. These were the students who needed the most support in order to successfully complete Algebra 1 and the partner teachers kept a strong focus on helping these students succeed.

Another group of students the partner teachers paid particular attention to was the high percentage of students who were English Language Learners (ELL). Many of these students recently immigrated from their home countries and some experienced their first formal schooling when they arrived at Clark HS. During the fifth MFE debrief, one of the teacher candidates asked how ELL students were placed into mathematics classes, especially when they were recent immigrants to the U.S. The partner teachers discussed the ways in which these students are often incorrectly placed due to their English skills and not their mathematical knowledge.

Tanya: So, I had a 9th grader who came from the Center for Bilingual Students²³. He graduated out of that program and couldn't speak English very well. They put him in Algebra 1 because he's a 9th grader. I moved him up two levels to Honors Advanced Algebra. (To Vanessa, who now has this student in her class): Is he doing OK?

Vanessa: He could really be in Pre-Calculus but yah, he's great.

...

Wendy: A lot of the strategies we use are totally compliant with ELL differentiated instruction...so we can check a lot of boxes for supporting those kids and the change that does happen is amazing. And if they are here the whole year, a lot of times we'll put them

²³ The Center for Bilingual Students is a district-sponsored program attended by recent immigrants. These students first attend this program for up to six months before they are then placed into a public school setting. The program is designed to support ELL students in their transition to public schools.

in the support class²⁴ because a lot of time those kids want to do well but they just need the extra time and they realize that, so they utilize that. So it's really hard for them to change their status through the course of the year because they've always had a problem with the language and not with the understanding behind the math so it's a hard year to get through Algebra. But I do feel like they make gains and strides in math *and* language skills *and* social skills *and* groupwork. (*MFE debrief, 5.11*)

The partner teachers were aware of the inequities of the schooling system, specifically the problematic way ELL students were placed in mathematics classes and how those students were often perceived as low status because of their developing English language skills. The teachers' awareness of the problem and their collaborative work to address the inequity demonstrates how they actively worked against and also within that system. Tanya knew that moving a student to Vanessa's Honors Advanced Algebra class would best meet that student's needs. Wendy stressed how the teaching practices of the Algebra 1 team also supported this particular group of students by working toward not only development of mathematical understanding but also development of language and social skills. These teachers problematized common assumptions about ELL students and how they get placed in mathematics classes at Clark HS. They raised questions about resources, processes, and policies and how the system might change in a way that challenges the deeply rooted inequities that exist.

The Partner Teachers theorized, studied and acted on educational problems and it was this stance, rooted in inquiry and redefining what it means to teach and learn mathematics, which the Partner Teachers brought to the MFE each week. It was this knowledge that was made visible and accessible to the teacher candidates as they observed and questioned the partner teachers during the MFE.

²⁴ The support class for Algebra 1 is designed as a second mathematics class that focuses on teaching the skills and knowledge students will need to engage successfully in their regular Algebra 1 class.

Supporting Candidate Learning Through the Structures and Activities of the MFE

The activities and structures of the MFE, rooted in collaboration between the partner teachers and the university instructors, allowed teacher candidates to gain access to the thinking and decision making the Partner Teachers experienced as they designed, taught, and reflected on their lessons and practices. Additionally, the structures and activities of the MFE allowed the teacher candidates to connect what they learned in the MFE to their university coursework. In this section, I first briefly describe the four main structures of the MFE. I then take each structure and discuss it in more detail, describing how the structure and the activities connected university coursework to the field experience by drawing on partner teacher knowledge.

Overview of the structural elements of the MFE. During the first quarter of the five-quarter Teacher Education Program, the math methods course met two days each week. On the first day, teacher candidates and methods instructors gathered at the university where they focused on a particular essential question²⁵ posed at the beginning of the week. The teacher candidates engaged in activities such as reading and discussing research, planning lessons, examining and analyzing instances of teaching on video, microteaching with peers, and solving, designing, and analyzing mathematics tasks. All of these activities were focused around the essential question of the week.

On the second day of the course, the teacher candidates and methods course instructors met at Clark HS to observe two partner teachers, Tanya and Wendy, as they taught one period of an Algebra 1 class. The teacher candidates, randomly divided amongst the two teachers' classrooms, intensely observed the classroom lessons using observation protocols and activities that were designed to enable the teacher candidates to focus on the question of the week, to pay

²⁵ Examples of these weekly questions are: "How can we implement high level activities and sustain the cognitive demand?" and "How can we plan activities to optimize participation and sensemaking?" The weekly questions were sub-questions of the course "Essential Questions".

specific attention to student thinking and interactions, and to observe and analyze specific teacher moves.

This structure can be broken down into four phases that made up the Mediated Field Experience: Planning, Observation, Debrief, and Reflection. In the next section, I will describe how each of these phases was enacted across the three groups of participants, the partner teachers, university instructors, and teacher candidates.

Planning. Prior to each observation, Savannah, the lead university instructor, and the partner teachers communicated over email about the plan for the upcoming observation and debrief. Savannah informed the partner teachers of the focus of the week in the methods course and the important ideas and teaching practices that were discussed in the class. Savannah also let them know about the articles and book chapters the teacher candidates had read by providing the partner teachers with the course syllabus. In addition, toward the middle of the quarter and by request of the partner teachers, Savannah also emailed the partner teachers the observation protocol or questions she planned to use during the upcoming debriefing session.

In return, the partner teachers informed Savannah, via email, of the lesson they intended to teach during the observation and sent her any worksheets or handouts they were planning to use in class. Savannah then emailed the candidates with the task or activity attached and instructed the teacher candidates to solve the problems or engage in the activity prior to the observation. Savannah wanted the teacher candidates to be able to focus on how the students were making sense of the mathematics rather than trying to figure out the mathematics during the observation. The teacher candidates felt this was beneficial to their observations because it allowed them to figure out the mathematics and anticipate what might be difficult for students before they were actually sitting in the classroom watching the students solve the problems.

In addition to the mathematics task, teacher candidates were also provided various observation activities and protocols that focused on the question of the week. The university instructors designed the observation activities although Savannah periodically requested feedback from the partner teachers about the observation activities. For example, when the question of the week was “How can we use representations to help students make sense of mathematics?” the teacher candidates were instructed to focus their observation on the ways in which the students were using manipulatives to make sense of the mathematics they were learning that day. Other activities included an Interaction Tracker where the teacher candidates kept track of the amount, direction, and quality of interactions between students within their small group, and an assignment where the teacher candidates interviewed a student using high-pressure questioning techniques.

The partner teachers, Tanya and Wendy, experienced the planning and coordination of the activities of the MFE very differently. Tanya experienced the planning to be solely directed by Savannah, the lead university instructor. When asked about whether Tanya felt she was a part of the planning of the MFE activities, she responded:

She (Savannah) decided ahead of time what they (teacher candidates) were going to look for and what they were going to talk about. How it was going to run. We had no idea the first time what was going to happen. Well...maybe other people had an idea. I felt like I guess maybe the format was going to be about the same. (Savannah) would come around at the beginning (of the debrief) and lay down some questions and say these are the things we are looking at today or we want you guys to address. That would be the first that I had seen of those. And then she would open the meeting with this is what we are going to do and then we would like to hear from you guys (the PTs). (*Tanya, Interview 2*)

It was clear that Tanya, who was participating in the MFE for the first time, was not always clear about the focus of the debrief or the nature of the activities that would take place during the debrief. On the other hand, Wendy reported a somewhat different experience:

It has really been cool to have that dynamic (between Savannah and the partner teachers) because I just feel like we are all in this same – like we know where there are some problems, we know where there is improvement and we want to help make this a better experience - we want to help these teachers be better teachers or these teachers can be better teachers but – I think we all like learning from each other. Just the other day Savannah shot me an email and said “This is what we are thinking of doing in our MFE observation on Friday and I am going to fix it tomorrow. If you guys (partner teachers) have any suggestions – if you have time to look it over – do that. She has emailed me about Lab Gear, a couple questions. We are very much in this together...it seems like the communication is there and it’s not like she just shows up with the (teacher candidates) and facilitates the conversation. We are trying to be much more aware about how we do things and how we talk about things and the timing. They (teacher candidates) get to see manipulatives and participation quizzes and shuffle quizzes and what not – she is kind of like part of the team right now. (*Wendy, Interview 1*)

It is important to recognize that Wendy’s Interview 1 occurred after the first MFE debrief while Tanya’s comments came from Interview 2, which occurred after the last MFE debrief. I hypothesize that Wendy’s familiarity with the MFE, given this was her third time participating as a Partner Teacher, allowed Wendy a sense of comfort with the process of the MFE debrief. On the other hand, this was Tanya’s first experience with the MFE and it is likely she did not have a clear sense of what to expect.

During the second partner teacher interview, Wendy emphasized the importance of the MFE in relationship to her own growth as a teacher and to the learning potential of the teacher candidates. When asked what could be improved in terms of the MFE structure, she suggested that greater coherence between the focus of the MFE and what takes place in the Algebra 1 lesson would potentially improve the MFE.

I know we (partner teachers) never know what we are [going to] teach. I do feel like it could be maybe synced-up a little bit more, about what they (teacher candidates) are looking for - what their focus is for that day - and what we are actually teaching. And you know, you (university instructors) have your syllabus way a head of time, and we have no idea what [we are teaching] on those days. So it is a little bit unfortunate, I mean it could be matched up better. But you know it doesn’t seem like it is a bad thing. It just maybe could be improved a little bit more. (*Wendy, Interview 2*)

Drawing on the experiences of both Wendy and Tanya, although communication occurred between the partner teachers and Savannah, this was an area that both partner teachers felt could be more tightly coordinated by attempting to align the specifics of the classroom lesson to the Essential Question of the week in the methods course.

From Savannah's perspective, she believed she worked to incorporate the partner teachers' ideas and suggestions into the MFE across the seven-week experience. Although Savannah, along with the other teaching assistants Spencer and Sylvia, designed most of the activities in the MFE, the partner teachers were able to provide feedback and suggestions through email and in person. In one instance, the partner teachers requested that the university instructors talk with the teacher candidates about the teacher candidates' use of evaluative language when talking about the teachers' teaching practice. As a result, the instructors developed a sentence starter ("I noticed....and it made me wonder...") and they used this protocol, as did the partner teachers and the university instructors, during the debrief sessions. During the time frame of the MFE, Savannah was also conducting a separate research study in Wendy's classroom and met with Wendy periodically. During this time, Savannah often talked with Wendy about the MFE and received feedback from Wendy about particular ideas they might focus on during the debrief. Like Wendy, Savannah also lamented the lack of time and coordination between the partner teachers and the university instructors. When asked if she would do things differently if she were to teach the MFE again, Savannah responded:

If I did this again...I would like to actually meet with the teachers in person. When I was able to meet with Wendy, we could talk about [the MFE] and when we did, she and I were able to make some decisions about what would go on during the debrief. But high school teachers are so busy – it's just ridiculous so I don't know...In the perfect world, I think the university instructor would show up the period before the observation and meet with all of the teachers and talk about what they were all about to observe together. And then do the observation and then get feedback from them on the debrief. (*Savannah, Interview 2*)

Savannah and the other teaching assistants, with some input and feedback from the partner teachers, designed, planned and coordinated the MFE. Both of the partner teachers and Savannah agreed that the MFE would have perhaps been a richer experience had the teachers and the university instructors had more time to plan together.

Observation. Wendy and Tanya taught their Algebra 1 classes as they normally would if the teacher candidates had not been present to observe the lesson. That is, they did not structure their lesson any differently because of the MFE except to make sure they did not give their students any tests during the observations. The partner teachers did not feel that watching students take an exam would be worth the teacher candidates' time. During the observation, the two teaching assistants, Spencer and Silvia, were assigned to observe in the same partner teacher's classroom each week. Spencer was assigned to observe Wendy and Silvia observed Tanya. Savannah and I took turns switching between Tanya and Wendy's classroom each week.

During the observation of the lesson, the teacher candidates sat near a group of students but did not actually join the group of students. The students were seated in groups of three or four students and initially, the teacher candidates were instructed to not interact with the students. This was an agreed-upon arrangement between the university instructors and the partner teachers. From the university instructors' standpoint, the teacher candidates were in the classroom to closely observe how students were making sense of mathematical ideas *with their classmates*. The focus of the first quarter of methods was to observe what students could do in collaboration with other students – to see the authenticity of classroom life, for better or for worse. The university instructors felt that if the teacher candidates were able to freely interact

with the students, the students would no longer look to their group members for help in mathematical understanding but would instead begin to look to the candidate for help.

The partner teachers shared this concern. They had spent the school year teaching their students how to work equitably and cooperatively in their small groups with their peers and to see their peers as mathematical resources. The partner teachers felt that if the students were able to interact with the teacher candidates, the students would no longer see a need to work with their group members. The partner teachers were also concerned that the teacher candidates might not yet know how to direct questions back to the student groups and might unknowingly undermine the purpose of the students working together by explaining to the groups how to solve problems. For these reasons, the teacher candidates were asked to only introduce themselves to the students and the students were told by the partner teachers to participate in their groups as if the teacher candidates were not there.

The students in Wendy's classroom found this to be awkward at first. Wendy recalls how she helped her students come to understand why the teacher candidates were observing and the students' role as people who were teaching the teacher candidates how to become mathematics teachers:

S: How do you talk to your students about the Mediated Field Experience when the teacher candidates aren't there? How did you talk to about it to your kids about it this year, if at all.

Wendy: I don't think I did as good of a job in the beginning about talking to them. I guess after two days of having observers, I kind of opened it up (with my students). My kids were kind of freaking out, like "there are so many of them, and they just sit there and they stare at us. They don't say anything and they write stuff down, and we don't even know what to do or what they are thinking". And I was like "Oh my gosh you guys, you have no idea! They are learning from *you* guys. They don't know how students think about math. They don't know how to talk to students. They don't know how students talk about math. *You* are teaching them. You are like an example for them - teaching them how kids do this stuff and what makes sense to you at this point. And they are going to take that and apply that when they become teachers next year. They are taking notes so

that they can look at them and learn how to talk to their students and do math with their students.” So I really told them that these people aren’t evaluating them, or judging them, they are actually *learning* from them. I also tried to be like “You guys actually *talk* about math. You know, it is really hard to go to a classroom where kids are just working quietly on examples. You don’t know how kids are making sense of math and what is confusing and what’s not confusing. So the fact that you guys are *talking* about it, they really *really* want to be here and hear what you guys are saying, and how you make sense of it, and what to expect from students.” (*Wendy, Interview 2, emphasis is the speaker’s*)

This excerpt demonstrates how Wendy positioned her students as teacher educators as a way to both highlight their status as important participants in the work of teaching teachers and as a way to calm their anxiety of having so many adults in the classroom observing their every move. Wendy noted that this was very effective in calming their nerves and allowing the students to participate as they normally would if the observers not been in the classroom. Additionally, Wendy used the MFE observations, and the fact that the teacher candidates were learning from them by listening to them talk about their mathematical thinking, as a way to encouraged her students to talk about mathematics more openly while the teacher candidates were observing.

Another aspect of the observation was the activity or protocol the teacher candidates were instructed to use to guide their observations of the lessons. These observation protocols were designed around the Essential Question of the week in the methods course and the intention was to support the teacher candidates to focus their attention on specific aspects of classroom practice. For example, during the second MFE observation, the essential question was “What keeps students from learning math?” and the focus of the methods course was on the concept of status in the classroom and how students’ perceptions of competence impacted their opportunities to learn, especially during small groupwork. The teacher candidates had read research-based texts about status in groupwork and they discussed this concept in the university classroom before the MFE. To connect to this concept during the MFE, the teacher candidates were instructed to complete an “Interaction Tracker” during the classroom observation. This

assignment required the teacher candidates to track the verbal and non-verbal interactions within the small group as students worked on their group task and to consider how status, such as academic or social status (Cohen, 1994), might have impacted the interactions between students. This activity not only allowed the teacher candidates to focus on student-student interactions but they also noticed how the interactions changed or shifted as a result of particular teacher interventions in the groups. This dynamic is discussed further in Chapter 6.

For each MFE observation, the teacher candidates were provided with an observation protocol, which was either a set of questions that supported the Essential Question of the week or an activity in which the teacher candidates observed and collected data from the student's mathematical work, actions and/or interactions. These observation protocols were tools Savannah and the other Teaching Assistants designed to help the teacher candidates make connections between their work at the university and what they were observing in the Clark HS classrooms. The observation protocols provided a way for the teacher candidates to turn their attention toward a particular concept or practice, rather than the teacher candidates focusing on classroom management or practices in which they are more familiar (Erickson, 2011; Star, Lynch, & Perova, 2011). Because the observation protocols were used to focus teacher candidates' attention on a particular instructional practice or concept, this allowed Savannah to focus the debrief session around that same idea.

Debrief. Immediately following each observation, the teacher candidates, partner teachers, and university instructors gathered in Tanya's classroom to debrief the lesson. Although only two classroom teachers were observed, the other two teachers on the Algebra 1 Team, Vanessa and Zoe, participated in the debriefing. They too had taught a similar lesson

earlier in the day, jointly planned during the Collaborative Planning Period (CPP), and were able to share their experiences.

The desks in the classroom were moved into a large rectangle and the teacher candidates sat around the outside of the rectangle with the partner teachers in the front of the room. The university instructors sat amongst the teacher candidates. On one occasion, Savannah decided to split the debrief session into two groups – those who observed Tanya’s class and those who observed Wendy’s class. This was the only time the group was split. In all other debrief sessions, the participants all sat together.

Each debriefing session began with the partner teachers detailing their goals for that lesson, what they thought their students had learned, their evidence of student learning, and what more they thought their students needed to learn. This was an opportunity for the partner teachers to communicate why they made certain decisions in the classroom, their assessment of the lesson in terms of their students’ mathematical understanding, successes they noticed with student understanding and what they felt their students struggled with, and what they felt they personally struggled with. On a few occasions, this was a difficult conversation for the partner teachers because the lesson was not as successful as the partner teachers had hoped. However, the partner teachers talked openly about why they thought the lesson did not go as they had planned, usually citing their own assumptions about how students might respond or engage in a lesson. For example, upon reflection, a worksheet the partner teachers created in their Collaborative Planning Period was determined to be too cognitively demanding. In another example, the partner teachers decided that the directions on a task card were unclear, causing confusion for their students.

Following this, the teacher candidates were asked to share an observation they made during the lesson. Because the teacher candidates were provided with a focused observation protocol, their attention and thus observation they shared during the debrief, was related to the focus of the observation. For example, when the teacher candidates were asked to attend their observations to instructional moves teachers made during the lesson, the teacher candidates later shared specific teacher moves they observed Wendy and Tanya make during the lesson. The teacher candidates also asked the partner teachers questions about pedagogical decisions they made or questions about particular students and their histories as mathematics learners in that classroom. Sometimes Savannah asked that the partner teachers wait until all of the candidates shared their observation and questions before responding to the questions, and other times the debrief was less structured and a back-and-forth emerged as the candidates and partner teachers' interactions more closely resembled a conversation.

The debriefing session was held for approximately one hour with about half of that time allocated to the partner teachers unpacking the lesson for that day and the other half allocated to candidate observations or questions and partner teacher responses. Each debrief session was primarily facilitated by Savannah. Interestingly, Savannah rarely spoke during the debrief sessions except to give instructions or re-orient the conversation. Sometimes the university instructors, including Savannah, would offer their own perspective on the topic of discussion but this only happened on occasion. For example, during one of the debrief sessions, the teacher candidates were asked to share an observation and then pose a question to the partner teachers using a particular sentence-starter. Each candidate shared an observation and question in the form of "I noticed that the teacher/student I observed today _____ and it made me wonder

_____.” Then, each partner teacher shared an observation from their classroom and posed a question using this same protocol. After this, the three university instructors took a turn.

Although Savannah’s verbal participation in the debrief sessions was limited, it was clear she was facilitating the event. During each debrief session, she was the person who spoke first, most often by giving the participants instructions as to what activities would take place during the debrief, keeping track of time, indicating when and how each participant should take their turn sharing an observation, and informing the participants when time was up.

The majority of the debrief sessions were centered on the partner teachers, their experiences and interpretations of the lesson, and the candidate questions and observations. Because the debrief focused on how the partner teachers were making sense of the lesson they had just implemented and also focused on how the teacher candidates were making sense of the lesson they had just observed, the debrief became a space in which both teacher candidates and Partner Teachers were “generating knowledge”. The debrief session was a place for the teachers and the teacher candidates to interrogate the practices that took place during the lesson, to explore the relationship between practices and student understanding, and to connect this relationship to the larger social, political, and cultural issues taking place both at Clark HS and also within the framework of public schooling.

For example, during the second MFE debrief, Wendy explained how using manipulatives in her classroom to teach Algebra provided more of her students opportunities to participate in making sense of mathematics. The visual nature of the Lab Gear was a way many students could access the mathematical ideas, which then impacted how students perceived themselves and each other as competent. This practice opened up the mathematics lesson for students in ways that direct instruction or individual work could not provide.

[The] Lab Gear has really turned the status upside down in our groups because students that are really good with the manipulatives and hands-on and very visual will be the ones to figure out that rectangle. I mean this is a worksheet and I don't know how much you [teacher candidates] have talked about groupworthy tasks but there are things we do to make it a four-person job instead of a one-person job. And I think this lends itself to having more kids participate... (*Wendy, MFE debrief, 4.16*)

Wendy and the other partner teachers recognized that in order to learn mathematics, they needed to engage their students and increase the ways in which their students could participate in learning. Telling their students how to solve problems and giving them independent work was not going to support these students. Figuring out ways to get their students *to* the mathematics was the focus of their pedagogy and this focus was continually revealed in the debrief discussions with the teacher candidates.

This type of knowledge generation was most visible when the partner teachers discussed their own interpretation of the lesson and what they thought the students learned or didn't yet learn. The partner teachers modeled a particular way in which they interrogated their own practice by taking an inquiry stance (Cochran-Smith & Lytle, 2009) on what they taught and how they taught it. In this excerpt taken from an MFE debrief, the partner teachers had taught a lesson to their students but the students did not take up the ideas and struggled to recognize the patterns the teachers had hoped they would see. The partner teachers were visibly upset by the outcome of the lesson. During the debrief, Vanessa modeled how the partner teachers critically examined their teaching practice.

But I think what we recognized was that yesterday's lesson actually went a lot easier than we expected for most of us, right? And the students just sort of breezed right through these generic rectangles. We thought that the abstraction of going from actual pieces drawn to just these boxes where the space doesn't actually represent the size of the lab gear – we thought that was going to throw them and it didn't. So I guess that's where we thought the cognitive demand was higher than it really was. And then we thought that by using bigger coefficients, the little patterns they were looking at or noticing in the parenthesis, some of (the students) were starting to actually "FOIL" (use the distributive property) without using that terminology. We thought that by increasing the coefficients

that it would keep a high level of cognitive demand. [The room is so quiet! It seems uncomfortably quiet. The teachers are not happy with the way classes went today and it is obvious they are frustrated.] (*Vanessa, MFE debrief, 5.4*)

Vanessa pointed to the fact that the lesson from the previous day turned out to be less challenging than the partner teacher had anticipated but that the lesson from this observation was much more difficult for the students and the partner teachers did not anticipate that students would struggle. Notably, Vanessa's analysis of the lesson focused on the teachers' misguided anticipation of how students might engage in the activity and did not focus on what the students didn't understand or couldn't do. The work of teaching is often constructed as determining what students don't know and then "fixing" it. These teachers examined their practice by determining how they planned and enacted the lesson in ways that could be improved, rather than blaming the students' lack of prior skill development, their behavior in class, or their lack of motivation. During the debrief sessions, I often heard the partner teachers take responsibility for their students' learning. Rather than saying "the students don't understand..." they stated, "I am struggling to find ways to help these students understand" placing the onus on themselves and not their students. This shifting of responsibility was modeled through the partner teacher talk in the MFE debrief sessions.

Reflection. Following the MFE observation and debrief, the teacher candidates were required to submit a short reflection through an online blog site. This was due the same evening of the observation. Interns were instructed to write their reflections based what they observed during the MFE and to relate their comments to the question of the week in the syllabus. They were also encouraged to draw on the texts they had read that week in the methods course or previously in any of their courses. The reflections served as a venue for connecting what the

teacher candidates were learning through their university coursework and their experiences in the Clark HS classrooms.

