

Language Policy, Teacher Beliefs, and Practice:
Implications for English Language Learners in Mathematics

by

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ABSTRACT

In 2007, Arizona voters passed House Bill (HB) 2064, a law that fundamentally restructured the Structured English Immersion (SEI) program, putting into place a 4-hour English language development (ELD) block for educating English language learners (ELLs). Under this new language policy, ELL students are segregated from their English-speaking peers to receive a minimum of four hours of instruction in discrete language skills with no contextual or native language support. Furthermore, ELD is separate from content-area instruction, meaning that language and mathematics are taught as two separate entities.

While educators and researchers have begun to examine the organizational structure of the 4-hour block curriculum and implications for student learning, there is much to be understood about the extent to which this policy impacts ELLs opportunities to learn mathematics. Using ethnographic methods, this dissertation documents the beliefs and practices of four Arizona teachers in an effort to understand the relationship between language policy and teacher beliefs and practice and how together they coalesce to form learning environments for their ELL students, particularly in mathematics.

The findings suggest that the 4-hour block created disparities in opportunities to learn mathematics for students in one Arizona district, depending on teachers' beliefs and the manner in which the policy was enacted, which was, in part, influenced by the State, district, and school. The contrast in cases exemplified the ways in which policy, which was enacted differently in the various classes, restricted teachers' practices, and in some cases resulted in inequitable opportunities to learn mathematics for ELLs.

DEDICATION

I dedicate this dissertation to my family, my husband, Alex, and my two amazing children, Marcus and Arianna. Without their support and encouragement, I would have never been able to get to this juncture. Even when I doubted myself, they gave me the strength to persist and ultimately complete this dissertation.

I also want to dedicate this dissertation to my mother-in-law, Celia, who believed in me even when I doubted myself. And finally, I want to dedicate this dissertation to my mom, Esperanza, who passed away two weeks before I started this long and incredible journey.

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Chapter 1

INTRODUCTION

We must have but one flag. We must also have but one language. That language must be the language of the Declaration of Independence, of Washington's Farewell address, of Lincoln's Gettysburg speech and second inaugural.... We call upon all loyal and unadulterated Americans to man the trenches against the enemy within our gates
(Theodore Roosevelt, 1917).

The educational predicament of English language learners (ELLs) has been a focus of policymakers and the courts for more than 60 years (August & Hakuta, 1997; Valencia, 2005). The academic performance of ELL students raises questions about how to best meet and support the linguistic, cultural, and academic needs of this dynamic group of students, especially since ELL students represent the fastest growing student population in the United States (Kohler & Lazarín, 2007; Leos, 2004). It is reported that the ELL student population grew 56% between 1996 and 2006 in the U.S., compared to the general student population growth of only 2.6% (Batalova, Fix, & Murray, 2007). Of the students designated as ELLs, approximately 80% are Latino/a, with Spanish being their native language (U. S. Department of Education, 2006). Nationwide, ELL students make up approximately 10% of the total student enrollment for kindergarten through twelfth grade (Batalova, 2006; Davenport, 2008).

Whereas the ELL student population continues to grow at an astonishing rate, data show a striking and persistent difference of performance in standardized tests among ELLs and their English-speaking peers. For example, a look at standardized mathematics tests indicates that Latino/as, especially ELL students, continue to score well below their white counterparts. According to the 2009 National Assessment of Education Progress

(NAEP), 43% of fourth grade ELL students scored below basic in mathematics, compared to only 9% of fourth grade white students (National Center for Educational Statistics [NCES], 2009). In Arizona alone, an astounding 69% of fourth grade ELL students scored below basic on the same assessment. A concern with these types of comparisons is that they can potentially promote deficit views of ELLs by not accounting for the many variables that affect how ELLs perform on these tests, such as their English proficiency level, the amount of time they have been in the country, and the opportunities that they have to learn the material being assessed (Wright & Sung, 2012).

Although the ELL student population continues to grow, U.S. schools have been slow to respond to the unique cultural, academic, and linguistic needs of this group of students. Not only is this lack of response, recognition, and value of this diverse group of learners' unique needs and qualities evident in their performance on standardized tests (National Center for Educational Statistics [NCES], 2009), but also in the educational and language policies that serve to curtail linguistic and cultural diversity (Mahoney, MacSwan, Haladyna & Garcia, 2010).

Problem Statement

The educational opportunities granted to ELL students, particularly those of Mexican ancestry, have historically been characterized by structural and systemic inequities that have persistently framed ELLs as problematic. For decades, a monolingual ideology, one in which English language proficiency is a measure of Americanization and citizenship, has been a major underpinning of educational policies affecting ELLs (Bartolomé & Liestyna, 2005; Wiley, 1999).

Not much has changed since Roosevelt’s statement in 1917. In fact, we have seen an influx of policies and movements aimed at limiting bilingual education and cultural diversity. States like California, Arizona, and Massachusetts have implemented English-only policies for educating their ELL student population. In addition, across the U.S., policymakers have specifically targeted Latino/a immigrants and Spanish-speaking English language learners. For instance, Arizona, one of the states with the highest number of Latinos/as (Census, 2010), recently passed Senate Bill (SB) 1070 (2010), a law where executors target Latino/a immigrants by making it state law to carry identification at all times, and allowing law enforcement to check citizenship status at any time, raising concerns about the racial profiling of Latinos/as in the state. States like Georgia, Colorado, and Alabama have also either passed or attempted to pass similar laws targeting immigrants and ELLs. In a recent effort to ban ethnic studies curricula and programs, Arizona passed House Bill (HB) 2281 (2010), stipulating “that public school pupils should be taught to treat and value each other as individuals and not be taught to resent or hate other races or classes of people.” Most recently, a school district in Tucson, Arizona voted to dismantle its Mexican-American Studies program after Superintendent of Public Instruction John Huppenthal announced that more than \$1 million per month would be withheld from the district until the district complied with state law.

The extent to which these policies have an impact on the access to learn mathematics is not yet understood. While educators and researchers have begun to examine the organization and structure of language policies in Arizona, little is known about the effects of these policies on opportunities to learn mathematics for ELLs.

Questions remain about how language policy, coupled with teachers' beliefs and practices serve to mediate learning opportunities for ELLs, particularly in mathematics. Using a critical lens and a sociocultural perspective, this study documents the beliefs and practices of four teachers in an Arizona urban school district, and examines how language policy impacts their mathematics instruction and ultimately their students' access to learn mathematics.

Purpose of Study and Research Questions

The purpose of this study is to understand the complex relationship between language policy, teacher beliefs, and practice, and how this phenomenon manifests itself on the level of educational access that ELL students, particularly those of Mexican descent, receive in mathematics. Specifically, the aim of this study is to examine: 1) a case of the implementation and enactment of HB 2064, also referred to as the 4-hour block, in elementary classrooms in a PreK-8 district in the metropolitan Phoenix area; 2) how such policy is either supported or challenged by classroom teachers, as expressed through teachers' instructional practices, and; 3) the opportunities to learn mathematics that ELL students have afforded to them as a result of constraints and/or affordances that this policy places on teachers' practices. The following research questions were used to accomplish the purpose of this study:

Primary Research Question

How do language policy, and teacher beliefs and practice mediate each other and how does this mediation affect the access that ELL students have to mathematics instruction and curriculum?

I examined a single urban district in Phoenix to uncover these influences, using this case as a first model for developing a theory of how language policy impacts equitable access to mathematics and consequent achievement and success of ELL students as a result of mediation by teachers and local school and district policy.