It is important to note that the partner teachers did not have access to these reflections and that Savannah did not share specific teacher candidate reflections with the partner teachers. Savannah wanted to create a space where the teacher candidate could be candid and honest about how they were making sense of their experiences in the Clark HS classrooms and during the debrief. Savannah used the post-MFE reflections as a formative assessment, attending to what the teacher candidates understood, misconceptions they had, ideas they were struggling with, and questions they asked. She and the other two teaching assistants, Spencer and Silvia, read the reflections and sometimes made comments on the posts. Other times, they would take the teacher candidates reflections into consideration when planning the next university methods class. Sometimes Savannah would also discuss, with the partner teachers, particular struggles the teacher candidates revealed through their reflections. In one particular example, Savannah and the other two TAs noticed how the teacher candidates were using evaluative language when they discussed the partner teacher's practice, both during the MFE debrief and on the post-MFE reflections. Savannah, Spencer, and Silvia felt this was problematic and, after discussing this issue with the partner teachers who had also noticed the use of evaluative language, together decided to implement a sentence prompt for the observation statements during the rest of the MFE debriefs.

The reflections served as a rich data set for examining the ways in which the teacher candidates were making these connections. Often times the teacher candidates drew on experiences they observed in the Clark HS classrooms and used these experiences to make sense

of something they were learning in their university courses. For example, one of the teacher candidates, Mei wrote the following reflection after the third MFE observation:

I learned a lot from Tanya on how to facilitate the students to get the correct answer. When some kids were confused about the relationship between rectangle and square, she did not directly tell the students if they were right or wrong. Instead, she tried to assist students to clarify the definition of the rectangle. I think this procedure was totally making sense to the students. I noticed that she came to the table many times to ask how the students feel about the work, which was a nice way to motivate students. This reminds me about (Geneva) Gay's idea that "Caring prompts effort and achievement."
(Mei, MFE reflection #3)

For Mei, observing how Tanya facilitated students working in groups connected to Gay's (2000) conception of a "caring" teacher, something the teacher candidates were learning about in one of their other courses. In another example, one of the teacher candidates, Hannah, decided to comment on her observation of three boys who were talkative and "had lots of energy":

I noticed that the students talked almost non-stop during the groupwork session. Their discourse switched seamlessly and rapidly between math talk and social talk – even some quiet singing/chanting. I was using the task, social/personal, and behavior identifiers we discussed in our Adolescent Development class to track interactions. After a few minutes, I noticed that the boys continued to make steady progress on their worksheet even as they bantered back and forth. Math talk seemed to break out whenever one of the students had a question or was stuck on the problem. Then other group members would explain their solution or offer suggestions. Just as quickly, the conversation returned to non-math related topics. This pattern repeated continuously. At the end of the hour, the group had stayed together and completed the front of the worksheet. During the Teacher Checkout, each boy was able to successfully explain his reasoning in problem #3. This made me wonder about the way I code student discourse. I was reminded of Boaler's (1994) remarks about off-task talk in Phoenix Park classrooms and Gay's (2000) discussion of culturally appropriate norms. I wonder if I need to adjust my interpretation of on-task, off-task discourse for this group of students. I wonder if my biases about "appropriate" student behavior limit my ability to recognize all the times when students are doing math. *(Hannah, Reflection #6)*

In this example, Hannah drew on a concept she had learned in her Adolescent Development class to collect information about student engagement and interactions in relationship to the task.

Collecting this type of data was not required of teacher candidates during the observation;

Hannah decided to do this on her own. She took a concept from one of her other courses and

applied it in the MFE to help her understand what she was observing. Additionally she drew on a reading from her mathematics methods course (Boaler, 1994) and a reading from a foundations course (Gay, 2000) to connect her observation to her university coursework.

The debrief postings also served as a formative assessment tool for Savannah and the university instructors. The teacher candidates used the online reflections to pose questions about things they observed in the Clark HS classrooms that confused them or they didn't totally agree with. Savannah used the candidate reflections to determine what the teacher candidates were noticing, how the teacher candidates were interpreting and making sense of their experiences at Clark HS and how the teacher candidates were relating those experiences to the concepts of the methods course. Often times Savannah would use these reflections to plan the next on-campus methods course. In one instance Savannah noticed that many of the teacher candidates were questioning the partner teachers' use of the manipulative Lab Gear, determining that students were too dependent on the Lab Gear and were continually wondering when the partner teachers would take it from the students. Savannah posted an additional prompt that asked the teacher candidates to discuss the limitations and affordances of manipulatives in the mathematics classroom and she later took up this conversation in the methods course at the university.

Connecting Experiences at Clark to Learning Moments at the University

The debrief postings served as one space where visible connections were made between university coursework and the Clark HS field experience. The teacher candidates also made these connections during the MFE debrief and during the methods classes and other classes held at the university. They discussed how they were able to make these connections at length during the individual and group interviews. Many of the teacher candidates repeatedly stated that

observing at Clark helped them make sense of what they were learning in their methods course and in their other courses, and they were able to provide multiple examples.

Connecting through teaching practices. In the following excerpt taken from the group interview, I was interested in finding out what it meant to the teacher candidates to have the partner teacher available to field questions and to provide situated knowledge about the specific students, their histories, and what the teachers knew about the students academically, personally and socially. During this discussion, several teacher candidates made connections between their university coursework and their observations at Clark. This next excerpt shows how two teacher candidates, Anya and David, observed Wendy draw on students' funds of knowledge to engage them in learning mathematics.

Anya: It relates back to our Foundations of Teaching class. We are talking about funds of knowledge and we are really seeing that in our teachers (at Clark HS). In practice, how they are using funds of knowledge in *so* many ways. Seeing how they can use relationships to give students an opportunity to succeed.

S: Can you give an example, anyone?

David: Last week Wendy was talking about how she made a competition between groups and she wouldn't normally do that. But because she knew those particular students, she knew that was an effective way to get them involved.

From these comments, it is clear that the teacher candidates were using the field experiences to make sense of concepts in their university courses such as funds of knowledge. Concepts such as funds of knowledge are potentially more abstract for teacher candidates because they are often learned in the university context absent of any students. David was able to connect Wendy's knowledge about her students and how they might respond to competition in ways that increased their engagement in learning mathematics. David recognized this as funds of knowledge when, during the debrief, he asked Wendy about her decision to whisper a hint to half of the group but not the other and what she knew about her students that enabled her to

make that decision. Wendy explained that while she thought that “ typically competition doesn’t have a place in a collaborative learning classroom”, she knew that those particular students would respond positively if she instilled some competitiveness into their groupwork. The four-part cycle of the MFE provided David and Anya an opportunity to learn a concept in their university course, observe the concept in practice, gain access to how the partner teacher made the decision to draw on students’ funds of knowledge, and then reflect on this practice in preparation for the next university class.

Connecting through students. Another significant aspect of the four-part cycle of the MFE was the fact that the teacher candidates were able to observe the same students across multiple weeks. The MFE was held over the course of six weeks (see appendix A for the exact timeline). In all, the teacher candidates visited the Clark High School mathematics classrooms seven times in a six-week period²⁶. Continuing this cycle over the six week time period allowed the teacher candidates to observe an entire unit on quadratic functions and how it unfolded over time. The teacher candidates were able to observe how the unit was launched, how the teachers gradually supported the students’ conceptual understanding of quadratic functions, and how student understanding grew over time.

In the beginning of the quarter, the teacher candidates tended to make broad generalizations about students based on the lesson they observed. For example, during the first MFE debrief, the partner teachers had to attend a staff meeting for the first twenty minutes of the debrief so Savannah asked the teacher candidates to share their observations in small groups.

Mei made this comment to her peers during the small group sharing:

But the kids in my group, they tend to – they are not going to think about it by themselves. When the teacher came to the table and they asked for help, after the teacher

²⁶ Three of the debrief sessions occurred during the teacher candidates’ 2-week field experience. During this time, there were no university courses held on campus but the teacher candidates continued meeting at Clark High School.

explained it, they can follow the teacher's steps to do it—they just can't figure it out by themselves. (*Mei, 4.6*)

Comments about the students in general, based on the teacher candidate's observations of a small group of students, were often made during the first few debrief sessions. However, because the teacher candidates were able to see the same students across multiple lessons, and because the teacher candidates were able to listen to how the teacher planned the lesson and made particular pedagogical decisions during the lesson, the candidates were less likely to make broad generalizations about student participation, engagement, and understanding toward the end of the quarter. For example, although an candidate might make a generalization about a particular student, when the candidate returned the following week, that generalization was often challenged because the student was either sitting with a new group of students, had learned something important since the last observation, or the student was simply having a different kind of day.

In one particular example, one of the teacher candidates, Emma, had observed a group of four students, two girls and two boys. Emma noted in her first reflection that the two girls “seemed more interested in touching up their makeup than doing the assignment” and that “the majority of learning seemed to be in a social capacity rather than in math content.” However, after the next observation, in which Emma observed the same group but with one of the girls absent, Emma wrote the following reflection:

While tracking the interactions of the students I was impressed with the number of moments where in the middle of a non-school conversation one student in particular, Felicity, would chime in with a math-related question. This was not always immediately answered but I did find it interesting that she would interrupt the conversation to state that she had a question. This was a bit different from what occurred in the previous week. Part of this seemed to be from the fact that last week there was one more girl in their group who Felicity talked with about non-school issues, where as this week, that student was absent, allowing her (Felicity) more time to learn math rather than socialize. Thus by not having a person to talk to off-task, she was able to focus better on the problems and

ask for help when needed. I wonder if this is a status issue and if, when the other student is present, Felicity is pressured to be off task. (*Emma, reflection #2*)

In the first observation, Emma questioned the mathematical learning of the group because of the amount of social and “off-task” talk that was taking place. However, during the next observation of the same group, Emma noticed how Felicity’s engagement changed when the other female student was not in the group. This is significant because often times, teacher candidates will make generalizations about students’ engagement (or lack of) and mathematics knowledge (or lack of) based on a single observation. This is also true when videos are used in university courses. When the teacher candidates are not able to see how students respond when their group members change or when the mathematics content changes (some students might struggle with computation but excel when asked to solve problems in a context) the teacher candidates may make inappropriate generalizations. The teacher candidates in this study may have formed particular ideas about students’ engagement or mathematical understanding based on single observations but often times the teacher candidates would be forced to revise those generalizations because they observed something in their subsequent observations that conflicted with the original generalization. Observing the lesson, debriefing the lesson and then reflecting on the lesson, as well as following the same students over time, allowed the teacher candidates to continually reshape their understanding of what and how the Clark HS students were learning.

The cycle of holding the methods class at the university, observing a mathematics classroom with a particular focus, and then debriefing the observation with classroom teachers provided a way for the teacher candidates to connect their university coursework experiences to their experiences in an Algebra 1 classroom where teachers implemented equity-oriented instruction. Because the teaching practices of the partner teachers were aligned to the practices that were the focus of the methods course, and because the teacher candidates were able to

follow students across time, the teacher candidates were able to access academic knowledge in the university context and practitioner knowledge in the field. This allowed the teacher candidates to move between learning contexts in a more coherent way. The teacher candidates were able to take what they learned in the university context and use it to make reasoned observations in the field. Likewise, the teacher candidates were able to take their observations in the Clark HS classroom and use those experiences to make sense of abstract ideas in the university classroom.

Shifting the role of the Partner Teachers: Partner Teacher as Teacher Educator

The structures and activities of the Mediated Field Experience dramatically shifted the role of the partner teachers at Clark HS. The four structural elements of the MFE - planning, observation, debrief, and reflection - positioned the partner teachers in a way that shifted their traditional roles from mentor/cooperating teachers to teacher educators. This shift in role created opportunities for the teacher candidates to draw on partner teacher knowledge in significant ways.

The “acquire-apply” theory of teacher education (Korthagen & Kessels, 1999), which currently seems to dominate university-based teacher education, marginalizes partner teacher knowledge while valorizing university knowledge. In typical field experiences, the classroom teacher is expected to provide a space for the candidate to “apply” what they “acquired” in the university. It may be the case that the field experience is seen as a place to demonstrate what was learned in the university rather than a place where teacher candidates can learn ways to teach. Rarely are practicing teachers positioned as people who can contribute to an candidate’s academic, or theoretical, knowledge.

The teachers in this study were asked to participate in the MFE because their pedagogy closely aligned with the practices taught in the methods course and because they were willing to make their practice visible to new teachers. These three partner teachers had extensive knowledge of the goals, activities, and language of the course; they had read much of the same research literature as the teacher candidates and had engaged in many of the same activities. Having participated in earlier versions of a MFE, either as an candidate or as a partner teacher or both, provided Wendy, Zoe, and Vanessa a vision for how they interpreted the goals and purpose of the MFE. This determined how they would participate and plan for the MFE. When asked what she knew about the goals of the TEP and more specifically, the methods course, Wendy replied:

I think I know a lot about it (methods course) because I went through it. I can picture them in the room doing math and talking about status and reading Jo Boaler and all those kinds of things. I definitely have faith that the things they see in this (my) classroom will come up in their (university) classroom and they will have time to read the theory behind it and see it in action and talk about the “why” of it – more so than just at our debrief... So I have a good idea of where the TEP is coming from and where they are going and the research that pushes them that way. And in turn, I feel safer sharing my classroom because I know that you guys will talk about why sitting in a group is better than sitting in a row and why having kids doing it is better than having them listening – I don’t have to justify all that stuff with research and with theory – you guys will get to that. (*Wendy, Interview 1*)

Wendy saw herself as someone who had a deep understanding of the goals the TEP had for its teacher candidates because she had recently graduated from the same program. This created a sense of “safety” for Wendy because she knew that her pedagogy aligned with what was being taught at the university. She knew that she was not the only person responsible for helping the teacher candidates understand why she was implementing particular teaching practices. If the teacher candidates questioned her practices Wendy felt confident the university instructors would

corroborate her practices back at the university by analyzing how those practices enhance student learning using research to support that analysis.

In addition to having been a recent graduate of the TEP, Wendy was also an candidate in the first cohort to participate in the Mediated Field Experience and observed in Vanessa's classroom when she was in her first year of teaching. Wendy remembered the observations and debriefs as a place for her and her peers to explore the relationship between teaching and learning mathematics. She recalls learning, through the MFE in Vanessa's classroom, that teaching is not prescribed or formulaic but something that is "such a personal activity and people handle things in different ways" (Wendy, Interview 1). Wendy saw the MFE as a way to support new teachers in seeing that teaching was not about having all the answers but instead, gaining effective tools for teaching, trying different practices and seeing what works for different students. For Wendy, teaching was a puzzle to figure out.

... school (TEP) is not a recipe for how you teach. It is some theories and some ideas of what people think should happen. But it's not formulaic and you can't tell the 60 kids (candidates) in your cohort what they should do to be great teachers... (As a result of my experience in the MFE) I think I was more accepting of the reality... where I think other people got frustrated and had all these emotions about "Why didn't she prepare me?" or "Why isn't this TEP teaching me to be a teacher?" You know? They are giving me ideas but they are not answering "How do I help *every* ELL student?" You know? And the reality is – that's not formulaic. People don't have that figured out yet. So I think we (the math cohort who participated in the first MFE) were just accepting of it and willing to go on and try things as opposed to 'I need to do this, this, and this to be a great teacher'.

(Wendy, Interview 1)

Wendy saw her own experience as an candidate in the MFE as a way to come to understand teaching as relational work (Grossman, et al., 2005) where different practices work successfully with different students depending on several factors including the student, the teacher, and the context.

In addition to graduating from the same TEP and participating in a MFE model when she was an candidate, Wendy had also partnered with the TEP and mathematics methods class for the past three years as one of the partner teachers for the Mediated Field Experience. At the time of this study, this was her fourth consecutive year as a Partner Teacher. When asked to reflect on her overall experience as an candidate and then as a Partner Teacher, she described the function of the MFE in the following way:

The purpose is to get the teachers (candidates) more of a realistic view of math classrooms, or high school math classrooms. It's so different just to read about something than to see what the daily struggles are, and see what different personalities bring with the teachers and the students. So it is such an opportunity for them to see what the stuff looks like. And see all those little details that matter about running class and doing group work and working with math and working with kids, and kids working with kids and all that stuff... they get to see specific things. They don't get to see all of it, but they hopefully get to see a lot with their time in the classroom and then ask... "Were you aware of this, how'd you deal with this, what leads up to this, what do you do now, etc.?" That is just irreplaceable. You don't read articles about daily stuff. (*Wendy, Interview 2*)

In this quote, Wendy alludes to the idea that teacher candidates can learn about specific practices in a university setting but the candidate must then be able to take those practices and adapt them to a different context with students who will respond to the practices in different ways. Practices must also be coordinated with other practices such as using high press questioning in a groupwork classroom. Wendy saw the MFE as a place for teacher candidates to notice and pay attention to how practices learned in the university get taken into real classrooms and how those practices are coordinated with other classroom factors such as the participation structure (groupwork) or the content. She saw the MFE as a way for the teacher candidates to investigate the results of those practices with support from the classroom teacher.

Unlike Wendy, Tanya had not attended this TEP. She was an experienced teacher, in her 18th year of teaching, and was in her fourth year of teaching at Clark HS. When Tanya was hired, several of the Clark HS mathematics teachers had committed to implementing Complex

Instruction in their classrooms. The year this study took place was Tanya's first year on the Algebra 1 Collaborative Planning Team. This was also the first year Tanya committed to implementing Complex Instruction in her classroom.

Although Tanya did not have the same experience with the TEP as Wendy or the other two Partner Teachers, she nonetheless shared a similar knowledge base, although perhaps not as extensive. Tanya had recently participated in an extended professional development opportunity that focused on implementing Complex Instruction in mathematics classrooms – a major focus of the methods course. This professional development included reading some of the same research studies and books as the teacher candidates read in their methods course. It also focused on implementing many of the same practices taught in the methods course.

Additionally, Tanya had hosted a student teacher from the same TEP during the six months prior to the beginning of the MFE. The experience of hosting a student teacher allowed Tanya to gain knowledge regarding the practices and dispositions the TEP encouraged. When asked to name some of the goals of the methods course, she explained, "...some of this is based on having a recent student teacher from that program..." (Tanya, Interview 1). For Tanya, hosting an candidate meant learning how the program would assess the candidate. During the student teaching experience teacher candidates are expected to implement practices learned in the TEP and they are expected to be able to analyze the impact of those practices on student learning. This occurs through a final project the candidate must complete in order to graduate. As a cooperating teacher, Tanya supported her student teacher through the final project and this provided Tanya information about what the TEP expected from the teacher candidates.

Tanya's experience as a cooperating teacher combined with her recent professional development in Complex Instruction gave her a particular knowledge about the goals and

promoted practices of the TEP and, specifically, the mathematics methods course. This was Tanya's first experience as a partner teacher for the MFE so, unlike Wendy, she was not able to draw on past experience with the MFE.

Although Zoe and Vanessa were not observed, they both participated in the debrief portion of the MFE. They too had a particular knowledge about the goals of the TEP and practices promoted in the methods course. Vanessa, as mentioned earlier, was one of the first teachers to host the MFE during her first year of teaching. She was also a graduate of the TEP and had hosted two student teachers through the TEP. At the time of this study, Zoe was in her first year of teaching and had graduated from the same TEP the previous year. Zoe had participated in the MFE as an candidate and was placed in Wendy's classroom for her observation.

Table 5.1

Overview of Partner Teachers' experiences with the TEP and Complex Instruction (CI)

Partner Teacher (PT)	Graduated from the TEP (years prior to study)	# of years of Professional Development in CI	Hosted student teacher	Participated in the MFE as candidate	Previously participated as PT in the MFE
Zoe	1 year	2 years	no	yes	no
Vanessa	5 years	5 years	Yes - 2	no	yes
Tanya	No	1 year	Yes - 1	no	no
Wendy	4 years	4 years	Yes - 2	yes	yes

The fact that all four of the partner teachers had a particular understanding of the concepts and practices the teacher candidates were experiencing in the TEP, and in the methods course, allowed the partner teachers to engage in the Mediated Field Experience in a fundamentally different way compared to traditional field experiences (see Table 5.1 for an overview of the partner teachers' experiences with the TEP).

Rather than being viewed as a place where teacher candidates can apply the knowledge and practices they gained from the university, the MFE was a field experience in which the teacher candidates could investigate and explore the relationship between what they were learning in their coursework and what they observed during the MFE. The partner teachers co-instructed the methods course with the university instructors and were therefore positioned as teacher educators in the MFE. In order to demonstrate how the partner teachers were positioned as teacher educators, I describe the structures within the MFE that contributed to the sharing of the responsibility of educating the teacher candidates.

Planning and observation. During the MFE, the partner teachers demonstrated a shared responsibility for the education of the teacher candidates. This responsibility was developed and negotiated over time. The partner teachers, especially Wendy and Tanya, communicated a sense of responsibility through the ways in which they planned for the MFE.

As mentioned previously, the four partner teachers were involved in a Common Planning Period where they met most days of the week to share their experiences teaching the Algebra 1 class, check in with each other about how things were progressing in their classrooms, and plan activities and lessons. During the six-week period of the MFE, the partner teachers' planning took into consideration that the teacher candidates would observe some lessons. The partner teachers were committed to providing the teacher candidates both a realistic classroom environment and an opportunity to observe a few key practices, especially those practiced the partner teacher knew the teacher candidates would learn about in the methods course or in their TEP. When asked how the partner teachers planned for their lessons, knowing the teacher candidates would be observing, Wendy responded:

I mean it didn't really change like what we were going to teach, but there were a few times, when it was like, "Well we will do a participation quiz on this. Oh yeah, the

(candidates) are here tomorrow, it would be great for them to see the participation quiz. We should actually do it tomorrow instead of over the block period.” We did try to kind of expose some of our methodologies, so that they could see a shuffle quiz, or participation quiz. I mean we talked about having students present problems and stuff like that. Without altering what we had set out...for that week, we included maybe some teacher strategies, some different moves, just to let them know some of the divergent tools that we use...But this year I was not as contrived about it, you know, just kind of was like “It is what it is, they want to see the reality so here we go.” (*Wendy, Interview 2*)

Although the partner teachers did not alter the mathematical content they planned to teach the students on the MFE observation days, they did at times alter the activities they planned to implement. In the excerpt above, Wendy communicated the notion that the partner teachers wanted the candidates to see particular practices in action and would plan particular practices around the observation days. However, the partner teachers also wanted the candidates to see “reality”.

Although the partner teachers did not change the sequence of the mathematical content they had planned to teach their students, they did discuss their teaching practices and made decisions regarding which practices to highlight during the MFE observation. The partner teachers wanted to show the teacher candidates how particular practices, such as a shuffle quiz, worked in their classrooms and what that particular practice did for student learning and student engagement in their learning. The partner teachers saw it as part of their work to model pedagogies that were “divergent” and because they altered their lessons in a way that would allow the teacher candidates to observe some of these pedagogies, they took on the responsibility of “teaching” the teacher candidates.

The partner teachers did not consult with Savannah about which pedagogies they would model – nor did Savannah request to have input into which practices they would model. The partner teachers decided this amongst themselves and then emailed Savannah to let her know about the activity for the observation.

During their Collaborative Planning Period, the partner teachers planned as a team to discuss how they might (1) continue teaching the mathematical content their students need to learn (2) in a way that would meet the needs of their students and (3) also showcase particular practices for the teacher candidates. The partner teachers planned with the best interests of both their own students and the teacher candidates in mind. This was possible because the partner teachers' pedagogy closely aligned with the pedagogy the teacher candidates were learning in their methods course, and in their TEP.

Observation and debrief. In the most direct sense, the partner teachers were positioned as teacher educators through the observation and debrief structure of the MFE. These teachers partnered with the university instructors to teach a portion of the methods course – the MFE. Simultaneously teaching their high school students mathematics, while also sharing their own understanding of the lesson and the teacher moves that were made during the lesson, served to teach the teacher candidates about effective practices and strategies in a mathematics classroom. The knowledge and practices of these four partner teachers was prominently featured during the observation and debrief sessions of the MFE.

The university instructors also saw the partner teachers as co-instructors of the methods course. This was demonstrated in the way the debrief was structured, particularly in the sequence of events that typically took place following the observation. Additionally, the activities that took place during the MFE, such as how the teacher candidates were instructed to pay attention to the partner teachers' classroom practice or how they were instructed to interact with students, also positioned the teachers as teacher educators.

The observation protocols were one particular structure of the MFE that positioned the partner teachers as teacher educators. The protocols focused the teacher candidates' attention

toward a specific pedagogy or toward a set of teaching practices, which related to the work the teacher candidates had done in the university. For example, during the 3rd MFE, the question of the week was *What kinds of activities help students make sense of mathematics?* The teacher candidates had read articles about groupworthy tasks (Lotan, 2003) and maintaining the cognitive demand of tasks (Henningsen & Stein, 1997) and had examined different types of tasks for their groupworthiness and their cognitive demand. During the MFE, the teacher candidates were directed to focus their attention on “activities that help students understand mathematics, cognitive demand and groupworthiness. Focus on the task itself and how the teacher sets it up, and how the students engage in the task.” (*MFE debrief observation protocol, 4.27*). The observation protocol required that the teacher candidates pay attention to the ways in which the partner teachers designed and launched the task and the ways in which the partner teacher maintained the cognitive demand during the lesson. This placed the partner teachers and their practices and interactions with students at the center of the observation, indicating the teacher candidates needed to learn something by attending to these teachers’ practices and interactions.

They way Savannah structured the debrief sessions also positioned the partner teachers as teacher educators. First, the partner teachers always sat together in the front of the room while Savannah and the other university instructors sat amongst the teacher candidates. This seating arrangement drew the attention of all participants to the partner teachers. Second, the debrief was structured so that the partner teachers began each debrief by stating their goals for the lesson, what they thought their students understood about the mathematics, and what more they thought their students needed to learn. By speaking first, the partner teachers’ knowledge, decisions, and interpretation of the classroom observation was positioned above that of the university instructors. It was clear that the partner teachers were the experts of their own

teaching practice, knowledge of students, and beliefs about learning and had important knowledge to share. Third, the teacher candidates were required to make observations and pose questions during the debrief. These questions were always directed toward the partner teachers and the dialogue in the MFE debrief sessions was most often between the partner teachers and the teacher candidates, with the university instructors occasionally making a statement or asking a question. Although Savannah facilitated the debrief sessions by indicating the activities that would take place during the debrief, the structure of the debrief sessions demonstrated that the partner teachers were positioned as those with important authority and knowledge on teaching mathematics.

Although the partner teachers set out to model particular practices for the candidates during the classroom observation, the teachers did not consider themselves “expert” mathematics teachers. During the initial interviews, both of the MFE teachers, Tanya and Wendy, made statements in which they positioned themselves as learners within the MFE partnership. Wendy noted how her role in the MFE was not just about opening up her classroom for others to learn from her but that she was a co-learner with her colleagues:

I am definitely willing to give back and to help that process (of teacher learning). I by no means feel like I am an expert but my classroom is not like a sacred – it IS a sacred place for me but it’s not like - I don’t check everyone at the door. You can come in and watch. I think it is very beneficial to be in the classroom and to talk with the teachers and talk with students – I am really open to that process. (*Wendy, Interview 1*)

The partner teachers’ understanding of their role in the MFE was to model practices and be available to discuss how and why they decided to implement particular practices, the goal of the practices, how they thought students responded, and what students learned. The partner teachers did not enter the MFE with a mindset that they “had it all figured out.” In fact, during the first

MFE debrief, Tanya made it a point to let everyone know she was learning right along with the teacher candidates:

I think it's important for you to know, this is my first year making a commitment to Complex Instruction, or making a commitment to trying to learn how to even think about maybe doing a part of Complex Instruction (everyone laughs). And so I try a few things rather than 20 things because I can only remember a few. (*Tanya, 4.6 MFE debrief*)

Tanya acknowledged that she was still learning and was willing to engage in conversations with new teachers about the classroom practices she was trying to implement. Wendy expressed a similar viewpoint during her first interview:

I'm willing to share my experiences and share my ideas...But I think more than anything I am someone willing to talk about it and willing to admit what is not figured out and what is figured out – it's sort of like an internship for them or a rotation or whatever doctors do – it's just a place to get field experience and I am willing to have those conversations and let them in...I mean, I guess in some ways I am a mentor ...I am someone who is doing it and talking about in ways they are learning about it. So I don't know if...I am a real life example of some of the things they are reading about. (*Wendy, Interview 1*)

Although the partner teachers did not consider themselves expert teachers, they acknowledged that they could share what they understood about teaching and learning mathematics. They saw themselves as models for how the teacher candidates might one day teach but they also saw themselves as continuing to learn, or generate knowledge about how to effectively teach mathematics to their students.

The teacher candidates also saw the partner teachers as teacher educators. During the reflections and individual and group interviews, the teacher candidates often described how they could see the partner teachers enact particular teaching practices such as asking high-pressure questions or assigning competence. When the teacher candidates made connections to their coursework, it was often by calling up a specific event they observed in one of the partner teachers' classrooms or recalling something one of the partner teachers said during the debrief. This occurred multiple times in the post-MFE reflections. The partner teachers' classroom

practices, students, and knowledge of teaching mathematics became a resource for the teacher candidates as they learned how to teach mathematics to secondary students.

Discussion

In this chapter, I described how the structure of the MFE, namely the four-part cycle of planning, observing, debriefing, and reflecting provided the teacher candidates opportunities to make connections between their university coursework and their field experience at Clark HS. These connections were made, in part, by observing in partner teachers' classrooms in which equity-oriented mathematics teaching practices were implemented and by debriefing with these same teachers who were simultaneously working to improve their own instruction. The four-part cycle, and the activities that took place within each cycle, provided the teacher candidates opportunities to engage in generating local knowledge (Cochran-Smith & Lytle, 2009) by accessing the situated and contextualized knowledge of the partner teachers as they engaged in a critical examination of teaching practice geared toward increasing student participation. Unlike traditional field experiences in which mentor teachers are not typically positioned as teacher educators, the structures and activities of the MFE allowed the teacher candidates to draw on academic and practitioner knowledge through their observations and interactions with the Clark HS partner teachers.

In the next chapter, I begin to take a closer look at what the teacher candidates noticed during the MFE observations and how the partner teachers' practices and the observation protocols provided the teacher candidates opportunities to notice "invisible" aspects of classroom practice important to teaching for equity.

Chapter 6

Learning to Notice the Invisible Aspects of Teaching Practice

Teacher candidates spend a great deal of time observing classroom practice by watching video in university courses and participating in field experiences. It is assumed that teacher candidates are learning from the time they spend observing. However, they may not attend to or notice what teacher educators intend for them to notice. Often times, teacher candidates observe what happens in the classroom through their own lenses, which may be based in their own schooling experience (Kennedy, 1999). In addition, much of the work of teaching is “invisible” (Lewis, 2007), even to the more experienced eye. When teacher candidates are asked to observe classroom practice without knowing how to attend to the important, and often invisible aspects of practice, a critical examination of practice and opportunities to learn may be limited.

Those who study teacher noticing argue that in order for teacher candidates to be able to make decisions about important aspects of practice, they must learn to notice these aspects of practice (Mason, 2011; Miller, 2011; van Es & Sherin, 2008). These same researchers also use the term “noticing” in different ways. Mason (2011) defines noticing as a collection of practices, which allow a teacher to *respond* rather than *react*. He says that noticing allows the teacher to recognize moments in which they might respond “freshly” rather than out of habit. van Es and Sherin (2008), who have examined teacher noticing through video of classroom practice, define noticing as having three components:

- a) identifying what is important or noteworthy about a classroom situation;
- b) making connections between the specifics of classroom interaction and the broader principles of teaching and learning they represent; and
- c) using what one knows about the context to reason about classroom events. (p. 573)

van Es and Sherin take noticing as the act of being able to see a particular aspect of classroom practice, connect the event to ideas of teaching and learning, and then use that connection to reason about and interpret the event in ways that may support further action. For van Es and Sherin, noticing is much more than simply taking note of an event in a classroom.

Miller (2011), who wrote about the nature of noticing, contends that noticing is a shifting of attention, and that in teacher education, novices are most often provided opportunities to take on an observer perspective in noticing rather than a teacher perspective. This most often happens through watching video of classroom practice in university courses. He argues that the observer and teacher perspectives are fundamentally different when it comes to novice teacher learning and that the observer perspective differs greatly from what teacher candidates would see when they themselves teach. He calls for more complex ways of teaching novices how to notice through a perspective that doesn't always focus on the teacher but brings the students into view.

Research on teacher noticing has shown teachers' abilities to notice particular aspects of classroom activities are related to teachers' experiences in the classroom. Berliner and colleagues (Berliner, 1988; Carter, Cushing, Sabers, Stein, & Berliner, 1988) found that more experienced teachers were able to notice both teacher and student actions while inexperienced teachers tended to focus on only the teacher's action and viewed the lesson as a sequence of disconnected events. In another study that compared what experienced and novice teachers noticed in video of classroom practice, researchers found that teacher candidates tended to focus on classroom management aspects of classroom activities and did not tend to focus on aspects such as content, the classroom environment, or classroom communication between students and between students and the teacher (Star & Strickland, 2008). If we know that teacher candidates most often attend to surface features of practice while observing classroom lessons, how can we support them in

learning to focus on the more important, and less familiar, aspects of classroom practice such as student engagement and participation and teacher moves that increase engagement and participation for students?

This chapter describes how the MFE supported teacher candidates in noticing particular aspects of classroom activity that went beyond attending to surface features such as classroom management. I first describe what the teacher candidates noticed by drawing on and expanding the Classroom Interaction triangle (Hawkins, 1974; Lampert, 2001), which relates teacher, student, and content (see Figure 6.1). I then describe the particular structures of the MFE that allowed the teacher candidates to learn to “professionally notice” classroom events, particularly classroom events that attended to student engagement and participation in mathematics.

Drawing on van Es and Sherin’s (2002) components of professional noticing, I conceptualize the MFE as an opportunity in teacher education to teach candidates how to

- attend to and identify important equity-oriented aspects of a classroom lesson (component a);
- make connections between the specific classroom events and broader principles of teaching and learning mathematics (component b); and
- use what they know about the Clark HS classroom contexts, theories of learning, and notions of equity to reason and make sense of the classroom events (component c).

In order to understand what the candidates noticed during the MFE and how their ability to notice developed over time, it is important to begin with a framework for what could possibly be noticed in a classroom.

A Model for Analyzing Teacher Noticing

Classroom teaching practice has been conceptualized as the ways in which teachers, students, and content interact to produce learning (Kilpatrick, Swafford, & Findell, 2001). Within this conceptualization, the work of teaching involves continually solving “problems of practice” (Lampert, 2001). Teachers have the charge of addressing these problems of practice on a daily basis, some of which include: planning lessons, working with students individually or in small groups, motivating students, establishing norms or ways of behaving, communicating with students’ families, attending to learning over time, and “covering” the standards. Teachers work on these problems of practice through several relationships within the classroom. Drawing on the familiar triangle-model of teaching practice, Lampert (2001) identifies “practice” – elements of the work of teaching or actions the teacher takes up – occurring along four relationships as represented by arrows in Figure 6.1. This figure is useful because it shifts the focus from the teacher as the primary participant in the classroom to the interactions between the teacher, students, and content, which together define instructional practice.

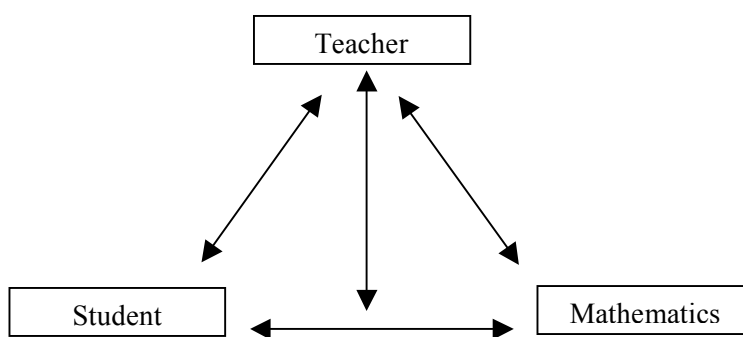


Figure 6.1: A Model of Classroom Practice

Practice, and how teachers go about solving the problems of practice, lie along the arrows, making up the space where the interaction occurs within the relationships between teacher and student (Teacher-Student); teacher and mathematics (Teacher-Mathematics); and student and mathematics (Student-Mathematics). The fourth practice arrow occurs as teachers work on or attend to the student-math relationship (Teacher-Student-Mathematics) (Lampert, 2001).

In their discussion of effective teaching practice, Kilpatrick et al. (2001) use this contextualized instructional triangle, and the “mutual and interdependent” elements of the triangle, as a basis for discussing quality of instruction (see Figure 6.2). They argue that quality of instruction depends on how the teacher interacts with the mathematics and students through curriculum development, lesson planning, expectations of students, and how the students engage with the learning tasks.

The bi-directional arrows in each diagram signify the potential for each element in the triangle to influence any other element. Additionally, this model for instructional practice highlights the ways in which students interact with each other. That is, students make meaning through their interactions with other students, with the teacher, and with the subject matter. This addition to the instructional triangle is important as more research points toward more equitable learning benefits for students working collaboratively to make sense of mathematical ideas (Boaler & Staples, 2008; E. Cohen, Lotan, Abram, Scarloss, & Schultz, 2002; Esmonde, 2009).

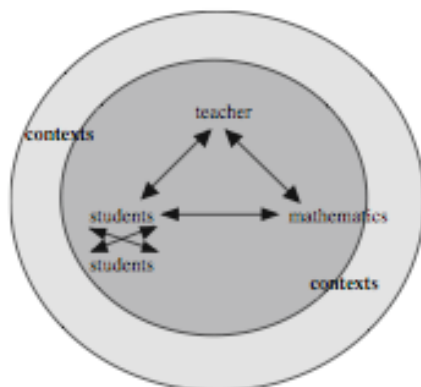


Figure 6.2: A revised model of classroom instruction, Kilpatrick et al., 2001.

Using this model, and combining it with Lampert's model, there are essentially five interactions that constitute instruction:

- Teacher-Student
- Teacher-Math
- Student-Math
- Student-Student (Kilpatrick et al., 2001)
- Teacher-Student-Math (Lampert, 2001)

This particular interaction triangle framework became useful in my analysis of the transcripts of the MFE debrief sessions and the teacher candidate online reflections which followed each classroom observation. In the next section, I explain how I drew on, and necessarily expanded, this framework in order to understand what the teacher candidates noticed as a result of the MFE. I begin by explaining my coding process using the five practice relationships and why I decided to expand the framework by adding three new practice relationships. I then provide definitions for the eight practice relationships as a way to demonstrate what the teacher candidates noticed during the MFE observations. I support these definitions using excerpts from the debrief sessions and the online reflections written by the teacher candidates.

Noticing Teaching Practice Interactions

As I began the open coding process, I paid attention to the content of the comments made by the teacher candidates and the partner teachers as they debriefed the lesson and observation. I

noticed immediately that, as the teacher candidates and partner teachers shared their observations of the lesson, most of their observational comments could be categorized as one of the five practice relationships described above. As I began the coding process, I tried to stay true to the ways in which Lampert defined the classroom practice interactions. However, I noticed that some interactions surfaced so frequently that it was no longer a useful category, while other interactions only came up a few times.

During the first run-through of coding, a vast majority of the comments were categorized as the *teacher* \rightarrow *student-math* (T \rightarrow S-M) relationship. Here, I use a unidirectional arrow to signify that the interaction noticed was the teacher influencing the S-M relationship. The fact that most of the observational comments attended to this interaction was not entirely unexpected due to the focus and purpose of the MFE. Interns were instructed to pay attention to how the teachers interacted with the students in ways that supported students' learning the mathematical concepts of the lesson. However, having such a large portion of the comments coded as one category did not allow me to understand the more nuanced differences among the comments in that category. Additionally, I found myself trying to double-code several observations. For example, I found myself coding some observations as both *teacher-student* (T-S) and *student-mathematics* (S-M). Other comments were not easily categorized into any of the five available interaction types. Therefore, I decided to examine more closely the T \rightarrow S-M coded comments to see if I could reveal differences within this category. In doing this, I ended up expanding the interaction triangle in a way that allowed me to make sense of the different interactions in which the MFE participants were taking notice. Three new interactions emerged within the T \rightarrow S-M interactions I originally coded. Creating these three new interactions also caused me to re-define how I was thinking about the original five relationships within the interaction triangle. I then set

out to examine more closely each of the eight relationships using the data I had already coded. As I began to more clearly define how I understood each of the eight relationships in the instructional triangle, and used the coded data to support that understanding, I realized that I needed to go back and re-code the data using the expanded instructional triangle relationships (see Figure 6.3).

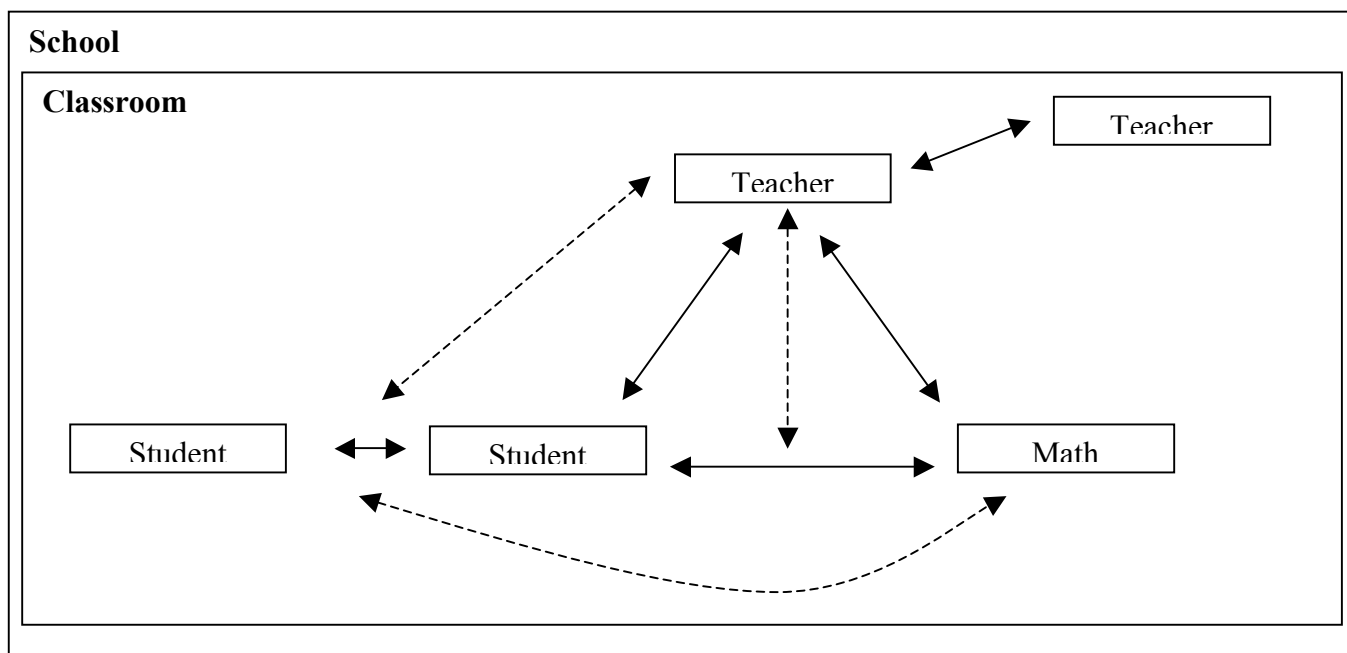


Figure 6.3: The expanded instructional triangle for Teacher Noticing during the MFE
Note: The dotted lines and solid lines signify different relationships between the elements in the diagram. The solid line signifies an interaction between two elements of the instructional triangle (T-M or S-M). The dotted line signifies an interaction between three elements, or a linked interaction: how two elements work together to impact a third (such as S-S→M) or how one element impacts the relationship between two other elements (such as T→S-M).

As I re-coded the transcripts with my new set of codes, which will be defined in the next section, each participant comment string or talking turn was often assigned several categories due to the fact that the participant noticed several different aspects of the lesson during their turn sharing an observation. However I did not allow for any overlapping or double coding of a single statement because I wanted to be as precise as possible concerning the interaction the teacher candidates and partner teachers were noticing. If something was double coded, this indicated that I needed to examine both my codes and the comment to determine if I needed a new code or redefine an existing code. I coded each participant comment based on the ideas or topics they shared during their turn and treated the topic separately. For example, if an candidate noticed how students were working together (S-S) and then shifted to how the teacher made a

move that supported mathematical understanding (T→S-M) these were coded as indicated. With this method, some participants stayed with the same topic and attended to the same interaction throughout their turn so the entire turn was coded as single type of interaction. Other times, a participant made several different, unrelated, observational comments and these were treated as separate “noticings” and were coded separately.

A vast majority of the comments by the teacher candidates and the partner teachers fell into one of the eight relationships within the expanded instructional triangle. There were a few comments and observations that could not be coded in this way. Most of these comments were about topics that fell outside of the classroom lesson but within the realm of schooling. Examples include discussions about how ELL students are placed in mathematics classes at Clark HS, tracking or placing students in mathematics classes by perceived ability, and discussions about the differences between the students in the Accelerated Learning Program at Clark and the “neighborhood kids”. These types of comments were coded as *schooling* and were designated as falling outside of the expanded instructional triangle. Although these noticings fell outside the categorized events that took place during the classroom observation, they were nonetheless critical ideas for the teacher candidates to explore and directly related to equitable teaching and learning. Therefore, the comments were kept in the data set and coded as events indirectly related to the classroom lesson that was observed.

The section that follows details the way in which I used the expanded instructional triangle to categorize the teacher candidates’ and partner teachers’ observations and comments during the MFE debrief²⁷. This sorting allowed me to surface patterns in what the teacher

²⁷ It is important to note that, although this chapter is about what the teacher teacher candidates noticed during the MFE observations, I also coded and analyzed the partner teachers’ comments as “noticings”. For contextual purposes and to help describe how I defined each interaction, I include data from both the teacher candidate observations and the partner teacher observations.

candidates found salient as they watched the classroom lesson unfold. Although Lampert used this triangle to detail how a teacher goes about “solving the problems of practice” within a classroom, I have used this triangle somewhat differently. In the next section, I explain how Lampert defines relationships within the instructional triangle and how I have interpreted these relationships somewhat differently for the purposes of uncovering what the teacher candidates and partner teachers *noticed* during the classroom lesson.

Teacher-Student. At the minimum, learning in schools involves a teacher and a student. The teacher-student relationship can be thought of as an interaction the teacher has with one student. This interaction is a collaborative one as it connects the work teachers and students do together (Lampert, 2001). Teachers can use their students as a way to solve problems of practice and, at the same time, students can also constrain a teacher’s efforts to support their learning. The overall goal, though, is to produce a teacher-student interaction in which learning occurs.

I chose to conceptualize this interaction on a more social and inter-personal level. When looking at a classroom lesson in action, I might see a teacher interact with a student in a way that helps the teacher develop a relationship with the student. Student-teacher relationships are fundamentally important in a classroom environment (Ball & Cohen, 1999) as these relationships can directly impact students’ academic achievement and behavior (Crosnoe, Johnson, & Elder, 2005; Valenzuela, 1999). For many students, the teacher-student relationship must come before the student-math relationship. The Clark HS teachers stated that their relationships with their students were extremely important to them and that getting the students to trust them was a priority. As demonstrated in the quotes below, the Clark teachers understood that if they could get students to trust them, they could get their students to learn mathematics.

I think it’s impossible to over emphasize the importance of relationships...some kids really need a relationship...they all need to know that you personally care about their

personal success and well being, both in math and in the larger world. And when you make a connection you can just see what they give back. It's just huge. (*Vanessa, whole group debrief, 4.27*)

...they want to know not only do you care about their academic success but that you care about them as a person... And it's just amazing to me how powerful that can be. But you know - if you think about that – as human beings we really do want people to notice us, pay attention to us, and tell us that we're important somehow. I want that from my kids (students), I want that from my friends, I want that from my spouse. Why wouldn't our Algebra kids want that to? Yes it takes some extra effort but man! The payoff is *so* huge. (*Tanya, whole group debrief, 4.27, emphasis is the speaker's*)

When coding the MFE debrief discussions, I marked a comment or observation as a teacher-student interaction when a partner teacher provided information about a particular student that demonstrated how the teacher used that information to support the student as a learner. Often times the partner teachers would talk about one particular student in their classroom, providing social and academic history of that student, which would help the teacher candidates understand how and why the student was participating in the classroom. During the first debrief session, Wendy gave the teacher candidates some information about one of her students, Kahil:

Kahil is another one who I also recommended for a support class. He's really quiet; he's an ELL student. I think he's flown under the ELL radar – I think he's been classified as an ELL kid and just kind of had lower standards his whole life or he's gotten really good at like, faking it. But I think he's got some major learning disabilities and it's been really hard for me to get him tested. He's really good at copying and culturally doesn't really know that's the wrong thing to do because he thinks he's just doing his work - so that's been a battle. Like, he can finally, at this point in the year, show the pattern in a t-table but what else he remembers from day to day is different, (it) changes all the time. He's super quiet so I have been really trying to get him to ask questions of his group and here we've switched groups and it's the second day and he hasn't asked a question. (*Wendy, whole group debrief, 4.6*)

This segment was coded as T-S because it highlights what Wendy knows about Kahil as a person and as a learner in her classroom. In this comment, Wendy demonstrates how this particular knowledge about Kahil, that he is good at flying under the radar, and “faking it”, but can now

“show the pattern in a t-table”, helps her make decisions about how she can best support his math learning (getting him tested for learning disabilities, getting him to ask his group questions).

In addition to providing particular histories of the students by the partner teachers, teacher-student interactions were coded if the teacher candidates made observations or comments regarding the way in which a teacher interacted with a single student during the lesson in a way that demonstrated the relationship between the teacher and that student. For example, during the beginning of a lesson in Wendy’s class, Wendy had asked the students to put their homework on their tables so she could walk around and check it. Lakeisha was visibly upset that she could not find her homework in her backpack. She was standing near her group, saying several times “Where is it? I did it!” Wendy noticed this and went over to Lakeisha and gave her a new homework paper, telling her to not worry about it and that she could turn it in the next day. This seemed to appease Lakeisha and she sat down at her group and looked at Wendy for her next direction. During the debrief, Bree, one of the teacher candidates, chose this interaction as her observation to share with the whole group.

One of the things that I noticed is that at the beginning of the period Lakeisha was a little bit distressed because she couldn’t find her homework and you did a really nice job of just trusting that she actually did her homework and giving her a new paper so that she didn’t have to focus on that for the entire class period. Cause it was really bumming her out. And once they (her group) got to talking about the math, they were all about it – they were completely focused on talking about the math. (*Bree, whole group debrief, 4.23*)

Later in the debrief, Wendy addressed this observation.

It’s such a balance – they are so different, they all have different needs so like being fair – you don’t treat them all the same way...Like, if it’s a little bit of extra attention then that’s what it is. I am not going to treat her (Lakeisha’s) homework being late any different but she wasn’t sitting down – she was copying and I was like ‘Hey man, don’t worry about it. Are you OK today? Are things ok?’ She was able to push that whole thing outside. In the past, it would have brought down her whole group to get back to work. (*Wendy, whole group debrief, 4.23*)

In this episode, Wendy demonstrates what she knows about Lakeisha (she was visibly distressed, copying her homework so she could get it checked, and needed extra attention) and how she used this information to support Lakeisha's learning (by not treating her late homework any differently but gave her the attention she needed to refocus and re-engage in the mathematics with her group). Bree noticed an aspect of a relationship Wendy had developed with Lakeisha, notably that Wendy knew what Lakeisha needed in that moment in order to re-engage in learning. Instances like these allowed the teacher candidates to gain a particular perspective on the students in Wendy and Tanya's classes, a perspective based on the partner teachers' knowledge and history with the students and not simply based on one observation.

The teacher candidates noticed the teacher-student interactions as they focused their attention on particular interactions within the classroom that demonstrated the relationship between the teacher and the student and how the teacher drew on that relationship in a way that supported student learning. Comments made by the partner teachers that attended to teacher-student interactions provided specific information about their students as learners and as individuals, allowing teacher candidates to have access to a broader perspective than simply what they observed and possibly assumed in that hour-long lesson.

Teacher-Math. In the case of the teacher-math relationship, Lampert (2001) defines this interaction as involving "teaching actions in relation to the content" (p.33). As an example of this teacher-math interaction, Lampert details her own experience as a teacher and the way she drew on her relationship with the content by referring to a diagram that represented the rates and ratios her students were studying. The teacher-math interaction accounts for the ways in which the teacher works in relationship with the school curriculum (making tables or diagrams) in an effort to prepare the groundwork for learning to take place (noticing patterns in a table or

“seeing” rates in the diagram). In classroom practice, the work of the teacher is to ensure students understand the content. However, the teacher’s understanding of the content, and which content is important for students to know, determines the nature of the classroom practice.

As I coded the MFE debrief transcripts, I viewed almost all of the teacher moves that were noticed by the teacher candidates and partner teachers as involving teaching actions in relation to content. Even when the teaching action was geared toward getting students to ask each other questions, which on the surface appears to be a teaching action geared toward student collaboration, the underlying motive is for students to collaborate around the *mathematics*. Rather than coding for teaching actions related to content, which I viewed as a T→S-M interaction, I defined a teacher-math interaction as instances when the partner teachers or teacher candidates were working to make sense of the mathematics themselves. I viewed this interaction as the relationship the teacher has with mathematics – what the teacher understands about the mathematics and how the teacher understands the mathematics they will teach their students.

Interestingly, I only coded 4 comments out of the entire MFE debrief data set as a teacher-mathematics interaction. One instance occurred when one of the guest partner teachers, Ms. G who was a mathematics instructional coach at a nearby school and a former mathematics teacher at Clark HS, explained how the manipulatives the students were using to factor quadratic functions only allowed for even coefficients. This was due to the rectangular shape of the pieces. A short discussion ensued about how teachers can use this limitation of the manipulative to quickly determine if students have made mistakes. This instance was coded as a teacher-math interaction because it involved the teachers understanding the mathematics behind the manipulatives, and thus a particular limitation or affordance of the manipulative.

Another instance occurred when the partner teachers were describing the difficulties of their first year of teaching, partly due to their limited view of how to think about and solve mathematics problems. Wendy explained how her understanding of the mathematics grew as she allowed her students to generate their own solution methods and share these methods with her and their classmates.

...when I first started teaching, you don't really know how kids are going to be thinking about math – you know (the way) you think about math. And giving kids work and having them talk about it publicly – you have a lot of stuff thrown at you that you never thought of. Or you wonder if it's always correct or mathematically sound. So I just remember spending hours my first year (of teaching) taking the worksheet before I photocopied it and just doing the math and considering different ways (the problems could be solved)...(*Wendy, whole group debrief, 5.4*)

This was coded as teacher-mathematics because the comment was about Wendy's relationship with and development of the mathematical ideas she was teaching her students. This instance demonstrated Wendy's relationship to the content (she wanted to think about different ways her students might solve the problems) through her own understanding of the content.

Across each of the instances coded in this category, the teachers discuss their understanding of a mathematical idea or how their understanding of particular mathematical ideas has shifted. I did not find any instances in which the teacher candidates make observations during the MFE debrief that attended to their own understanding of mathematics, however there were instances in the online post-MFE reflections. Mostly, the reflections in this category attended to the ways in which the teacher candidates were beginning to shift their own understanding of particular mathematical concepts. The partner teachers were teaching the students the distribution property, particularly with multiplying and factoring trinomials. Most of the teacher candidates had learned to do this using the "FOIL" method, indicating that one should multiply the first (F) terms, then the outside (O) terms, then the inner (I) terms, and

finally the last (L) terms. The teacher candidates had never seen a visual representation of this, which was exactly what the partner teachers wanted their students understand through their use of the Lab Gear. Several times throughout the post-MFE reflections, the teacher candidates commented that they were learning new ways of understanding mathematics.

Student-Math. A large proportion of observational comments from the MFE debrief data set fell into this category. As Lampert (2001) points out, although the teacher can interact separately with both the content (what the teacher knows about the mathematics) and with the students (what the teacher knows about the students), the work that actually brings about learning is “an act of the student in relationship with the content” (Lampert, 2001, p. 31). The student-math relationship is what occurs in order to cause learning to happen. As Lampert states, “...teaching cannot proceed without some complementary actions on the part of the learners working in relation with ideas, processes, and language they are to learn” (p. 31) This is the primary goal and focus of any classroom – learning as a result of the student-math interaction.

One of the primary goals of the MFE observation was to uncover exactly this type of interaction; how the students in the classroom were working to understand and learn the mathematics. Many of the MFE observation prompts were centered on this relationship. As I coded the observation comments made by the teacher candidates and partner teachers, I paid particular attention to the subject of the comment – whether the subject of the comment referenced a student and the way in which that student was working to understand an idea (a student-math interaction) or whether the subject of the comment was the teacher acting in some way to support student learning (not a student-math interaction because the teacher move was the focus of the comment and not the student’s mathematical work). Often times, these observations were made by the teacher candidates as they noticed what a student understood, or more

commonly, did not understand, about the mathematical ideas in the lesson. To a slightly lesser extent, the partner teachers made comments about what they noticed the students understood or struggled with during the lesson. The following two excerpts, one made by Luke and Gretta and another made by Bree and Mei, demonstrate contrasting ways the teacher candidates noticed the S-M interaction during the classroom lesson.

Luke: The girls in our group didn't understand how to use the blocks. They pulled the blocks out and wanted to do something with the blocks but didn't understand – I was in the same group with Gretta – they wanted to do something but they weren't quite putting it together.

Gretta: They weren't getting it. I mean our group, they didn't finish number one.
(*whole group sharing before partner teachers joined the discussion, 4.6*)

In these comments, Luke and Gretta paid attention to the fact that the students in this group didn't seem to know how to use the manipulatives they were given to solve the problems the class was working on. This student-math interaction, as noticed and interpreted by these two teacher candidates, was focused on what the students did not understand. By contrast, in the next example, Bree identifies what the students in the group she was observing did seem to understand about solving systems of linear functions.

Bree: When they actually had to use the numbers they were -

Mei: Actually, right, use numbers to draw two lines with the same rate of change, they don't know how to do that one.

Bree: I found that the kids in my group did a really good job using the tables. So one of the activities, to take a line and graph a point, so they were really good at filling out their tables and then once they had found the point of intersection they were able to use the combination of the table and the point of intersection to draw the lines pretty quickly. It took them a long time to find the intersection point but they eventually – I was in the group she (math coach, Ms. G) was talking about with Takeesha where they (the students) physically got out the Lab Gear and showed her (Takeesha) how to do it.
(*small group debrief, 4.6*)

While some teacher candidates attended to what the students didn't understand, other teacher candidates noticed what the students did understand or how they drawing on resources, such as other students and adults in the classroom, to help them make sense of the mathematics.

The teacher candidates made many of the student-math interaction comments but the partner teachers also made observations about what their students seemed to understand. The partner teachers offered both what they observed during class, and also sometimes outside of the observed class, regarding what their students seemed to understand about the mathematics.

Wendy: We haven't solved systems of equations since before spring break...So I saw a lot of kids relying on stuff we've done a long time before: starting point, rate of change, t-tables, going straight to the graph. But the big stuff that was new, they seemed to steer away from - like solving equations algebraically or knowing much about horizontal and vertical lines.

(whole group debrief, 4.16)

Tanya: Um, it was really a hard day - for me and for you to be in here - and it's not because of you but because of how things went. My goal for today's lesson was...I wanted them to start...being able to multiply and factor without me necessarily using those words, with more complicated binomials. So when the coefficient is not just 1. When it was just $(x+2)$ times $(x+2)$, x-squared always got filled in correctly it seemed like and their homework last night involved two of them that didn't have coefficients of 1 and one that did...but I need them to be at the point where they can multiply 2 times $3x$ and get $6x$ every time and I need them to be at the point where they can multiply $2x$ by $3x$ and get $6x$ -squared *most* of the time - so that was my hope for today's lesson. (She looks at Wendy and lets out a big sigh indicating that this didn't happen during today's lesson.)

(whole group debrief, 5.4)

Although the lesson did not go as Tanya had planned, Tanya knew what her students could do mathematically (successfully multiply binomials with coefficients of 1) and what her students needed to continue to work on ("multiply $2x$ by $3x$ and get $6x$ -squared *most* of the time"). In these excerpts, the partner teachers' comments revealed what their students understood about the mathematics. Observations made by both the teacher candidates and partner teachers were categorized as student-math interactions when the subject of the comment was what the students

understood about the mathematics or how the students were coming to understand the mathematics.

Student-Student. Although Lampert does not include this relationship within her visual framework, she does recognize this relationship within the classroom. She states that students do not always present themselves as individuals in the classroom but sometimes as groups or even the entire class. Boundaries of groups are fluid in classrooms and relationships are often nested, where students are simultaneously individuals, part of a small group, and part of a whole class. Within these various groups, students interact with each other socially and also intellectually.

At Clark HS, the Algebra teachers structured their classrooms so that students worked daily in small groups and as a whole class. The partner teachers also understood that the nature of their students' social interactions was critically related to their opportunities for learning mathematics. However, this was the first time many of the teacher candidates had seen a mathematics classroom in which the desks were not in rows and direct instruction was not the dominant teaching practice. This meant that seeing students working together in groups during a mathematics lesson was very new to the teacher candidates and there was the possibility they might not attend to the importance of the students' interactions. One of the primary goals of the MFE observation was to focus teacher candidates on how students' groupwork interactions opened or closed opportunities to learn.

Observational comments made by the teacher candidates in the student-student category were characterized by noticing how students interacted together *socially* but not necessarily mathematically. Often times, the observations were about the ways in which the students got along in their small groups and how the students participated within their small groups. Comments about individual students' participation within small groupwork also fell into this

category. As demonstrated in the next excerpt, Bree noticed how a group of students interacted during the first MFE lesson observation:

There was an interesting situation. There were two boys and two girls in my group and there was one that was clearly, like, not just a group leader but a class leader. Kind of dominant personality and then the two boys were a little bit quieter. One boy clearly had a good command of the material but he could not explain it well and the girl was like... (Bree looks through her notes)... he was like trying to show her his paper and she was saying "I don't want you to show me! I want you to tell me! I want you to tell me the words without writing it!" So she knew how to ask for what she wanted but he was having a difficult time responding to her. He was like "I don't understand what you don't understand!" and so then they gave up.
(Bree, small group debrief, 4.6)

In this excerpt, Bree noticed how two students, within a group of four, interacted socially and how Bree related their interactions with what she noticed about their "personalities" (dominant personality, two boys who were "a little bit quieter"). Bree was paying attention to particular social qualities of individual students and how these qualities played out in the interactions within the small group ("he could not explain it well...so then they gave up"). This interaction was initially coded as S-S→M because Bree also attended to what happened as a result of the interaction ("so then they gave up."). Upon further analysis, I decided that I could not actually say for sure if Bree noticed that their opportunities to learn had been closed off because of the interaction or if she simply attributed the interaction to ineffective groupwork. Because Bree did not specifically state what she noticed about the groups' opportunity to learn mathematics, I coded this as a S-S interaction.

As the teacher candidates' observations continued over the weeks and the Algebra students' small groups changed, the teacher candidates were able to observe how students interacted in different situations, specifically with different students in their groups. In this next

excerpt, Ingrid noticed how a particular student interacted very differently in his new group compared to how he interacted in his previous group:

But what I observed in my new group was, one of the students was from my old group and he was one of the ones that was harder to keep on task. But in this new group, the three kids worked together really well and kept progressing through the problems and kept pulling him along. He didn't want to be behind. He didn't *not* want to be in the conversation. He likes to talk! (*Ingrid, whole group debrief, 4.23*)

In this excerpt, Ingrid attended to how a particular male student interacted socially with his peers and how this was different from her previous observation of him. Similarly to Bree, Ingrid noticed something about the result of these social interactions (“kept progressing through the problems and kept pulling him along”) but did not directly attend to the student’s opportunities to learn mathematics.

The partner teachers also made comments that were coded as student-student interactions. Sometimes these comments were general in nature, reflective of what the teacher saw in their classrooms across the entire school year. Other times, the comments were about what happened in the classroom that day.

...and that's really cool to see kids demanding other kids to put their paper in the middle (of the table) and talk about what they did. Or demanding for an explanation because an answer is just not going to help them. Our kids will read the directions out loud on their own without being prompted or ask each other for help or say they need help. The community changes drastically from the beginning of the year...
(*Wendy, whole group debrief, 4.6*)

Here Wendy offers a more general noticing about how her students interact with each other in small groups. This was coded as student-student because the comment reflected what Wendy notices generally about how her students *participate* in her classroom.

Observations in this category were centered on the ways in which the students interacted with each other, usually in their small groups. Sometimes the candidate’s observation would go beyond the student-student interaction and take up the result of the student-student interaction –

such as the mathematics that was or was not learned as a result of the student-student interaction. Or, the candidate noticed a particular teacher move that impacted how the students interacted. These observations were not coded as student-student interaction because these observations noticed more than how students were interacting with each other. In order to be coded in the student-student category, the observational comment had to attend to either the participation of a single student in small groupwork or whole-class work or the comment had to attend to the ways in which students interacted with each other socially.

Teacher→Student-Math. Learning is situated within the student-math relationship and successful teaching depends on this learning to take place (Lampert, 2001). In order for learning to take place, students must have opportunities to engage in activities or learning practices. When a teacher takes action to provide such opportunities, this is what Lampert calls a Teacher→ Student-Math interaction. An arrow is used here to indicate that one aspect of classroom practice (the teacher) has a relationship with or impact on another classroom relationship (the student-math interaction). In the practice of teaching, when a teacher tries to make sense of what a student says (how the student explains or justifies her thinking, asks a question, or solves a problem) the teacher uses both her relationship with the student and her relationship with the mathematics. The teacher moves made during practice consist of several sequenced actions that are both social *and* intellectual because the teacher simultaneously works with the student *and* with the content (Lampert, 2001, p.34-35, emphasis added).

During the debrief sessions, many teacher moves were noticed in which the move worked to impact student learning. When coding for teacher→ student-math interactions (T→ S-M), I again paid attention to the subject of the comment. T→ S-M interactions were noticed by teacher candidates and partner teachers when they made an observation about a teacher action that aimed

to support or impact student learning. This could be a teacher move such as posing a question to a small group, or a physical tool a teacher used such as a worksheet or a manipulative. What is important about comments coded in this category is that the participant noticed the teacher move and *may* have also noticed the impact of the move on students' learning. This was not a requirement to be coded in this category because noticing the teacher move without noticing the impact on student learning was one way to notice the T→S-M interaction. However, if the teacher candidate or partner teacher made a connection between the teacher move and students' social interactions (as opposed to mathematical), this was coded as T→S-S.

This category primarily focuses on participants noticing particular teacher moves aimed at supporting student mathematical understanding (as opposed to teacher moves aimed at supporting students to work collaboratively). The teacher moves that were noticed by the teacher candidates were diverse and could be further categorized into specific teacher moves. Below is a list of teacher moves that were noticed in the T→S-M category of classroom interactions and an example from a teacher candidate.

- Asking a group of students questions about the mathematics
 Mei: And also during the groupwork, Tanya went to his table to clarify some mistakes but Tanya didn't just say "Oh, you got some wrong answers", she just told the students "So, you have different answers, what does that mean?" The students realized "Oh, if we have different answers then some of us got the wrong answers." After that, they checked their answers with each other to help each other get right answer.
(whole group debrief, 4.23)
- Intervening in the small groupwork
 Kelsey: Mine tried for a bit longer than that. They tried to focus on what Tanya said at the table, and then as soon as she walked away, the encouragement Tanya was giving, the ideas she was giving, they dismissed them pretty quickly and went back to, like their thought they were already having. *(small group debrief, 4.6)*

 Mei: But actually when the teacher came to the table and explained the problem to them, they can follow. They can figure it out. *(small group debrief, 4.6)*
- Refraining from intervening in the small groupwork

Neal: Also I definitely liked how, at one point, you came by and - I might have jumped in and said something - but then you kind of looked over and went “hmm...” and kept going. And the students noticed and then they went down a path where they found it was the wrong answer and together came up with the right answer afterwards. And it was really cool to see - not necessarily the mistake but - a different path dead end and come back which wouldn't have necessarily happened if you had said “Ah, what is going on here? Can sides on opposite sides be different?” Or something like that. (*whole group debrief, 4.23*)

- Use of body gestures to demonstrate a mathematical idea
Wendy: Marisol also couldn't articulate it but she went like this (Wendy motions with her hand, her finger out, going in a circle indicating perimeter) so I, like, brought her back to remember “What's the hand motion for perimeter?” And she went like this (hand motion again) and she said “Oh yah, add them all up around the outside.” So it's like – I don't know – distance around the outside! $2L$ plus $2W$! It comes so naturally to us but this is something they really struggle with - or you've got to meet them where they are to help them remember and understand it – this (motioning with her hand) is just fine. (*whole group debrief, 4.16*)

- Teacher's use of a physical tool such as a warm-up problem, a worksheet, or the Lab Gear and how the teacher sets up an activity with the physical tool in mind.
Farah: Well, my kids had a hard time understanding the difference between perimeter and area. And then you (Ms. Meyer) came around and were like “What is a perimeter? Area?” and she did this (motions with her finger like going around a shape) and area was this, I think, inside. I think the Lab Gear really helped them understand what perimeter and area was cause they couldn't really figure out the difference. But once they figured out around was the perimeter and inside was area, they understood it a lot better – the Lab Gear really helped them understand that. (*whole group debrief, 4.16*)

Wendy: That made me think about...what information we give them when we make these worksheets to force them to build (with the Lab Gear). And that's because when they are doing (she makes her fingers move as if she is moving the Lab Gear around) they seem to remember better. And even when kids pull the x piece out – even having it on the homework, having it on the diagram, when they actually physically see it, they won't label this side x anymore (indicating the side which is length of one), they are going to label it one. So there is so much memory and understanding that happens here and it doesn't mean we are aware of - how do we give them this information where we make them use the Lab Gear, where they have to pull out – it's very intentional. (*whole group debrief, 4.16*)

Included in the $T \rightarrow S-M$ interaction were instances in which the teacher candidates noticed teacher moves that were not made. Although this happened relatively infrequently for

the teacher candidates, it is important to consider. In this excerpt, Bree and Luke noticed how the partner teacher Wendy got caught up with one group and how the students responded:

Bree: One thing that was funny was that they (students) didn't have enough work to do today and they weren't encouraged to go on to this sheet quick enough and so, they had finished the warm up pretty early and at one point one of the kids said "Ms. Meyer isn't coming over, maybe we should make a stink!" She was like "Maybe we should be more rowdy!"

Luke: I even wrote it down too (reading from his notes) "Ms. M seems to be spending a lot of time with Farah's group. The whole class is done and involved in non-math talk, getting louder..." So I don't know, I wasn't there [in Farah's group] – maybe they were making a discovery or something.

Bree: Yah, maybe it's hard to leave when you see something coming...
(*small group debrief, 4.16*)

In this case, Wendy made a move (staying with one group for a considerable amount of time) that impacted the student-math interaction (the students were disengaged, not working on their math problems).

Thus far, I have described five categories of classroom interactions and how I understand these interactions similarly or differently from Lampert's instructional triangle. I have detailed each of the interactions that made up Kilpatrick's framework, which visually includes student-student interactions (Figure 6.2). However, not every observation, comment, or question fit into these categories and I found that I had to then extend the triangle to accommodate what the participants were noticing during the classroom observations.

Expanding the Classroom Practice Triangle

The Clark HS mathematics teachers who participated in this study utilized collaborative groupwork to help students learn and understand mathematics. This often required the students to understand multiple perspectives on problems and to make mathematical connections between those multiple perspectives within their small groups. These types of interaction required students to work together in a way that moved them toward the important mathematical ideas.

Issues such as status, or perceived competence within the small groups, often threatened to disrupt the groupwork. The Clark teachers often enacted particular tools, or teacher moves, that worked to support productive and more equitable participation within the small groups of students. The teacher candidates noticed these aspects of the classroom practice and many of their comments paid attention to interactions related to how students worked together in groups.

As I coded the transcripts and post-MFE reflections, I noticed that some observational comments were about social interactions students had with each other, how the teacher made moves to impact these student interactions, and how some student interactions provided the students greater access to the mathematics while other interactions barred some students from participating. I found that I could not categorize these types of comments using the previous five codes because the interactions that were noticed between students were social in nature and often impacted student access to the mathematics they were learning. The comments were not about what groups of students understood about the mathematics (which would have been coded as S-M) but were about the social interactions within groupwork and how those interactions supported or limited mathematical learning, ways in which the teacher facilitated these interactions, and what students learned mathematically as a result of these interactions.

I also began to see that the events that were noticed during the observation and brought to the debrief discussions and online reflections were sometimes a linking or chain of noticed events. For example, an candidate may have noticed a group of students working together in a particular way. Along with that observation, the candidate may have also noticed a teacher move aimed to facilitate student interaction among the group of students and perhaps also how the interaction impacted the mathematical learning among the group members. In order to differentiate these types of interactions and the linking between the interactions, I expanded the

interaction triangle to include three additional interaction types: Teacher-Teacher, Teacher→Student-Student, and Student-Student→Math. In the next section, I define these classroom practice relationships and provide evidence of how these relationships were noticed by the teacher candidates and the partner teachers.

Teacher-Teacher. The Clark HS Algebra teachers who participated in the MFE also participated in a Collaborative Planning Period (CPP). This was an additional period dedicated solely to planning and preparing for the Algebra 1 classes and all Algebra 1 teachers participated in this CPP. They met daily to plan what and how they would teach the algebra curriculum to their students. They collaboratively designed groupworthy tasks, created quizzes and tests, and they supported each other in finding ways to better meet the needs of the struggling students in their classrooms (Horn & Kane, under review).

The partner teachers made most of the comments in this category as they described how they collaborated and how their collaboration supported their students' learning. It was not until the very last MFE observation, in which the teacher candidates observed the partner teachers as they collaboratively planned a lesson, that the teacher candidates noticed a Teacher-Teacher interaction. In the following excerpt, Vanessa and Wendy describe how the partner teachers collaborated during their common planning to support each other in teaching mathematics to their Algebra 1 students:

Vanessa: So right now it is 5th period and this is our time when we meet and plan together. We all have – we all teach four periods a day – we all have one period to do the grading and planning and everything you have to do and then we have this period (indicating the current time the MFE occurs) to get together and sort of just focus on Algebra. And it has changed over the course of – over the past five years we have focused on the entry level. It's all focused on supporting struggling students. That's why we aimed it at Algebra. Which used to be Integrated 1 – and then there was a year we spent on Integrated 2 and then (the next year, the CPP was focused on) Integrated 3 and now we are back to Algebra.

Wendy: Because we were Integrated the last handful of years too, this is the first time we've gotten this far with Algebra with our freshman. This (mathematical concept) is typically a year 2 or 3 conversation as it's been at Clark HS. So we (teachers) are trying to find our footing with how we talk about things and where we expect our kids to be. (*whole group debrief, 4.6*)

Comments such as these were coded as Teacher-Teacher because they attended to the ways in which the teachers interacted around the goal of student learning in mathematics.

Teacher→Student-Student. For the Clark HS teachers, the work of teaching involves structuring student-student interactions in a way that produces learning. The Clark teachers were well aware of the problems that often emerge when students work in small groups and therefore needed to take action in particular ways to both support productive student-student interactions and to refocus non-productive student-student interactions. As mentioned above, the teachers enacted many tools, such as assigning competence and randomly selecting students to explain their work, which impacted the way their students perceived each other as competent in mathematics and thus how they worked together in small groups. Interns took note of these teacher moves and the way in which a particular move impacted how the students were participating with each other in their groups. When the subject of a comment was a teacher move or tool the teacher enacted aimed at impacting student-student social interactions, this comment was coded as T→ S-S.

During the first MFE debrief, the partner teachers spent a great deal of time discussing how they typically teach their classes. Much of the teacher-talk centered around teacher moves and strategies they used to support their students working productively in their groups. Although the goal behind the practice was to increase participation for students by providing opportunities for mathematical learning, the teacher candidates and partner teachers did not always take up the mathematical learning piece. For example, in the following segment, Wendy and Tanya detailed

a few of the teacher moves they used and how those teacher moves were aimed at getting their kids to work collaboratively but they don't go as far as saying how those same moves supported students to learn mathematics:

Tanya: As far as getting my kids to work together...one is pulling their paper toward the middle of the group so that everyone can kind of see what is going on. I like to be on one side of the group and talk to the kid on the other side so it makes it tougher...for side conversations to start.

Wendy: We are really thoughtful about how we go to our groups, so putting the paper in the middle, and what side of the group you are on, there are some things to consider...I try to model and facilitate that group conversation so I kneel down, I am at their level, I am not above them telling them how to do things. By getting the paper in the middle, we are trying to get kids to show what they know, we will elicit what they know and get them to talk about what they know and get them to be the experts on the content. So when I go to groups I try to figure out who knows what, poke some kids to share some ideas and let them be the ones doing most of the talking. (*MFE whole group debrief, 4.6*)

The Clark HS mathematics teachers utilized many teacher moves aimed at encouraging their students to work together on the mathematics. Moving the mathematics task or manipulatives to the center of the table so each group member could clearly see it was one strategy. Another strategy was to “enter” the groupwork by first finding out what students understood about the mathematics. The Clark teachers were very clear that in order to support their students in moving forward with their mathematical understanding, the teachers’ first job was to find out how they were coming to understand it. Other strategies I observed during the lessons were holding participation quizzes, randomly calling on one student to share the groups’ work, asking one student to explain their thinking to another student, and assigning competence to students when they made intellectually important contributions to their groupwork or during whole class presentations. Although all of these moves are meant to indirectly increase opportunities for student to learn mathematics, the partner teachers and teacher candidates did not always connect the move to the mathematical learning. In these cases, the comment was coded as T→S-S.

Not all teacher moves produced positive student interactions. For example, Wendy discussed what she observed during a lesson where the students were introduced to the idea of vertical and horizontal lines:

...today was the first day we did vertical lines and horizontal lines and systems of equations. This assignment was very difficult for my class and their groupwork. Everything seems to break down when the content is over their head – or just a little too challenging. It's great to have some challenge and I felt like I saw that today...So the assignment was pretty difficult and some of those (groupwork) structures broke down because of that. And we are definitely not done with special lines and systems of equations. (*Wendy, MFE debrief, 4.6*)

The teacher candidates noticed many of the teacher moves the Clark HS teachers utilized in their teaching practice as they observed the lessons. In the teacher candidate comments that were coded as T→S-S, they noticed how particular teacher moves influenced how students interacted in their groups but did not connect that teacher move to opportunities for student learning. In this excerpt, Gretta noticed a move the mathematics coach, Ms. G made and how it impacted the students' participation in the group but Gretta did not connect this to how the participation impacted the students' learning opportunities:

And so Ms. G came over and was trying to facilitate the discussion because obviously the concept is not there and she was saying "Well, can you explain it to someone else?" and so she finally stimulated some conversation and got things going in that group. But like Sade was asking Cheng "How did you get that problem?" or "How did you get that solution or layout?" and he was kind of making a connection saying "Well the area is the area of everything inside it – this plus this and that's the area that was shown and that's how you make that area." (*Gretta, MFE debrief, small group debrief, 4.16*)

In this excerpt, Gretta notices the teacher move Ms. G made in an attempt to stimulate conversation in a group that was struggling with the mathematics. Gretta noticed this teacher move and also noticed the student response as a result of the teacher move – a social interaction involving Sade asking Cheng to explain his thinking and then Cheng making an attempt to be clear about how he solved the problem using the Lab Gear. Gretta stops her comment and does

not continue to discuss what she observed in terms of the mathematics she thought the students understood as a result of that interaction. Therefore, this interaction was coded as T→ S-S.

In another example, Hannah notices how Tanya made a subtler move that directly impacted the student interactions in the small group:

I observed a three-person group today and the teacher that I observed helped the student, who was alone on one side of the table, to move around to the side so that she was very close to the other students. After that happened, I noticed that this student had her hands on the manipulatives. In fact, she was almost in charge of the manipulatives and the other students were reaching over to make adjustments and changes. (*Hannah, MFE whole group debrief, 4.27*)

By moving the student around to the side so that she was closer to the other two group members, Tanya intended to increase the participation of that student. This particular move indirectly impacts opportunities to learn because students who are physically removed from the group often have a difficult time gaining access to the ideas and conversation of the group, thus limiting learning opportunities. By moving the student closer, Tanya intended to increase that students' opportunity to learn with her peers. However, in this except, Hannah notices the direct impact of the teacher move on the students' interactions but does not attend to the indirect impact on mathematical learning opportunities.

This category was difficult to code because, as a researcher, I could see how particular teacher moves worked to impact student-student interactions directly but student-math interactions indirectly. This was, in fact, the goal for the Clark HS teachers – to directly impact student interactions in an effort to indirectly impact mathematics learning through the student interactions. For example, the use of a participation quiz directly impacts how students interact with each other. However, there is an indirect result. By holding the students accountable for interacting in a particular way, there is potential for students to gain access to the mathematics in the task, perhaps by discussing different strategies and explaining their thinking to their group.

Although this is an indirect result of the use of participation quizzes, it is actually the primary intention of using this practice. It was common for the teacher candidates to notice how a particular teacher move, such as a participation quiz, directly impacted student interactions with each other, but they did not always notice the indirect impact of the mathematical learning that may have taken place. The T→S-S category is centered on participants noticing teacher moves that impact student interactions but stop short of noticing the resulting mathematical learning that may (or may not) have taken place.

Student-Student→Math. Just as the teacher candidates noticed particular teacher moves that impacted student social interactions but did not notice the mathematical learning, teacher candidates also noticed student interactions – absent of a teacher move or absent from noticing the teacher move - and how the social interaction facilitated mathematical learning. In this category, what was not noticed was the teacher move that facilitated the student social interaction, if a teacher move was even made.

Comments made by both teacher candidates and partner teachers that were coded in this category focused on student-student interactions and how the student-student interaction afforded or limited the students to gain access to the mathematical ideas. The teacher candidates and the partner teachers made observational comments that focused on how students were working together and how the interaction impacted student learning. In order to be coded as this category, the comment had to address both an interaction between two or more students *and* how this interaction facilitated or limited mathematical learning.

In one example, Ingrid noticed how two students worked together by offering different strengths and how their collaboration supported their mathematical learning:

And then also what I saw was there were two –they (students) kind of split up in sets of two and the girl over here was really good at doing the tiles. She was amazingly fast. But

she had a hard time actually doing the math, like distributing-the-x kind of thing. However the student over here, he could do the math but was like “Oh the area is just the number of pieces.” Not as fast at making the rectangle. So it was nice to see them kind of work together to get both parts on their paper. It seemed like they both had high strengths in both areas and so they kind of complemented each other nicely. (*Ingrid, MFE whole group debrief, 4.23*)

Ingrid noticed that these two students had different but complementary strengths and how their interactions provided opportunities for these two students to leverage each others’ strengths in order to “get both parts”, or the algebraic and geometric representations, on their paper.

In another example, Hannah noticed how a group of students used justification and reasoning to figure out a problem that involved combining like terms.

There were two sets of tiles they had created on the table and they were checking with each other to make sure that the two sets were the same and they were noticing they weren’t. But then at the end they – one of the students said “Well, this would add up to $10x+2$.” And they looked at that for a minute and then another person at the table said “No, it wouldn’t be $10x+2$ because you can’t add up the x-squared (pieces) with the x (pieces).” And so they had this really nice conversation that went back and forth, “Well, why can’t you do that? Because you only add up the one that have the same shape.” And so it was really neat to see that they made a lot of sense in that conversation... (*Hannah, MFE whole group debrief, 4.23*)

This was coded as S-S→M because Hannah noticed the way in which the students were interacting and how their interactions supported their mathematical learning through sense-making. The dialogue between the students that Hannah attended to was rooted in mathematical reasoning and Hannah noticed both the interaction and the mathematical understanding. In order to be coded as a S-S→M interaction, the participant had to notice both the interaction between students and the impact of the interaction on the students’ opportunities to learn mathematics.

Attending to the Act of Teaching and Learning: Linking Teacher→Student-Student→Math

Thus far, I have detailed the various types of interactions that were noticed by the teacher candidates and the partner teachers during the MFE debrief sessions and from the teacher

candidates' online reflections. Looking across the categories of interaction, I found that the teacher candidates noticed many interactions that included the T-S, S-S, S-M, and T→S-M interactions. However, they noticed far fewer interactions in the T→S-S and S-S→M categories. What is relevant about this pattern is twofold. First, it is significant that the teacher candidates noticed interactions beyond Teacher-Student and Student-Student. Research has shown that when novices observe classroom practice, they typically focus on aspects of classroom management and discipline (Star & Strickland, 2008). This would be consistent with a T-S or S-S interaction. The teacher candidates in this study did notice classroom events that were rooted in management problems and unproductive student interactions but the teacher candidates also noticed ways in which students were and were not making sense of mathematics and ways in which the partner teachers influenced how students went about making sense of mathematics. The teacher candidates noticed ways in which teachers worked to increase students' opportunities to access and learn mathematics and they also noticed how students supported each other in this work.

Second, it is significant that teacher candidates noticed fewer T→S-S and S-S→M interactions than other interactions. In classrooms in which teachers work to implement equity-oriented teaching practices by increasing all students' opportunities to participate and thus learn mathematics, clear links must be made between the practices and the impact on what and how students learn mathematics. If teacher candidates do not notice a teacher move aimed to broaden students' opportunities to learn and if they are not able to interpret how particular moves actually provide such opportunities, teacher candidates may react out of habit or from a place of familiarity rather than respond "freshly" to the situation. Ideally, we want teacher candidates to notice all phases of an instructional move: the interaction that occurs prior to the move, how the

teacher responds in ways that address opportunities to learn, and how the teacher move actually effects opportunities for students to learn. In other words, teacher candidates' attention can be focused on a teacher move, how that move provides students opportunities to learn through increased participation, and what mathematics students learn as a result of the teacher move. Essentially, this is linking the $T \rightarrow S-S$ and the $S-S \rightarrow M$ interactions.

Although the teacher candidates did not notice many $T \rightarrow S-S$ or $S-S \rightarrow M$ interactions, a few teacher candidates did make the link between the $T \rightarrow S-S$ and the $S-S \rightarrow M$. In one example, Gretta and Luke had noticed how Ms. G, the mathematics coach, made a teacher move with a small group that was not functioning productively. The students were quiet and not speaking to each other although that was the expectation for the task. Ms. G made a teacher move by assigning competence to Sade, a typically shy and quiet student.

One of the group members was grasping multiplying terms in parenthesis and one group member was not (Kahil). Ms. G came over and said "I see you are struggling a little bit and Sade is really getting this. Sade, try to help them out, see what is going on there and see if you can help them out." And it was good, I mean they weren't doing it on their own. Once that was facilitated they were starting to interact a bit more or exchange ideas, questioning (each other) as to why that is being done and where certain numbers and variables are coming from. It kind of needed a push a little bit but they were starting down that path. (*Gretta, MFE whole group debrief, 4.16*)

During the small group sharing, Gretta noticed the teacher move (Ms. G asking Sade to share her thinking with Kahil), how the students interacted (Sade began interacting with Kahil), and also identified the mathematical learning taking place ("...they were starting to interact a bit more or exchange ideas, questioning each other as to why that is being done and where certain numbers and variables are coming from.").

In another example, Mei noticed how Tanya delegated mathematical authority to a small group of students by letting them know, through a subtle but significant teacher move, that they had some mathematical ideas to work out together:

Also Tanya went to (Jian's) table to clarify some mistakes but Tanya didn't just say "Oh, you got some wrong answers." She just told the students "So, you have different answers. What does that mean?" The students realized "Oh, if we have different answers then some of us got the wrong answers." After that, they checked their answers with each other to help each other get right answer. (*Mei, MFE whole group debrief, 4.23*)

In this excerpt, Mei noticed that the group of students she was observing had different answers on their paper, even though the norm in the classroom was that the students were to "stay together" in their teams and that they should be talking about their solutions. Mei noticed that Tanya made a teacher move that aimed to get the students talking about their different answers and thus come to an agreement for the solution. Through this work, students are provided opportunities to learn from each other by justifying their ideas and convincing others of their solution. Mei also noticed that, after Tanya left the table, the students began to check their answers with each other and helped "each other get the right answer". In this case, Mei linked the $T \rightarrow S-S$ interaction to the $S-S \rightarrow M$ interaction.

This type of interaction, a linking between $T \rightarrow S-S$ and $S-S \rightarrow M$ was coded as a $T \rightarrow S-S \rightarrow M$. When a teacher candidate or partner teacher made a comment about a particular teacher move, the resulting student-student interaction and how that interaction facilitated (or not) mathematical learning, this was coded as $T \rightarrow S-S \rightarrow M$. These types of comments were not common. In fact, the teacher candidates and the partner teachers only noticed these interactions during three of the seven MFE observations. The partner teachers made these observations during the first, second, and fifth MFE observation and the teacher candidates made these observations during the third, fourth, and fifth MFE observation. Although these interactions were only noticed a minimal number of times, it is significant that these interactions were attended to at all. For the teacher candidates in this study, noticing these types of interactions enabled them to make connections between what they were learning in the university and what

they observed in the Clark HS classrooms. This is essentially the first two parts of van Es and Sherin's definition of noticing: identifying important classroom events and connecting those events to the principles of teaching and learning they represent. Although I have not yet made an argument as to the ways in which the teacher candidates were able to notice based on van Es and Sherin's third part of their noticing definition, using what one knows to reason about classroom events, I make this argument in Chapter 7 when I examine what the teacher candidates learned about equity-oriented teaching practices.

Structures that Orient Candidates to Notice Important Aspects of Classroom Practice

Two particular structures of the MFE supported teacher candidates in focusing their attention on important aspects of classroom practice, such as the ways in which the partner teachers attended to status ($T \rightarrow S-S$) or how the students utilized justification and reasoning in their small groups to make sense of mathematics ($S-S \rightarrow M$). First, the observation protocols, which were linked to the essential question of the week, provided scaffolding of teacher candidates' ability to shift attention away from classroom management and a focus on the teacher and toward paying attention to student thinking. Second, the MFE debrief structure, in which the partner teachers began by reflecting on the lesson, modeled for the candidates what was important to pay attention to.

Observation protocols. Consistent with the research literature, during the beginning of the MFE sessions, the teacher candidates in this study noticed classroom events that were mainly T-S and S-S interactions. That is, the teacher candidates attended to interactions between a teacher and a single student and also between students. Often, the interactions that were noticed were social in nature and the teacher candidates did not extend their noticings to students' mathematical thinking. Toward the middle of the quarter, the candidates began to notice more S-

M and $T \rightarrow S$ -M interactions, indicating they were beginning to attend to the nature of the mathematical learning that was taking place. They also began to notice $T \rightarrow S$ -S interactions, which indicated that they were attending to the teacher moves that aimed to support collaborative and more equitable student participation.

Although it could be claimed that the teacher candidates simply developed skilled noticing over time, I do not believe this to be the case. The observation protocols, at least in part, guided the teacher candidates' attention toward these interactions. Looking across all of the observations protocols, I coded the activity and/or questions that were posed to the teacher candidates similarly to the way I coded the classroom events the teacher candidates' noticed. This allowed me to see if there was a relationship between the observation protocol and what the teacher candidates attended to during the observation, based on the classroom event they shared during the debrief.

For example, during the second MFE observation, the observation protocol was an "interaction tracker" tool. The teacher candidates used this tool to keep track of the interactions between the students in the small group they were observing. In the university class that preceded the MFE observation, the teacher candidates learned about status and how students' perceptions of competence impacted their interactions within their small groups. I coded the interaction tracker observation tool as a S-S interaction because the tool drew the teacher candidates' attention to the ways in which student interacted in small groups during a mathematics lesson and how that might be related to the students' status in their groups. During the debrief 20% of the teacher candidate observations attended to the S-S interaction. This was the second highest category noticed, just behind S-M interactions at 25%. Only 7% of the comments attended to the $T \rightarrow S$ -S interaction. This indicates that although the candidates were

in fact noticing student-student interactions, they were not yet taking notice of the teacher moves that affected such interactions. In addition, the observation protocol did not focus the teacher candidates' attention toward teacher moves.

The observation protocols were a structure that deliberately focused the teacher candidates' attention toward important aspects of classroom practice. There was a relationship between the observation protocols and the types of interactions that were noticed by the teacher candidates. The protocols in the beginning of the quarter attended to how students interacted with each other and how they reasoned about mathematics. As the quarter went on, the observation protocols supported the teacher candidates in shifting their attention toward particular teacher moves and how the teacher moves supported student participation and learning of mathematics. Similarly, at the beginning of the quarter, the teacher candidates noticed interactions that were more social in nature, and between the teacher and one student or between students. As the quarter progressed, the teacher candidates began attending to the more nuanced aspects of classroom practice. The observation protocols made invisible aspects of classroom practice immediately available for candidates to notice given their limited experience in classrooms where students worked in groups and were expected to reason about and explain their mathematical thinking. As the teacher talk was modeled over the seven-week period and supported by the shift in the observation protocols from noticing student and teacher social interactions to focusing on the impact of particular teacher moves, the teacher candidates gradually began to notice and reason about critical classroom practices aimed at providing students more equitable access to mathematical learning opportunities.

Partner teacher noticing as a model for teacher candidate noticing. Another structure of the MFE that supported teacher candidates in noticing important aspects of

classroom practice was the debrief sessions. The Clark HS partner teachers all made a commitment to centering their teaching practice on their students and the ways their students understood the mathematics. To this end, the partner teachers implemented many of the teaching practices that aligned with the pedagogical focus of the mathematics methods course, namely Complex Instruction.

During the debrief sessions, the partner teachers were the focus of the discussion. They were seated together in the front of the room and began each debrief session by stating their goals for the lesson, what they observed their students understanding, and what more they thought their students needed to learn. By beginning the debrief like this, the partner teachers were able to signify for the candidates what they noticed during the lesson. This identified, for the teacher candidates, what was important to attend to, or notice, during the lesson.

Additionally, the partner teachers shared important information about their students – knowledge only they possessed. This information was critical because the teacher candidates tended to over-generalize their observations. For example, if they observed a student who was quiet all period and not participating, they tended to think that student behaved that way every day. It was helpful for the teacher candidates to gain background knowledge on the students so they might better understand why students behaved or responded in a particular way.

By surfacing and discussing the critical events that took place in the classroom, and rooting those events in the histories of the students in the classroom, the partner teachers modeled what was important to attend to and how classroom events could be interpreted keeping the students at the center of the conversation.

The two structures just discussed, the observation protocols and the structure of the debrief in which the partner teachers shared their observations first, provided opportunities for

the teacher candidates to notice interactions and teaching practices that are commonly invisible in the classroom. These invisible practices were often interactive in nature, requiring the teacher to be responsive to student thinking or particular groupwork processes, such as status problems or group interdependence, which would lead to student learning. In the next chapter, I provide two specific examples of how the teacher candidates themselves noticed and interpreted two equity-oriented teaching practices and how their interpretations developed over time.

Chapter 7

Learning about Equity-Oriented Teaching Practices in the MFE

As described in the previous chapter, the teacher candidates progressively began to notice interactive aspects of classroom practice. In particular, the teacher candidates began to notice a linking between teacher moves, student-student interaction and mathematical learning ($T \rightarrow S$ - $S \rightarrow M$). Noticing this sequence of classroom activity surfaced the invisible aspects of practice that teacher candidates are not likely to notice in field experiences that are disconnected from university experiences.

In this chapter, I take up two interactions of classroom practice, S-S and $T \rightarrow S$ -M, and examine the ways in which the teacher candidates went about interpreting and re-interpreting specific practices that lie within those interactions. I take up these two interactions because the two equity-oriented teaching practices the teacher candidates noticed most often fell within these two categories. First, I examined the student-student interaction. This describes the ways in which students interact with each other in the classroom. During the beginning of the MFE, the teacher candidates noticed these types of classroom interactions more than others, as evidenced by their stated observations during the debrief and what they chose to discuss during the online reflections. Within this interaction, I found that the concept of status resonated with the teacher candidates and they readily took up this idea to make sense of the ways students were interacting with each other during the class lessons. In the first part of this chapter, I will describe how status lies within the student-student interaction of classroom practice and how attending to status can be considered an equity-oriented teaching practice. I also describe how the teacher candidates learned to use the lens of status to examine student-student interactions.

The second classroom interaction I examined was the Teacher \rightarrow Student-Math interaction. This describes the ways in which teacher moves influence how students go about

learning the mathematics in the classroom. During the MFE, the teacher candidates noticed these interactions mostly toward the later half of the classroom visits and it often involved the students' use of the Lab Gear. I found that some of the teacher candidates struggled with understanding how the partner teachers were using the Lab Gear to support conceptual understanding of certain aspects of quadratic expressions, namely the distributive property and factoring. Initially, the teacher candidates rejected the use of the Lab Gear and felt the students were relying on the manipulatives too much or using the manipulatives without connecting the geometric representation of the Lab Gear to the algebraic representation of the problems they were solving. It wasn't until the 6th MFE observation that the teacher candidates began to see how students were making such connections. In the second part of this chapter, I describe how the use of manipulatives, in this case Lab Gear, lies within a Teacher→Student-Math interaction and that providing students manipulatives may in fact promote equity in the classroom. I then describe how the teacher candidates' understanding of the purpose and use of manipulative progressed across the seven MFE observations. Finally, I identify two particular structures of the MFE that allowed the teacher candidates to deeply investigate these practices.

Student-Student Classroom Interactions: Recognizing Status as an Equity-Oriented Teaching Practice

As research continues to build showing how cooperative learning models may support student understanding (Boaler & Staples, 2008; E. Cohen, 1994; Esmonde, 2009), it is important to discern how groupwork is structured in ways that may afford or limit students' opportunities to learn mathematics. Cohen's (1994) research of groupwork in classrooms has shown that students' interactions with each other greatly impact their access to a task. In her research, she observed groups of students working on a task where one student was left out, or in other cases,

one student took charge and did the work for the whole group. Teachers lament this problem of groupwork and it is the reason many teachers give when asked why they don't use groupwork in their classrooms. Cohen states that these interactions stem from how students in the group perceive themselves as intellectually capable of contributing to the groupwork task, or how they perceive the other students in their group as capable of contributing to the groupwork task. If a student believes she is not intellectually capable of contributing to the task, she may disengage or even become disruptive as a way to "escape" the mathematics. Similarly, if a student believes the other students in his group are not capable of contributing to the task, he may take over the task and not allow the other students in his group to contribute, essentially doing all of the groupwork himself. Cohen draws on the notion of *status* to explain the social hierarchies that students bring into the classroom and how students' status can influence their opportunities to participate, and therefore learn, during groupwork.

Cohen puts forth several specific teaching practices that work to shift students' perceptions of themselves and others as competent. I reviewed a few of these practices in Chapter 2 such as assigning competence and using multiple representations to broaden students' understanding of what it means to be competent in mathematics. Teaching practices that shift students' perceptions of competence address status by changing how students define what it means to intellectually contribute to a groupwork task. Drawing on Gutierrez's definition of equity as providing more students opportunities to learn mathematics, teaching practices that work to shift status and broaden ways for students to participate can be considered equity-oriented teaching practices.

Learning to notice how status influences students' opportunities to learn is an important first step in beginning to take action in one's classroom. Noticing status is important but having

the tools to take action is where equity comes into play. Simply recognizing that a particular student has low status in her group would not attend to equity. However, enacting a teacher move that disrupts that student's status may provide that student access to the mathematics.

Using the lens of status to make sense of student-student interactions. From the first MFE observation and debrief session, the teacher candidates attended to student participation and student-student interactions in the Clark HS classrooms. This is inconsistent with the research literature, which demonstrates that novice teachers typically take note of teachers' action, especially when related to issues of classroom management (Carter, et al., 1988). I assert there were at least two reasons for this. First, being in a mathematics class where students were seated in groups and were expected to learn mathematics from and with their peers was a new experience for the teacher candidates. Second, the observation protocols the university instructors provided to the candidates during the MFE observations, combined with the experiences during the university course, required that the teacher candidates pay attention to and interpret how student-student interactions influenced learning opportunities.

Initial post-MFE reflections demonstrated that the teacher candidates attributed variations in participation to personal characteristics held by the students. For example, the teacher candidates noticed how students interacted with each other in different ways and tended to explain these interactions by saying the student was a "natural leader" or "quiet and shy" or "talkative". After the first MFE observation, which was before the teacher candidates had read about Cohen's work around Complex Instruction and status, the teacher candidates reflected on their observations of the lesson. Emma wrote about the four students she observed and how they worked together, or didn't work together in their group:

I was in Wendy's room with two boys (Brian and Luis) and two girls (Felicity and Aliah). From the beginning it was clear the roles the students played within their group;

Luis understood the material (a majority of the time anyway), Brian liked to talk outside the group, and the two girls seemed more interested in touching up their makeup than doing the assignments. With this said however, some of the greatest contributions came from the girls who were seemingly off task the majority of the time. They did not always contribute “right” answers but they were willing to say ideas they had regardless if they were right or not. This differed greatly from Luis who may have written the “right” answer but was shy when it came to explaining his solution. (*Emma, MFE #1 reflection*)

After this same observation, Farah wrote:

During the warm-up, one particular student, Beth, in my three-member group clearly held the leadership role telling her group members what needed to be done while the others just listened. (*Farah, MFE #1 reflection*)

During the first observation, the teacher candidates did not necessarily see variation in participation in terms of how students perceived themselves or others in their group and how those perceptions impacted their participation but instead related participation to personality traits the students possessed.

After the first MFE observation, the concept of status was introduced in the methods class at the university. In preparation for the class, the teacher candidates read about common problems with groupwork and they related their own negative experiences working in groups. They discussed status through watching a video of students working in a small groups and interpreting the participation of students in those groups using the notion of status. They also engaged in a mathematics task while the university instructors modeled particular practices that aimed to impact status such as a multiple-abilities treatment, assigning groupwork roles, providing the teacher candidates with a groupworthy task, and assigning competence (Cohen, 1994; Featherstone et al., 2011; Horn, 2012). This provided the teacher candidates with a conceptual tool they could draw on to make sense of why students might participate in various ways.

When the teacher candidates returned to Clark for the second MFE observation, they were asked to track student interactions using an “Interaction Tracker”. The teacher candidates were instructed to record, using arrows and a seating chart for the small group they were observing, the interactions that took place between the students. During the debrief, the teacher candidates shared their observations of the groups and were surprised to find that some groups had many interactions between all members of the group while other groups had students who only had one or two interactions during the entire class period:

Luke: Yah, he didn’t talk at all – I’ve got my little sheet here (Interaction Tracker). He had like two interactions.

Bree: - at a table that is really quiet – I mean there is a low interaction. Whereas at my table it was almost exhausting to try and keep track of [the interactions] –

Gretta: Yah, I was thinking of that – wondering what your interaction sheet must look like.

Bree: The kids were like “What are you doing?”

Bree had observed a group of students who had worked together productively in terms of their interactions while Luke had observed a group in which one particular student only spoke twice during the class period. The teacher candidates used these interaction trackers and data they provided about student participation to begin noticing student-student interactions as a function of status.

When it was time for the teacher candidates to share their observations of the class, they were asked to provide evidence that students were making sense of perimeter and area using the Lab Gear manipulatives. Ingrid responded to this prompt by first using the notion of status to explain how her group worked together:

My group had four students and one of them really had the concept of the manipulatives...status, there was definitely a lower status student and academically higher status student and they seemed to work together really nicely. The two other students seemed to work together independently. So the two students who were working together quite nicely, the academically high status student was showing very well what the pieces meant. (*Ingrid, MFE whole group debrief, 4.16*)

Some of the teacher candidates shared their observations of how students were making sense of the mathematics by attending to how the students were interacting in their groups. Rather than attribute the students' variation in participation to personality traits, the teacher candidates began to explain participation in terms of status. In addition, when the teacher candidates shared an observation and did not relate the student-student interaction to status, the partner teachers responded to the observation in a way that re-interpreted the observed event in terms of a status interaction. In one example, Bree, Luke, and Gretta detailed how their group members worked together during the lesson. Their comments were mainly oriented toward what the students didn't seem to understand or know about the mathematics and their comments did not attend to how students' perceptions of themselves or others as competent influenced their interaction.

After each candidate spoke, Wendy responded to their comments by describing the relationship between each students' participation and their status in the classroom:

So they are definitely a group that has just not been talkative and, you know, friendly, talking about the math the whole time. Or at all. And I think you'll see Sade and Yi-Shen check in with each other in some sort of way. Otherwise, its just pairs. Like, Yi-Shen is just brilliant – he's in Algebra 1 because he's an ELL student. It's really – he's failing all of his other classes, getting an A in my class. Like, it's been such a battle to get him to, like, start talking to kids but I don't know if you guys noticed when we were doing linear equations [during the last observation], he was building [with the Lab Gear] in the middle, between him and Kahil. He doesn't need to build but that's his way of participating in the group and so I am - I blow him up for that. "Thank you so much for doing that – Kahil really understands it when he can move the pieces around and I really appreciate you pairing up with him on that." So there's strides and progress in that group and they still have a long way to go. (*Wendy, MFE debrief, 4.16*)

In this excerpt, Wendy acknowledges the variation in participation between the students and also relates their participation to how they were perceived by other students. Yi-Shen was an ELL student who was not talkative due to his language development. This limited his verbal interactions with his group members. The fact that Yi-Shen was an ELL student lowered his

status in the group because of the language barrier. However, Yi-Shen had a deep understanding of the mathematics content and Wendy was very much aware that Yi-Shen's participation, demonstrated by his building with the Lab Gear, was for the benefit of his group members and not himself. The fact that Wendy could interpret this groups' interactions in terms of status modeled for the teacher candidates how she understood their participation as a function of status.

By the third MFE observation, the candidates were taking up the language of status and beginning to identify students who demonstrated different types of status such as high or low status, and differentiating between peer status and academic status. Once the teacher candidates became comfortable with the concept of status and had opportunities to see how status impacted student participation in the groups, the teacher candidates began to notice particular factors that influenced participation in groupwork. For example, they began noticing that when Ss worked with different groups, their status shifted depending on who they were working with. They also began to notice how some ELL students were positioned as high academic status relative to their peers but low social status due to the language barrier.

The teacher candidates also noticed how some teacher moves directly impacted status and participation. Subtle teacher moves such as repositioning the materials to the middle of the table so all students could see them were noticed during the observations. Interns also noticed when the partner teacher would publicly assign a student competence through a verbal comment either in the small group or to the whole class, such as when a student presented their solution to the class.

Not only did the teacher candidates notice, or become aware, of status in groups, they also began attempts to interpret group interactions using their new lens of status. During the fifth MFE observation, Neal shared the following comment on the online post-MFE reflection:

I saw a student, who was usually on the fringes of the group, become the leader and the champion today. He seemed to have learned by watching and copying, all that he needed to know in order to teach the other members of the group. Usually the group was Tyrus, Ara, Mira, and Ayesha. Ayesha and Mira were both absent. Also there was a new girl named Claire. I think that the reason Tyrus was so empowered was because he was now the fastest and most correct student at the group. This made me think about some of the readings and how they addressed group structure and status. Usually Tyrus has low status in the group and today he did not. This really made him have to think about what he was doing, because he was explaining it to other students. What surprised me was that he didn't just tell the other students what the right answer was, he explained very carefully what to do and why to do it. (*Neal, MFE #5 reflection*)

Neal noticed how Tyrus' status shifted in this new group to the person with high academic status because he was perceived to be the person who was the "fastest and most correct student".

Although I don't know if this was how Neal was perceiving Tyrus or if Neal witnessed an interaction that led to make this claim with regard to how other students perceived Tyrus, it is important that Neal was attempting to link Tyrus' interactions in his group to his status in the group. This demonstrated that Neal was moving beyond simply noticing status to linking status to particular interactions and causes which revealed a deeper understanding of status.

Toward the end of the MFE observations, the teacher candidates also began to notice teacher moves that worked to shift status and participation. Teacher moves that were noticed by the teacher candidates included how the partner teachers limited the amount of Lab Gear students had access to in order to encourage students to share the Lab Gear and therefore interact around the Lab Gear; randomly changing groups frequently so that students had opportunities to work with several different students in the class; redirecting questions students asked back to the group in order to encourage students to use each other as mathematical resources; and requiring students to work interdependently in their groups by randomly selecting students to present the work of the group.

During the fifth MFE observation, Gretta observed Kahil working in a group with three other boys. Gretta noticed how the use of the Lab Gear provided Kahil access to the task and thus shifted his academic status in his group:

This week's observation was a great example of status shifting due to the alternate learning strategies that were used. Kahil has been in the group I observed that first two weeks. He barely said boo during that time, was hardly trying to do the work on his own, and barely made any contribution to the group in any work that they did. This week, however, was completely the opposite! He was very intently working the whole time with the tiles, trying to figure out the problem on his own. A few times Ramel (who was sitting next to him) actually said, "Kahil, help me." The boys from across the table were peeking at his tiles to see if he had gotten it yet. It was great to see this shift in status due to the introduction of manipulatives in this learning process. (*Gretta, MFE #5 reflection*)

Gretta not only noticed Kahil's status and was able to interpret his participation in terms of his status, but she was also able to connect Kahil's shift in status to a particular teacher move, the requirement that students use manipulatives to represent their thinking. Gretta's interpretation of Kahil's shift in status was that because Kahil could gain access to the mathematics through the Lab Gear, he was able to demonstrate his mathematical knowledge and thus change how the students in her group perceived him.

Across the span of the MFEs, the teacher candidates learned how to notice status, interpret status in relationship to students' varied participation, and link changes in status to particular teacher moves. The teacher candidates learned that participation was not static and related to students' personalities but rather participation was dynamic and impacted by a multitude of factors. They were able to link a student's status to specific instances or events prior to or during the lesson that influenced a student's status. Most importantly, the teacher candidates learned to recognize teacher moves, some of which were subtle or indirect, that shifted students' status and opened up opportunities to participate. Some of the teacher candidates identified these practices as those they wanted to bring into their teaching practice.

Manipulatives in the Mathematics Classroom: Conceptual Tool or Crutch?

Using manipulatives in mathematics has become almost doctrine with respect to “good” teaching practice. Many current mathematics curricula include activities using manipulatives whether it is flip chips for finding differences of integers or dice for finding probabilities of events. Although some research has found that teachers may use manipulatives as a “fun” kinesthetic activity with little attention to the mathematics (Moyer, 2001) or students may learn to use manipulatives in a rote manner (Hiebert & Wearne, 1992), other research has found that when teachers make direct links between the abstract and concrete representations of mathematical concepts, students’ mathematics achievement may increase and students’ attitudes toward mathematics may improve (Sowell, 1989). Mathematics education researchers have also warned of the danger in proceduralizing the use of concrete models (Chappell & Strutchens, 2001) and that too-common belief that mathematical knowledge will “magically” arise from the use of manipulatives (Ball, 1992). The use of manipulatives can be an effective tool for supporting students in making mathematical connections but it won’t support student learning on its own. The teacher plays an important role in helping students link visual representation to abstract concept through their implementation of manipulatives in the classroom.

Manipulatives fall under a broader category of mathematical representations. Brenner and colleagues (Brenner, et al., 1997) argue that because algebra is a gatekeeper, especially for marginalized populations of students, multiple representations can provide students additional opportunities to gain access to abstract algebraic concepts. In their study, they found that students who learned about functions in a unit that emphasized multiple representations were more successful in representing and solving word problems. I contend that the use of multiple representations, including manipulatives, in a mathematics classroom is an equitable teaching

practice when all students are provided opportunities to make connections between representations or concrete models and symbolic representations. If teachers can support students in building concepts through representations and avoid procedural manipulation, this practice can provide students access to mathematical relationships they might not otherwise gain.

Lab Gear in the Clark High School Mathematics Classrooms. The partner teachers at Clark HS used Lab Gear to teach concepts such as the distributive property, solving linear equations, combining “like” terms, and factoring and solving quadratic functions including the “completing the square” method. It appeared that the Clark teachers used the Lab Gear for two different purposes. First, the Lab Gear was used to help students access algebra concepts from a visual standpoint, which helped them understand abstract concepts such as solving equations and factoring. For example, a common mistake students make in Algebra, when combining “like” terms is to combine $x^2 + x$ and get $3x$ for an answer. As Tanya and Zoe explained during the second MFE debrief, their students did not tend to make these mistakes because they were able to draw on visual representations as a way to understand why x^2 and x cannot be combined:

Tanya: And [the Lab Gear is] such a great tool. This is my first year using it – it is such a great tool for strengthening skills that they needed for the past couple units. So we have a kid holding an x -squared [piece] and they have an x [piece] and they go “SEE?” (pretending she is holding two tiles up, indicating they are different). So I feel like the more often we can get them with those in their hands, just the depth of that understanding. And as soon as we get into multiplying stuff out – I mean, that whole thing about “What do you combine?” and all that’s gonna come right back.

Zoe: It fixes all those common mistakes that I see my Honors Geometry kids make. This year in Algebra, Algebra 1 kids don’t make [those mistakes] when they are using Lab Gear because they know, like Tanya was just saying, you don’t combine an x -squared with an x . Those two are different sizes so x -squared plus x is not $3x$. (*MFE debrief, 4.16*)

The Lab Gear provided the Clark students another entry point into the mathematical concepts. For students that struggled with symbolic manipulation, the Lab Gear could be a geometric representation that was more accessible than memorizing rules.

A second purpose of the Lab Gear was to address issues of status in the mathematics classrooms. The Clark teachers acknowledged that students often entered their classrooms with narrow ideas about what it means to be good at mathematics. Typically this meant being good at memorizing procedures, solving problems quickly, and getting the correct answer. The Clark teachers used the Lab Gear to broaden students' ideas of what it meant to be good at mathematics in the Algebra 1 class. The partner teachers recognized that many students were able to access the mathematics concepts through the Lab Gear and some were particularly fluent with their use of the manipulatives. According to the partner teachers, these were often the same students who struggled with symbolic manipulation. The use of Lab Gear allowed the teachers to assign competence to the students who could solve the problems and explain their thinking through the Lab Gear. That is, the teachers were able to publicly acknowledge ways students were demonstrating their mathematical knowledge or skills, especially when students solved problems in non-traditional ways. Zoe addressed this during the MFE debrief where the teacher candidates observed the students making rectangles with the Lab Gear to represent the product of two polynomials:

They are making a lot of different types of rectangles, which I think is really interesting. It's cool to see how you can solve the same problem in a bunch of different ways. So that makes it really easy to assign status to the students who are not as familiar with the math and don't line it up the way *we* think to line it up. They do it in a really creative way and it's cool to say, "Look how Savannah is doing it! She has her yellow pieces over in the corner. Is that the same thing?" and it's provided really interesting conversation in table groups as I've been walking around. (*Zoe, MFE debrief, 4.16*)

The teachers recognized that by providing multiple ways for their students to demonstrate their understanding, they had additional opportunities to assign competence to students, which worked to shift the students' status in the class or small group. Wendy discussed how the use of Lab Gear in her math classroom "flipped the status":

And I don't know, you guys haven't really hashed it out yet but we use Lab Gear to solve equations. It really just flipped the status in our classrooms about who was good at math and who could achieve math. So I've got students who say, "I'm not really good at math and I really get this stuff." (*Wendy, MFE debrief, 4.6*)

The partner teachers argued that because the Lab Gear allowed a broader range of students to demonstrate their understanding of mathematical ideas, they were then able to more effectively address status issues in their classrooms.

Initially, the teacher candidates were interested in the teachers' use of the Lab Gear and recognized how the Lab Gear helped students communicate ideas by using "the pieces to visually show the others what they were thinking, especially at times when words wouldn't have been as clear" (*David, MFE #2 reflection*). This became particularly salient during the second MFE observation, which happened to fall on a day when many of the Clark HS students were observing the "Day of Silence". During this day, students took a vow of silence to bring awareness to bullying and harassment of LGBT²⁸ students. Because some of the students were not talking during class that day, they used the Lab Gear to speak for them. Kelsey noted:

One of the girls, Jazarah, in my group was silent and this created an interesting dynamic within the group. I bring this up because I noticed how the Lab Gear facilitated her efforts at communicating with her group members even more than if she had been speaking. She seemed to hold high academic status within the group so the members would often ask her for help. I could see that she was trying to organize her thoughts in a way that she could communicate them through the blocks and writing. She always started with the blocks and only if she couldn't get her point across, would she write something down. The fact that she wasn't talking just intensified the usefulness of the blocks. (*Kelsey, MFE #2 reflection*)

Although some teacher candidates were able to identify several advantages to using the Lab Gear, they also questioned the students' seeming dependency on the manipulatives, as revealed by Luke's post-MFE #2 reflection:

²⁸ LGBT stands for Lesbian, Gay, Bisexual, and Transgender. For more information on the Day of Silence, please see dayofsilence.org.

The Lab Gear is obviously a very powerful tool for these students to be using and I saw an impact of it on their understanding. I have to remind my self sometimes that these students are just learning these concepts and are bound to struggle with them a little. With that in mind I tried to focus on the positives of the Lab Gear and how it was used in my group...I have one burning question about the Lab Gear, though. How are [the teachers] going to make the ideas more abstract when it seems the students are relying on the Lab Gear so much throughout the activities? *(Luke, MFE #2 reflection)*

Luke acknowledged that the Lab Gear was useful during the groupwork and, at the same time, he thought the students were depending on the manipulatives too much and wondered how they would be able to solve problems abstractly, without the use of the Lab Gear as a tool. Cassie also felt the students were relying too heavily on the Lab Gear and identified students' use of the Lab Gear as a "crutch", similar to using a calculator to solve problems:

I have seen students relying on calculators for the answer and missing the mathematics concept. In Friday's observation, the students' use of manipulatives allowed them to extend their thought on particular problems. Students who used the blocks were able to solve problems and then discuss their reasoning. The reasoning however, was geometric. I wonder how this will translate to their understanding of the underlying algebraic principles being modeled. *(Cassie, MFE #2 reflection)*

What is revealed in these two teacher candidates' reflections is how their own definition of "doing mathematics" conflicted with the partner teachers' definitions of doing mathematics. I argue that the teacher candidates questioned the students' use of the Lab Gear because their definition of "doing math" was strongly related to their own experiences mathematics in school: abstract manipulations of symbols. Cassie and Luke acknowledged that the Lab Gear could support a certain type of mathematical understanding but, in their opinion, students weren't really doing mathematics until they could "abstractly" solve the problems, without the use of the Lab Gear. For Luke and Cassie, the students weren't really doing mathematics with the Lab Gear and they wanted to know when it would be taken away.

During the third MFE observation (4.23) where teacher candidates again observed the students working on mathematical concepts using the Lab Gear, the issue of taking away the Lab Gear was brought up by the teacher candidates during the debrief. Teacher candidates were asked to first share an observation that related to the Question of the Week on the syllabus and then pose a question to the partner teachers. The partner teachers agreed to listen to all of the observations and questions before responding. During the sharing out, four of the teacher candidates asked the partner teachers either when or how they would “take the blocks away.” This was in addition to two other teacher candidates who posed the same questions in their post-MFE reflections from the second observation.

In response to this question, Vanessa explained how the Algebra 1 students, who were typically students who had previously struggled with mathematics, were able to gain access to the ideas through the Lab Gear. She also pushed the idea that the issue the teacher candidates were having with the Lab Gear stemmed from their own narrowly defined ways of doing mathematics:

But the fact that they are using the Lab Gear more than they have in a really long time, at least in my classes, it's been amazing. We are fully encouraging that. Because, like in the past when we were solving equations, some [students] would use the lab gear and some wouldn't. And here everybody has their hands on it all the time. It flips status around in ways nothing else that I have seen does. So if it seems like it might be a more basic tool, or whatever – like *we* feel like they need to move away from Lab Gear – that's just us. That's not them. They have no need to move away from Lab Gear. So I think we need to put those needs, our motivations to the side, and allow these kids who have not engaged with math really step up and feel empowered in a way they never have before. And so I think that is why we are OK sticking with the blocks for a while. (*Vanessa, MFE debrief, 4.27*)

Vanessa defended the teachers' use of the Lab Gear and encouraged the teacher candidates to consider their own needs for students to move away from the manipulatives versus how that might benefit (or not) students.

In the post-MFE reflection, a few teacher candidates acknowledged that, because the partner teachers had used Lab Gear with success in past years, they must have good reasons for not rushing the students toward solving the problems without the Lab Gear. However, two teacher candidates remained skeptical. In fact, Luke wrote the following for his post-MFE reflection that evening:

I want to leave everybody with a thought-provoking question. I have heard from multiple people in my cohort that they are frustrated about student dependence on Lab Gear. We can't ignore that Lab Gear is helping students understand with connections between second order polynomials and their factors. Now we must ask ourselves, "Is there an activity we could develop with will enable students to use tools such as Lab Gear and not become so dependent upon them?" (*Luke, MFE #3 reflection*)

Upon reading this posting, Savannah posted three questions for the teacher candidates to consider as a way to continue the conversation about using manipulatives in a mathematics classroom. Savannah asked:

- 1) When should we use manipulatives in math class?
- 2) What is the benefit of using them, in this case, and perhaps in others?
- 3) Why do we think students should move away from them?

Savannah encouraged the teacher candidates to respond to these questions. Mei responded to the third question by explaining that if students don't move away from using manipulatives, they will "become reluctant to find out the connections between models and concepts which will cause them to solve equations without a good understanding." Based on her response, and the response of others, it appeared that the teacher candidates were concerned students were not making connections between the geometric and symbolic representations and that this connection would not happen unless the Lab Gear was taken away.

However, not all teacher candidates viewed the Lab Gear "dependency" as a problem. Bree responded to Savannah's third question by stating:

I thought it was interesting that Wendy made reference to upper-level students still making connections to Lab Gear even after a couple of years of being dependent on it. It really makes you consider how the role of manipulative can change as a student's thinking evolves. I felt that the teachers were confident that when the student's were ready to move on to more challenging concepts, they would be able to make the transition away from the Lab Gear without much trouble. (*Bree, MFE #3 reflection*)

A few other teacher candidates expressed opinions similar Bree's view of the Lab Gear. Neal questioned why emphasis is so often placed on manipulating numbers and wondered if there was such a thing as a wrong way to solve a mathematics problem. He questioned whether the Lab Gear should ever be taken away.

By the 6th MFE observation, the teacher candidates who originally questioned the use of Lab Gear began to see how students independently transitioned from using the Lab Gear to drawing pictures of the Lab Gear, to being able to manipulate the symbols without the use of the manipulatives. The activity during the 4th MFE observation was for students to represent the product of two polynomials by drawing the Lab Gear onto their paper. Students were able to actually build the rectangles with the Lab Gear but their final product was the drawing of the Lab Gear pieces. During the 5th observation (5.4), a week later, the students had been introduced to "generic" rectangles. These were essentially rectangles that more abstractly represented the product of two polynomials. Unlike the Lab Gear or the Lab Gear drawings, these rectangles were all the same size but students inferred that the lengths, represented by the polynomials, were different. For example, the product $(x+2)(x+3)$ could be represented in a generic rectangle as shown in Figure 7.1, where students are required to divide up the rectangle based on the lengths of the sides (the products). During the 6th observation, students in Tanya's class were introduced to an "x-puzzle" which was used to help students factor trinomials. The x-puzzle did not have a connection to the rectangle representation except that it was simply a procedure for find the coefficients of the factors of the trinomial expressions. Over the course of five weeks,

the partner teachers provided opportunities for the students to shift from using a concrete object to representing the manipulatives abstractly using generic rectangles, to using an efficient procedure to factor and multiply polynomial expressions.

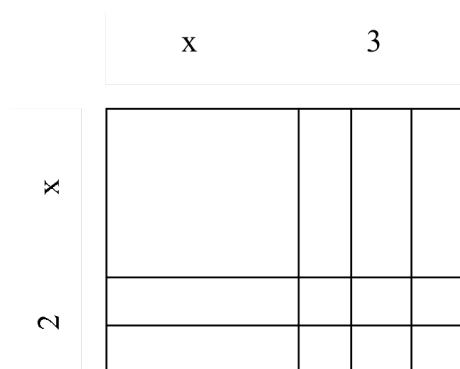


Figure 7.1: A generic rectangle showing the product $(x+2)(x+3)$

During the 7th and final observation, Ingrid acknowledged that the students she observed were now able to make deep mathematical connections without using the Lab Gear and realized that she may not have come to this conclusion had she not spent six consecutive weeks in the Clark HS mathematics classrooms:

When we began our observations at Clark HS I had reservations about Lab Gear. A little part of me felt that these tiles would become a crutch that students would not be able to give up. I also thought that maybe keeping learning so concrete, students may have trouble abstracting in the future. However, I was totally wrong. Today I was able to see, on more than one occasion, that students were not using Lab Gear and were making connections without being told what to do. I am sure that their understanding of factoring is much deeper than mine was at their level. I am so happy that I got to observe the whole span of learning within the same class. *(Ingrid, MFE #7 reflection)*

Ingrid alludes to the structural aspects of the MFE that supported her own learning and development across the six-week span of the MFE observation. In the next section, I explain how two structures of the MFE, namely the multiple visits to the Clark HS classrooms over a prolonged time period and focused debriefing sessions with the partner teachers and university instructors, supported teacher candidates in learning how the Lab Gear supported students'

understanding of mathematical concepts and how the Lab Gear was used to broaden students' notion of "doing math".

Observing students over time. Because the MFE was held on an almost-weekly basis over a six-week period, the teacher candidates were able to observe how the teachers use the Lab Gear in ways that developed mathematical understanding and notions of competence. By observing students over multiple weeks, the teacher candidates' broad generalizations about the relationship between teaching and learning in the Clark mathematics classrooms were often challenged.

There is a tendency to over-generalize based on a single observation and teacher candidates are particularly susceptible to this given their lack of prolonged experience in the classroom. In fact, the initial post-MFE reflections revealed over-generalizations made by the teacher candidates. However, because the teacher candidates returned the next week to observe again, often times their assumptions about how students interacted, how they worked, and what they understood about the mathematics were disrupted.

Being able to observe the same students over time allowed the teacher candidates to learn how students, with particular histories and experiences, went about making sense of mathematical ideas with this particular manipulative. Had the teacher candidates only spent one or two weeks in the Clark classrooms, they may have walked away believing that Lab Gear was similar to a calculator and that it was a tool that should only be used to introduce a concept but should be removed from the students as soon as possible, for fear of it becoming a "crutch". However, because the teacher candidates were able to observe over the span of several more weeks, they were able to see how the Clark teachers progressively supported the students in transitioning from concrete models, to visual representations, to more abstract procedures. They

were also able to observe how the students developed connections between the geometric representation and the algebraic representation and how this connection supported their transition to their facility with the abstract procedure using the “x-puzzle”. I hypothesize that some candidates may have dismissed tools such as Lab Gear altogether had they only observed in the classroom a few times. However, because the MFE was held across multiple weeks, the teacher candidates had time to observe a process of student learning unfold.

Observing the same students over time also allowed the teacher candidates to examine how the partner teacher used the Lab Gear as a way to broaden students’ understanding of mathematical competence in their classrooms, thus opening up more ways for students to be “smart” in mathematics. The students in the Clark HS mathematics classrooms were students who typically struggled in mathematics. They were also in a school where, because of the tracking associated with the Accelerated Learning Program, they were placed into the lowest-tracked mathematics course. In addition, African-American students were over-represented in these classes. The teacher candidates observed students who typically struggled with symbolic manipulation yet had facility with the Lab Gear. The partner teachers were able to use the Lab Gear to support mathematical justification between students, provide students with additional ways to access the content, and encourage students to use each other as mathematical resources during the small groupwork. The teacher candidates took notice of many of these uses of the Lab Gear. In one example taken from an interview with Hannah, she relates an event she observed with a female student who was a recent immigrant and spoke very little English:

...what I know about Ling is that it felt like the [Lab Gear] gave her a potential way to have been more involved in the classroom... I saw there was a lot of potential just because of that one day I observed what happened when they all work[ed together]. Because she became really an equal partner and they were really engaging her ideas. When she would move tiles around and try a new thing – you know she had her hands on the tiles as much as anybody else. (*Hannah, Interview 2*)

Hannah, as well as some of the other teacher candidates, were able to recognize that the Lab Gear provided additional opportunities for students to participate in the mathematics. For students like Ling who are often marginalized in groupwork because of language barriers, the Lab Gear provided a way for Ling to actively participate. The Lab Gear also provided the partner teachers opportunities to assign competence to students like Ling. As the candidates observed during the six-week period, they were provided opportunities to notice, interpret, and learn about ways Lab Gear can support students' success in mathematics.

Understanding students through the lens of the partner teachers. Typically during field experiences, teacher candidates are placed into mentor teachers' classrooms where the mentor is expected to "train" the teacher candidate in addition to her regular teaching responsibilities. Finding time to critically examine and debrief a lesson can be hard to come by. Yet, teacher candidates need access to the ways in which their mentor teachers notice, interpret, and act on teaching events in the classroom. The MFE debrief provided a space in which the teacher candidates could actively engage with the partner teachers about their students, their teaching practice, and the relationship between the two.

The Clark HS partner teachers were particularly eloquent in their ability to justify their teaching approach in ways that related to equity in the classroom and the use of Lab Gear was no exception. It was also common practice to discuss teaching moves in the context of particular students in the classroom. This allowed the teacher candidates to develop their understanding of the relationship between students, teaching practice, and learning. Different from the candidates watching a video of classroom practice where little is known about the students or why teachers made particular moves, the teacher candidates were able to draw on the partner teachers'

knowledge of practice and students. One of the teacher candidates, Emma, spoke of how being able to talk with the partner teachers made the student “a real student”:

Emma: I think it helps make the student a real student when you can ask history questions about them. Instead of – when you see a video in any teaching class, I feel like there is always this stereotypical kid and the kid ends up falling into the stereotype – oh, he’s the kid in the group who isn’t paying attention...but when you can ask the teacher “Why do you think they weren’t focused today?” and you can actually get a story about why they are that way, it helps me, as a future teacher, remember that there always is a story there. (*Group Interview, 4.27*)

By observing the same students over an extended period of time, and with the histories of the students provided by the partner teachers, the teacher candidates were able to get to know the students, both socially and academically. That is, they were provided opportunities to closely examine S-S and T→S-M interactions. Even though the teacher candidates’ interactions with the students were limited, they were able to come to understand the particular histories and experiences of each student through the partner teacher debrief. After each observation, the teacher candidates were able to ask the partner teachers questions about what they observed. Often times the partner teachers would respond to the teacher candidates’ questions by situating their response in the context of a particular student. For example, one of the teacher candidates, Kelsey, observed a female student who seemed to have a fairly deep understanding of the material yet she was reluctant to share her thinking with her group. During the debrief, Kelsey asked Tanya how to push students, like this female student, to explain their thinking. Tanya responded:

Jazarah is a student who has only been in my class since second semester so really, I’ve only had her for 3 weeks...And she’s also a high-needs student mentally – she is pretty fragile...I push really gently with Jazarah. Whatever Jazarah gives me – it’s all good because she is passing. She’s doing a lot of positive things right now in my class...So, I am good with Jazarah today. I hope in two weeks it’ll be different. (*Tanya, MFE debrief, 4.23*)

By sharing her knowledge about this student, Tanya supported the teacher candidates in learning how to make sense of classroom events, and decisions teachers must make, based on what the teacher knows about the students. Later, during a group interview with the teacher candidates, Kelsey used this example to explain how getting to know the students is so important:

Kelsey: So I asked Tanya, “How do you get a kid who obviously knows something [about the mathematics] to share that with her classmates?” And Tanya said, “Oh no, you can’t push this girl, she is really fragile.” It was interesting for me because you really don’t know as much about these students as you think you might from the little bit of interaction we’ve had with them. It takes a lot of time to get to know and understand them and you have to know these things. (*Group Interview, 4.27*)

By observing students and learning about their histories and experiences, the teacher candidates were able to develop their understanding of teaching in relation to the students in the classroom; they were able to see the relational aspects of teaching mathematics to high school students.

Hannah succinctly identifies what she learned in an assignment:

I used to think about my teaching in isolation from my students (i.e. I give a lesson, students do the work, I grade it and pass it back.) Now I see that teaching and learning are intimately intertwined. (*Hannah, Field Assignment*)

Hannah’s statement about what she learned during the MFE reflects how the MFE provided the teacher candidates opportunities to situate their knowledge of learning and teaching in relation to the students at Clark high school. Hannah learned that teaching is, in fact, an interactive and responsive process, something that is not conducted *by* the teacher but enacted *with* the students. Through observations of students who were learning mathematics in classrooms with reform practices such as attending to status and using mathematical representations, the teacher candidates were able to see how teaching mathematics involves not only the teacher’s understanding of the content to be taught but also an deep understanding of the students in the classroom.

Chapter 8

Bridging the Coursework-Fieldwork Gap in Teacher Education

In this chapter, I begin by reviewing the intention of this study. I then situate the major findings, which were discussed in Chapters 5 through 7, within the framework of the MFE as an activity system. I describe how the MFE attempts to address the contradictions present in a traditional field experience by attending to particular elements of an activity system. I then offer a discussion of the limitations of this study. I conclude with implications for future research and implication for practice in teacher education.

In the opening chapter of this dissertation, I identified a critical problem in teacher education, the coursework-fieldwork gap, and how this gap potentially limits novice teachers' ability to implement equity-oriented teaching practices in their classrooms. I argued that, in mathematics education where severe differences in achievement exist between students of color and students of poverty and their white, middle-class counterparts, supporting teachers in learning to meet the needs of all of their students was of paramount importance.

The research literature surrounding the coursework-fieldwork gap revealed three structural and epistemological constructions of university-based teacher education that contribute to the gap: The acquire-apply structure teacher education; the marginalization of practitioner knowledge; and the inability to shift teacher candidates' frames of reference for what it means to teach and learn. The literature also revealed that a common solution to the coursework-fieldwork gap is to increasingly move teacher education into schools. However, I argued that little research reveals how particular structures in field-based teacher education support teacher candidates in learning equity-oriented teaching practice.

The Mediated Field Experience was a model that was designed to bridge the gap between coursework and fieldwork while attending to practices that promote equity in the classroom. I

set forth a series of questions to examine this structure as a way to extend the literature base regarding field-based teacher education practices that provide teacher candidates opportunities to learn equity-oriented teaching practices. I began by examining the structures and activities of the MFE and the roles the participants took on during the MFE. I examined the experiences of the teacher candidates in the MFE and how their experiences related to the structures and activities of the MFE. I also examined what the teacher candidates learned about equity-oriented teaching practices in mathematics and how their opportunities to learn were related to the structures and activities of the MFE. I now turn the discussion toward the MFE as an activity system and how the MFE worked to address the contradictions in the system, thereby bridging the coursework-fieldwork gap in teacher education.

The Mediated Field Experience: Teacher Candidate Learning as the Object of Activity

In this study, I conceptualized the places in which learning to teach takes place as activity systems. Drawing on Cultural-Historical Activity Theory (CHAT), I framed a field experience as an activity system where the object of activity is intended to be teacher candidate learning. However, I make the argument that, because of particular structural and conceptual aspects of typical field experiences, such as the acquire-apply structure of teacher education and the marginalization of teacher knowledge, the object of the system is not teacher candidate learning as intended. Using Engeström's (2001) conception of *contradictions* in activity systems, I argued that fundamental problems in the coursework-fieldwork gap in teacher education result in these contradictions. Contradictions, such as the uneven division of labor and a community membership that lacks the necessary participants to support learning, work to shift the object of learning away from teacher candidate learning, contributing to the coursework-fieldwork gap.

In this dissertation, I contend that the Mediated Field Experience is an activity system that works to address particular contradictions, enabling teacher candidate learning to become the object of activity. At its inception, the MFE was created to address the problematic ways teacher candidates were taking equity practices into their classrooms (Nolen, et al., 2008). As Engestrom (2001) states, when people are able to come together around a *learning challenge*, “to acquire a new way of working” in which participants from different activity systems make “sideways moves” or alternative conceptualizations to the structural tension in the systems, the contradiction can be resolved. Engestrom further states that the object cannot be realized through individuals acting independently in the different activity settings and adopting some new skill or set of knowledge, which is what often happens independently in university coursework or field experiences. The issue can only be resolved through involving all participants in presenting alternative conceptualizations to the contradiction.

My analysis of what and how teacher candidates learned through their participation in the MFE focused on how activities (observation protocol, assignments, discussions) and structures (observation, debrief session, online teacher candidate reflection) shaped participation within the interacting activity systems and how opportunities to learn became transformed based on participation (McDonald, et al., 2011). In addition, my analysis focused on the ways in which the MFE held teacher candidate learning as the object.

In order to demonstrate how the MFE worked to address particular learning challenges related to the coursework-fieldwork gap, I map the outcomes of this dissertation, namely the structures and activities of the MFE that provided the teacher candidates opportunities to learn about equity-oriented teaching practices, onto the relational elements of the activity triangle (see Figure 8.1). I explain how the MFE worked to address the three problems in teacher education I

described in Chapter 1: The acquire-apply problem, the marginalization of practitioner knowledge problem, and the frames of reference for teaching and learning problem.

The Acquire-Apply Problem. In traditional university-based teacher education, teacher candidates are expected to acquire knowledge in the university and apply it in the field. It is left up to the candidate to mediate their own learning across these two contexts. This becomes particularly problematic when the two contexts present conflicting visions for what it means to teach and learn mathematics. In addition, novices cannot be expected to effectively navigate such complex terrain.

The Mediated Field Experience attempted to do the work of mediating teacher candidate learning across their university coursework experiences and their field experience at Clark HS. The pedagogical focus on Complex Instruction (Cohen, 1994) and equity-oriented teaching practices in mathematics was present in both the methods course and the Clark HS classrooms. The alignment between the practices the teacher candidates were learning about in the methods course and the enactment of these practices in the Clark HS mathematics classrooms provided the teacher candidates opportunities to make sense of these practices. This was particularly evident in the first few MFEs when the teacher candidates were beginning to learn about status and how it can afford or limit students' opportunities to participate, and thus learn, mathematics in groups. After the first MFE observation, the teacher candidates analyzed student interactions by attending to what they felt were particular personality traits that explained how the students participated unequally in groups. In the methods course, they learned about status, its theoretical underpinnings, and how status might interfere with students' opportunities to learn. Following this methods course discussion, the teacher candidates went back to the Clark HS classroom

armed with an activity that required the teacher candidates to attend to variation in student participation.

As evidenced in the post-MFE reflections, the teacher candidates began to re-interpret student interactions not as a function of personality traits but as a function of students' perceptions of competence of themselves and of other and how these perceptions limited or afforded participation. The discussion provided by the partner teachers supported this re-interpretation because the partner teachers modeled how they interpreted particular student-student interactions in groupwork by using status as their lens. Because of the pedagogical alignment between the university methods course and the Clark HS mathematics classrooms, the teacher candidates had opportunities to make sense of ideas they learned in the methods course through their observations in the Clark HS classrooms. Likewise, they were able to take events they observed in the Clark HS mathematics classrooms and analyze them in the context of the university methods course. The structures of the MFE, namely the planning, observation, debrief, and reflection, and the fact that the MFE took place in a cyclical nature across a six-week period, also supported their ability to carry ideas between contexts. The alignment between the two learning-to-teach settings and the structure of the MFE allowed the teacher candidates to connect their learning across the two settings, even reaching beyond the two settings and into other field experiences and other university coursework.

The alignment between the methods course and the Clark HS classrooms addresses the contradiction between the community, division of labor and object in the activity system. The community is implicitly and explicitly organized by a division of labor, which then transforms the object into the outcome (Roth & Lee, 2007). By including those responsible for supporting teacher candidates as they learn to teach, namely the university instructors and the partner

teachers, the division of labor became more evenly distributed across the two systems which provided the teacher candidates access to both university and practitioner knowledge. The partner teachers were knowledgeable and had access to the pedagogical focus of the methods course. Most of the partner teachers were graduates of the university teacher education program and all of the partner teachers had participated in professional development geared toward Complex Instruction and equity-oriented teaching practices in mathematics. Likewise, the university instructors also had knowledge of the kinds of practices the partner teachers implemented in their classrooms. Prior to teaching the methods course, Savannah had spent a quarter as a teaching assistant in the methods course, observing in both Wendy and Vanessa's classrooms. In addition, she was also conducting a separate study in Wendy's classroom and had supervised a student teacher in Tanya's classroom. These opportunities provided Savannah, the lead methods instructor, with valuable knowledge about the partner teachers' practices in mathematics. Because the partner teachers and the university instructors had knowledge of the others' context, they were better able to connect the learning trajectories of the teacher candidates as they moved back and forth between the university methods course and the Clark HS teachers' classrooms.

The Marginalization of Teacher Knowledge Problem. The research literature reveals ways in which practicing teacher knowledge becomes marginalized in traditional teacher education structures. When teacher candidates are placed in mentor teachers' classrooms for field experiences, often times the mentor teacher is not released from any of her regular teaching responsibilities to accommodate the additional responsibility of mentoring an student teacher or teacher candidate. In this situation, what the candidate learns may be haphazard and dictated by what the teacher candidate attends to and what the mentor teacher surfaces for the candidate.

Although the teacher candidate and the mentor teacher may be expected to plan, teach, and reflect together, often little time is provided for this important work.

The structures and activities of the MFE attempted to mediate teacher candidate learning by positioning the partner teachers as teacher educators. By partnering with teachers who shared a pedagogical focus of the methods course and could speak to both the theoretical and practical underpinnings of their pedagogical decisions, the teacher candidates were provided access to both academic and practitioner knowledge. In addition, specific time was set aside, outside of the partner teachers' responsibilities of teaching their Algebra students, to debrief the observation. This allowed the partner teachers to go about their work of teaching students Algebra but also deeply engage in the work of supporting teacher candidates as they learn to teach. The partner teachers were also compensated for their time, which signaled respect for the professional contribution of their work in the MFE.

Because the partner teachers and university instructors were included in the community of the MFE as an activity system, this mediated the division of labor by positioning the partner teachers as teacher educators. The fact that the responsibility to educate teacher candidates was more evenly distributed across both university instructors and partner teachers allowed the outcome of the activity to be teacher candidate learning.

The Problem of Shifting Teacher Interns' Frames of Reference. Mary Kennedy (1991) argued that if teaching practice in schools is to be reformed in any meaningful way, it is the work of teacher education to shift teacher candidates' frames of reference for what it means to teach and learn. When teacher candidates draw on their own experiences in schooling to make sense of how to go about teaching (Lortie, 1975), opportunities to reform teaching practice are limited. Research as shown that one way to shift teacher candidates' frames of reference is to

provide teacher candidates opportunities to engage with teachers who are themselves questioning and critically examining their own practice, what Cochran-Smith calls Teaching Against the Grain (1991, 2004).

The Clark HS teachers were teaching against the grain (see Chapter 2). They were aware of the social, political, and historical context of teaching in a school that served both “neighborhood” students, mostly students of color and students impacted by poverty, and also students who were bussed to the school from more affluent parts of the city as part of the Accelerated Learning Program. The Clark HS teachers participated in a Collaborative Planning Period where they collectively addressed problems of practice related to supporting their Algebra 1 students, most of whom came to their classrooms with self-perceptions of low competence based on their prior mathematics experiences.

By bringing together the Clark HS partner teachers and the teacher candidates in a field experiences structured around supporting teacher candidates to notice and interpret equity-oriented teaching practices, I contend that the teacher candidates were able to make shifts in the way they understood what it meant to teach and learn mathematics. This was evident in the progression of how the teacher candidates came to understand the partner teachers’ use of Lab Gear in the classroom, not as a “crutch”, but as an equity-oriented practice that provided more students opportunities to participate and learn mathematics, as discussed in Chapter 7.

It was also evident in the teacher candidates’ ability to notice links between teacher moves, student-student interactions, and how the students used their interactions to gain access to mathematical ideas (the $T \rightarrow S-S \rightarrow M$ interaction). By noticing how the partner teachers constructed learning opportunities that engaged students in participation in their learning, they

came to understand learning mathematics as something that cannot be given to students from the teacher. On her final MFE post-observation reflection, Gretta wrote the following:

It was great to see and hear the learning happening today. The conversation was definitely aiding in the learning of math. Where students may have become frustrated, they did not because they either knew the others were struggling with the same thing, and they worked through it together, or one of them understood it and could help the others through it. One of the best moments of the day was, after seeing the frustration, then group collaboration, hearing the “Oh! I get it now!!” (*Gretta, MFE reflection #7*)

By attending to the linking between Teacher, Student, and Mathematics, and how interactions between students mediated their understanding of mathematics, the teacher candidates came to see learning mathematics as a participatory endeavor rather than a transfer of ideas from the teacher to the student.

The Value of Cultural-Historical Activity Theory in Studying Teacher Learning

In my research into the structures and activities of the MFE, CHAT became a useful tool for studying teacher learning. Because I chose to examine teacher learning within the MFE and made this my unit of analysis, the theoretical framework of CHAT provided a way to take into account the complex and often messy historical and cultural tools and practices that shaped participation within the MFE. Rather than examining an individual and his or her appropriation of tools, I was able to expand my view of the phenomenon of learning to include the complicated and multiple activity systems in which teachers learn to teach and how these systems interact in ways that might support or limit learning. That is, I was able to pay attention to the social organization of the MFE, how it evolved over time and how the object of the activity system, teacher candidate learning, was impacted by social, cultural, and historical elements of activity systems such as university coursework and field experiences.

Teacher education itself has a long and enduring history and it has evolved over time by people making local changes that have led to systematic cultural shifts. This can be seen in the

increasing movement toward practice-based teacher education. The use of CHAT in this study allowed me to examine a local shift in the cultural practice of learning to teach. The study itself is my attempt to connect these local changes to broader conceptualizations of teacher education. By employing CHAT to examine teacher candidate learning, I was able to identify specific structures and practices that supported their learning. This is what Ellis (2012) calls identifying “buds of development” and these are the buds that can lead to systematic cultural change in teacher education.

Engestrom’s notion of contradictions in activity systems offered me a way to see how various elements within the MFE, and also across activity systems such as university and field experiences, mediated teacher intern learning. What was most striking was how my conception of the coursework-fieldwork gap changed once I viewed it through the lens of CHAT. Whereas I had originally seen that gap as a misalignment between university and field conceptions of teaching and learning, I now see with more clarity the underlying power relationships that contribute to what Feiman-Nemser and Buchmann called the “cross-purposes pitfall” (1985).

By taking into account who does the work of teacher education and how the work gets done, or what is identified as the division of labor within an activity system, the marginalization of teacher knowledge reared its ugly head as a significant contradiction in the activity of learning to teach. At the same time, I was able to examine this particular aspect of the MFE. How was teacher knowledge privileged, if at all, in the MFE? How did the teacher candidates gain access to the critically important knowledge the Clark high school teachers possessed and how did access to this knowledge change the teacher candidates’ participation in the MFE? In essence, the use of CHAT allowed me to examine how one model of teacher education worked to resolve a contradiction in the learning-to-teach activity system, how the emergence of a new

form of social activity supported teacher candidate learning about equity-oriented teaching practices in mathematics.

Limitations of the Study

I now turn to a discussion on the limitations of this study. In any study, whether qualitative or quantitative, one can only address a limited range of questions. In this particular study, I was interested in the relationship between the structures and activities of the MFE and the experiences of the participants, especially the partner teachers and the teacher candidates. This necessarily limited my scope of study in several ways.

First, my analysis of the experiences of the partner teachers, teacher candidates, and university instructors is limited by the boundaries of the Mediated Field Experience and its related activities such as the methods course and other university coursework and field experiences that took place concurrently to the MFE. This study investigated the experiences of a single cohort of teacher candidates, their partner teachers in the MFE, and their university instructors in the methods course. This study does not generalize beyond the experiences of these participants. In fact, had I conducted this study with a different group of teacher candidates or partner teachers, I imagine the results of my study might have been quite different. However, the work of this study is not to make general claims about the effects of the MFE on teacher candidate learning. Because this study was conducted within the constructivist paradigm and aimed to examine not only human behavior but the intentions, motivations, values and beliefs behind that behavior (Plack, 2005) my generalizations are theoretical in nature. That is, because I am interested in the meaning individuals make of their experiences (Merriam, 1998) and because I take the view that knowledge is a process and not a single truth to be determined, the work of this study aims to further what we know about the phenomenon under study, in this case,

what it means to learn to teach mathematics with attention to equity. Rather than attending to the generalizability of a study, research in the constructivist paradigm addresses transferability, the “degree to which similarities exist between contexts that allow findings to be transferred from one situation to another” (Murphy et al., 1998 as cited in Plack, 2005). By providing extensive details of the partner teachers classrooms and teaching practices, the goals, structures, content and activities of the MFE, and the experiences of the participants, I attempted to provide sufficient details so as to enable readers to make judgments regarding the transferability to their own contexts and situations.

A second limitation also arises from the bounded nature of the study with regards to the Mediated Field Experience. Although I aimed to examine teacher candidate learning about equity-oriented teaching practices, I did not examine this learning beyond the boundaries of the MFE. For example, I did not continue to follow these teacher candidates into their student teaching experiences or first years of teaching to determine the extent to which they implemented the practices they learned in the MFE. I did not examine their abilities to enact practices beyond their experiences in the MFE. I also did not collect data on what the teacher candidates were learning in their other university coursework. Therefore, my claims about what and how the teacher candidates learned are limited to their experiences in the MFE and methods course. This particular limitation of the study leads to implications for future research, which I discuss next.

Implications for Future Research

This study offers many questions for educational researchers regarding how teacher candidates learn to teach mathematics with attention to equity. I began this work with the goal of adding to the literature base about the relationship between particular structures in field-based teacher education and teacher candidate learning. Although I feel as though I have certainly

added to the conversation regarding teacher candidate learning, I am also left with many questions.

In my review of the research literature, I found that the marginalization of partner teachers dramatically limited teacher candidates' opportunities to learn. This study reinforced my understanding of practicing teacher knowledge as a valuable resource for teacher candidate learning. I am convinced that the teacher candidates were significantly impacted by what they observed, and learned, in the Clark HS mathematics teachers' classrooms. However, because my study was bounded by the MFE, I was not able to come to know how those experiences impacted the teacher candidates' practice in their own classrooms. How do opportunities to gain access to teachers who are teaching against the grain support teacher candidates as they work to similarly "practicize theory" (Cochran-Smith & Lytle, 2009) in their own classrooms? I wonder what additional supports, if any, aside from field experiences that are strongly connected to coursework, are necessary for teacher candidates to engage in equity pedagogy during their first few years of teaching. Prior work has shown that teaching communities, such as the Collaborative Planning Period in which the Clark HS teachers participated, can support the development of ambitious pedagogy when conversations are focused on a critical examination of practice (Horn & Kane, 2012). As I come to the end of this study, I wonder if any of the teacher candidates have themselves become collaborative leaders in their schools or departments? Did their work with the partner teachers at Clark provide an image of how they might similarly engage with their colleagues? I wonder if there is a link between the teacher candidates' participation in conversations about equity, teaching, and learning during their teacher preparation and their similar efforts to continue these conversations in their own contexts.

Another line of research I was unable to follow during this study was the way in which the teacher candidates came to see student competence in mathematics. I noticed at the beginning of the MFE that many teacher candidates commonly focused on what the students didn't know or understand about the mathematics. The teacher candidates' descriptions of students was deficit-oriented, and when pressed to say what the students did understand, the teacher candidates struggled. I noticed that across the span of the MFE, the teacher candidates' language made a subtle shift away from deficit-oriented talk and toward competence-oriented talk. I wondered about the nature of this shift. Perhaps it was brought about through the constant focus on student understanding provided through the observation protocols. Or perhaps it was the way in which the partner teachers talked about their students. Often times, the partner teachers framed their students' struggles in mathematics as a result of their own struggle to find ways to support their students. For example, during the first MFE debrief, the teachers were asked to describe five students who struggled in their class for a variety of reasons. When Wendy described her students and how they struggled, in every single case she made mention of how she herself was struggling to find ways to support that student. Rather than finding reasons within the students for their lack of success, she framed it as her own struggle to find ways to support their learning. Perhaps the way in which the partner teachers talked about their students' strengths and their focus on finding ways to assign competence to their students supported the teacher candidates in re-framing how they looked at student learning in the classroom. This is a line of study I would like to pursue further.

Finally, this research revealed that the teacher candidates were provided multiple opportunities to notice particular aspects of teaching and learning that are often invisible to the novice's eye. As the MFE took place at the beginning of the teacher candidates' program, I am

left wondering how their experiences in the MFE, particularly how they were supported to attend to equity-oriented practices, supported their ability to notice in later field experiences. Does work around noticing instances of equity-oriented teaching and learning provide opportunities for teacher candidates to do this work “on their own” later in their practice? And what happens to their noticing when they are in classrooms that pedagogically conflict with the practices of the Clark HS teachers? One perennial difficulty in teacher education, and especially in mathematics, is finding classroom placements where teacher candidates have opportunities to observe equity-oriented practice. Would a structure like the MFE early in a teacher education program support teacher candidates in their ability to notice and interpret, with a lens on equity, in classrooms where equitable practices are not taking place? It is my goal to extend the research in this dissertation in order to examine these questions.

Implications for Practice

The mathematics methods instructors at this university teacher education program were fortunate that a trusting and mutually beneficial relationship had been established with the Clark HS mathematics teachers, which enabled the MFE to continue for as long as it has. However, in my new position as a teacher educator in a different community, I find myself struggling to form these same relationships with teachers in my surrounding area. The model of a Mediated Field Experience depends heavily on relationships between university instructors and classroom teachers and these relationships must often develop over time. However, the relationship between Lani Horn, the creator of the MFE, and the Clark HS mathematics teachers started from somewhere. That somewhere was a mutual need to learn from the other with a common interest in finding ways to help students be successful in mathematics. If university teacher educators and classroom teachers can establish that mutual need and common ground for inquiry,

opportunities similar to those in the MFE can be provided for teacher candidates. This is of particular importance as teacher education increasingly moves to the field.

One of the most significant hurdles to overcome in carrying out the MFE was the coordination and commitment required from the partner teachers and the university instructors. As a former instructor of the MFE, and also being present during the planning meeting for the MFE of this study, there are sacrifices both university instructors and partner teachers must make in order for the MFE to be carried out in any meaningful way. First, the university instructor must be willing to give up large portions of their coursework in favor of replacing that coursework by field experiences. There must be a trust that comes along with knowing that what the teacher candidates learn from their experiences in an MFE will just as significant, if not more significant, than what they learned in a university course divorced from real experiences with students. Partner teachers must be willing to have many adults observe their practice and they must be understanding of how to support their students in ways that allow them to be comfortable with being observed by many adults. Wendy and Tanya were particularly adept at talking with their students and explaining how the *students* were actually teaching the teacher candidates how to become effective teachers simply by talking with their groups about mathematics.

Lastly, research has shown that as university faculty move closer to the work of schools, their own status falls in relation to their peers. The structures of tenure and promotion in many research institutions do not allow university faculty to the work that is needed in schools. University instructors who wish to work closely with classroom teachers are often forced to sacrifice time typically dedicated to other interests such as research although some institutions seem to be changing their tenure and promotion criteria to support faculty who work closely with

schools (Ginsberg & Rhodes, 2003). As an institution, teacher education must find ways to support the work of university faculty to work closely with schools, teachers, and students. This might mean awarding additional credit hours to courses taught off campus or changing tenure and promotion to place an emphasis on fieldwork.

Conclusion

Research in teacher education has called for a closer examination of the structures in teacher preparation that make a difference in teacher candidate learning (Grossman, McDonald, Hammerness, & Ronfeldt, 2008; Zeichner, 2010). Research in mathematics education calls for more effective ways to support teachers to enact equity-oriented practices as a way to close the opportunity-to-learn gap (Esmonde, 2009; Flores, 2007; Gutierrez, 2002). This dissertation attempts to further these lines of study by examining a model of teacher education designed to support teacher candidates in learning what it means to teach mathematics for equity. It is my hope that this work reaches the hands of those who are also refining, experimenting, and innovating ways to create opportunities for new teachers to meet the needs of their students and become change agents in their schools as they work toward achieving equity.

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Appendix A: Timeline of the Mediated Field Experience

Week (month.day)	Mon	Tuesday	Wed	Thursday	Friday
4.29-4.2		University		University	
4.5-4.9		MFE #1 (4.6)		University	
4.12-4.16				University	MFE #2 (4.16)
4.19-4.23				University	MFE #3 (4.23)
4.26-4.30		MFE #4 (4.27)		University	
5.3-5.7 (Middle School Field Experience – No University Courses)		MFE #5 (5.4)			
5.10-5.14 (Middle School Field Experience – No University Courses)		MFE #6 (5.11)			MFE #7 (5.14)
5.17-5.21				University	
5.24-5.28		University		University	
5.31-6.4		University		University	

Appendix B: Participant Interview Protocols

Teacher Candidate Interview #1 Protocol

Teacher Interns:

Past

- Explain your experience as a student (especially mathematics) in high school and also in college.
- Why did you decide to become a mathematics teacher?
- What experience have you already had that might prepare you to be a mathematics teacher?
- What makes a good mathematics teacher?
- How do you think one learns to become a teacher?

Present

- What do you see as your role in the MFE? What do you think is expected of you?
- Tell me about something that resonated with you or was interesting to you during the first (two?) GHS observations. (What sense are they making of this idea/concept?)
- What are you learning from observing the teachers and students at GHS?
- What have you learned so far in the methods course that has had an impact on you?
- What are you concerned about or struggling with?

Future

- What do you expect to learn in the secondary math methods course, including the Mediated Field Experience?
- Which methods and practices that you have seen so far do you think you want to use in your first year of teaching? Why?

Teacher Candidate Interview #2 Protocol

(After teacher candidates have participated in 2-week spring field experience)

- Examine their Student Interview assignment, ask them to discuss what they learned about their focal student during this assignment.
- What experience have you already had that might prepare you to be a mathematics teacher?
- What makes a good mathematics teacher?
- How do you think one learns to become a teacher?

Past:

- Where was your 2-week field experience? Describe the context, the students, the teacher, the content
- How does the teaching context for the MFE differ from your field experience context?
 - How do the students compare?
 - How do the departments differ?
 - How does the curriculum differ?

Present:

- Can you think of an example, if any, where you learned something in another course and being at CHS helped you understand that thing better?

Future:

- Which methods and practices that you have seen so far do you think you want to use in your first year of teaching? Why?
- Which methods and practices are you continuing to ponder/question?

Teacher Candidate Group Interview Protocol

- What do you see as your role being here at CHS? What are you supposed to be doing? What would characterize your responsibilities here at CHS?
- When you are in the classroom and observing, what are you looking for? What are you paying attention to?
- What characterized that nature of what you are supposed to be doing during the debrief? What is your job as the TC?
- What does it mean to you that the teachers are there to talk to you about their students...because these teachers have had these kids in their classroom...I mean, we could be watching a video of these teachers but we're not...we're actually in their classrooms. How does that impact you in your participation?
- Do you think the partner teachers are learning anything from you/this experience?
- What practices or ideas or concepts have you learned...in methods or other classes...that you KNOW you are going to use in your classroom. What is resonating with you?
- What are you struggling with? What are you critical about, what questions do you have or have had all along but you haven't had an answer to it yet? With respect to things learned within the CHS experience – how it is or isn't tied into what you are learning in the TEP?

Partner Teachers Interview #1 Protocol

- Explain how you came to be a mathematics teacher.
- What do you think makes a good math teacher?
- How does one learn to be a good math teacher?

MFE:

- What do you know about the goals and outcomes of the TEP, specifically the mathematics teacher preparation? (Trying to get at what they know about the TE program and which experiences have provided this info)
- In your view, what do you see as the purpose of the Mediated Field Experience?

Planning

- How do you prepare for the MFE? Does it alter your teaching practice in any way?
- How do you communicate with the UI about planning for the MFE?
- How do you talk to your students about the MFE?

Role

- In your view, what is your role in the MFE?
- Describe your relationship with the teacher candidates.
- What do you hope the teacher candidates learn as a result of the MFE? How do you see the MFE supporting (or not) the teacher candidates in learning this?

- What are your expectations for the university instructors in the MFE?
- Experience
- What reservations do you have about the MFE?

Specific Practice: Justification:

- Why should students justify their thinking/solutions in a math class?
- What counts as a good mathematical justification in your class?
- How do you support your students in learning how to justify?
 - In writing?
 - In public presentations?

Wendy only:

You were in the first cohort to participate in the MFE – what do you remember about that? How has that experience impacted what you do in the MFE now as a partner teacher?

Classroom Teachers Interview #2 Protocol

MFE:

PURPOSE

- Now that you have experienced the MFE, what do you see as the purpose of the Mediated Field Experience?
 - Purpose of the classroom observation?
 - Purpose of the debrief? How would you characterize the nature of the “talk” in the debrief?

ROLES

- In your view, what was your role in the MFE?
- What was UI’s role?
- What was the role of the teacher candidates?

DISCOURSE

- How did you talk with your own students about the MFE when the teacher candidates were not there?
- How did you prepare for the MFE? How did you talk with the other partner teachers about the MFE? (Did it alter your teaching practice in any way?) Ask for specific examples of anything that changed because they knew the MFE was coming.
- How did you communicate with Savannah?

LEARNING

- What do you think the teacher candidates learned as a result of the MFE? How do you know? How do you see the MFE supporting (or not) the teacher candidates in learning this?
- What have you learned about your teaching practice (?) as a result of the MFE?

STRUGGLES

- What reservations do you have about the MFE? (Tanya was concerned about the teacher candidates interacting w/her Ss. Ask her about this.
- What suggestions do you have for improving the MFE?

University Instructors Interview#1 Protocol

- What is your past experience in mathematics education? What experiences do you bring to being an instructor for this course?
- What are your goals for the secondary math methods course? Why should future teachers take this course?

MFE:

- What do you see as the purpose of the Mediated Field Experience?
- What do you hope the teacher candidates will learn as a result of participating in the MFE?
- What is your role in the MFE?
- What are your expectations for the teacher teacher candidates in the MFE? What role do you see them playing?
- What are your expectations for the partner teachers in the MFE? What role do you see them playing?
- How do you prepare for the MFE?

Questions about the debriefing of the MFE:

- What is the purpose of the debriefing session? (How do you see this as supporting candidate learning?)
- What are your expectations for the teacher candidates during the debriefing session?
- What are your expectations of the classroom teachers during the debriefing session?

Questions for particular assignments/activities in the course:

Following struggling students:

- What is the purpose of this activity?
- What do you hope the teacher candidates will learn from this activity?
- What experiences or ideas have the teacher candidates been provided in your course previously (or in the future) that support them in learning from this activity?

Why ask the teacher candidates to share an observation in the debrief?

What do you think the teacher candidates are learning from the debriefing/sharing? Questioning to understand assignment?

University Instructors Interview#2 Protocol

MFE:

- What was the purpose of the Mediated Field Experience?
- What do you hope the teacher candidates learned
 - About students?
 - About teaching mathematics? as a result of participating in the MFE?
- How did you prepare for the MFE?
 - w/partner teachers?
 - w/other UIs?
- What did you see as your role in the MFE?

- What role did you see the partner teachers playing?
- What role did you see the other UIs play? How did you communicate to them what they were supposed to do?

Questions about the debriefing of the MFE:

- What is the purpose of the debriefing session? (How do you see this as supporting candidate learning?)
- Why ask the teacher candidates to share an observation in the debrief?
- How would you characterize the nature of the discourse during the debriefing sessions?
- What do you think the teacher candidates are learning from the debriefing/sharing?
- What happened to following a struggling student? This part of the MFE didn't get follow-through – why?

Future:

- What reservations do you have with the MFE as a practice in Teacher Ed?

Ask about our relationship as colleague/mentor/researcher. This was tricky – what was Savannah's experience?

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PROFESSIONAL MEMBERSHIPS

Washington State Mathematics Council	1997-present
National Council of Teachers of Mathematics	1997-present
Washington Association of Teachers of Teachers of Mathematics	2006-present
Association for Supervision and Curriculum Development (ASCD)	2008-present
Association of Mathematics Teacher Educators (AMTE)	2009-present
Educators for Social Justice	2009-present
American Educational Research Association	2011-present

PUBLICATIONS

Bier, M. L., Horn, I., Campbell, S. S., Kazemi, E., Hintz, A., Kelley, M. P., et al. (in press). Design for simultaneous renewal in university-public school partnerships: Hitting "the sweet spot". *Teacher Education Quarterly*.

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Unpublished Work

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PRESENTATIONS

Campbell, S.S., Dunleavy, T. (2012, April). Connecting University Coursework and Practitioner Knowledge through Mediated Field Experiences in Secondary Teacher Education Methods Courses. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, British Columbia, Canada.

Horn, I., Campbell, S.S. (2012, April) Mediated Field Experience as a Pedagogy for Teacher Education. Paper presented at the annual meeting of the American Educational Research Association, Vancouver, British Columbia, Canada.

Campbell, S.S., Dunleavy, T. (2012, April). Connecting Methods Courses with Teachers' Knowledge through Mediated Field Experiences. Presentation at the annual meeting of the National Council of Teachers of Mathematics, Research Pre-session, Philadelphia, PA.

Zeichner, K., McDonald, M., Kazemi, E., Campbell, S.S. (2011, February). Democratizing Knowledge in Teacher Education Through Practice-Based Methods Teaching and Mediated Field Experience in Schools and

- Communities. Presentation at the annual meeting of the American Association of Colleges of Teacher Education, San Diego, CA.
- Campbell, S.S., Zavala, M., Dunleavy, T., Cundard, A., Kelly-Peterson, M., Kazemi, E. (2011, January). Learning There Together: Mediated Field Experiences in Teacher Education. Presentation at the annual meeting of the Association of Mathematics Teacher Educators, Irvine, CA.
- Campbell, S.S., Hintz, A., Harrington, R. (2010, October). Solving the Problem of Multiple Solutions. Presentation at the annual Northwest Mathematics Teaching conference, Spokane, WA.
- Campbell, S.S. (2010, October). Transforming Bad Apples: Supporting Students in Productive and Equitable Groupwork. Presentation at the annual Northwest Mathematics Teaching conference, Spokane, WA.
- Valencia, S., Bier, M., Campbell, S., Zeichner, K. (2010, February). Strengthening the Connections Between Campus and Field-Based University Teacher Education Through the Creation of “Third Spaces”. Presentation at the annual meeting of the American Association of Colleges for Teacher Education, Atlanta, GA.
- Campbell, S.S. (2010, January). Coordinating interns’ experiences in the field and university: The mediated field experience. Presentation at the annual meeting of the Association of Mathematics Teacher Educators, Irvine, CA.
- Campbell, S.S., Harrington, R. (2010, January). What should pre-service teachers read in methods courses and what do they learn from it? Presentation at the annual meeting of the Association of Mathematics Teacher Educators, Irvine, CA.
- Campbell, S.S. (2009, October). Solving the Problem of Multiple Solutions. Presentation at the Northwest Mathematics Teaching Regional Conference, Whistler, B.C., Canada.
- Nolen, S., Horn, I., Ward, C., Campbell, S. (2008, April). Becoming teachers: A situative look at identity, motivation, and learning objective. Presentation at the annual meeting of the American Educational Research Association, New York, NY.
- Campbell, S.S., King, J. (2007, November). The field-based secondary mathematics methods course: Helping pre-service teachers problem-solve around students. Presentation at the Teachers for a New Era Mathematics Conference, Michigan State University, Lansing, MI.
- Peck, C., Bier, M., Campbell, S. (2007, March). Design for simultaneous renewal in university – public school partnerships: Hitting the sweet spot. Presentation at the Northwest Association of Teacher Educators, Seattle, WA.
- Campbell, S.S., & Gunn, K. (2007, April). Creating common contexts for pre-service and veteran teacher learning in an urban high schools. Presented at the Washington Association for Colleges of Teacher Education Conference, Spokane, WA.
- Campbell, S.S., Harrington, R. (2006, October). Graduate programs in mathematics education. Presentation at the Northwest Mathematics Conference, Victoria, B.C., Canada.
- Campbell, S.S. (2004, April). The abacus as a conceptual tool. Presentation at the Near East South Asia Teachers’ Conference, Bangkok, Thailand.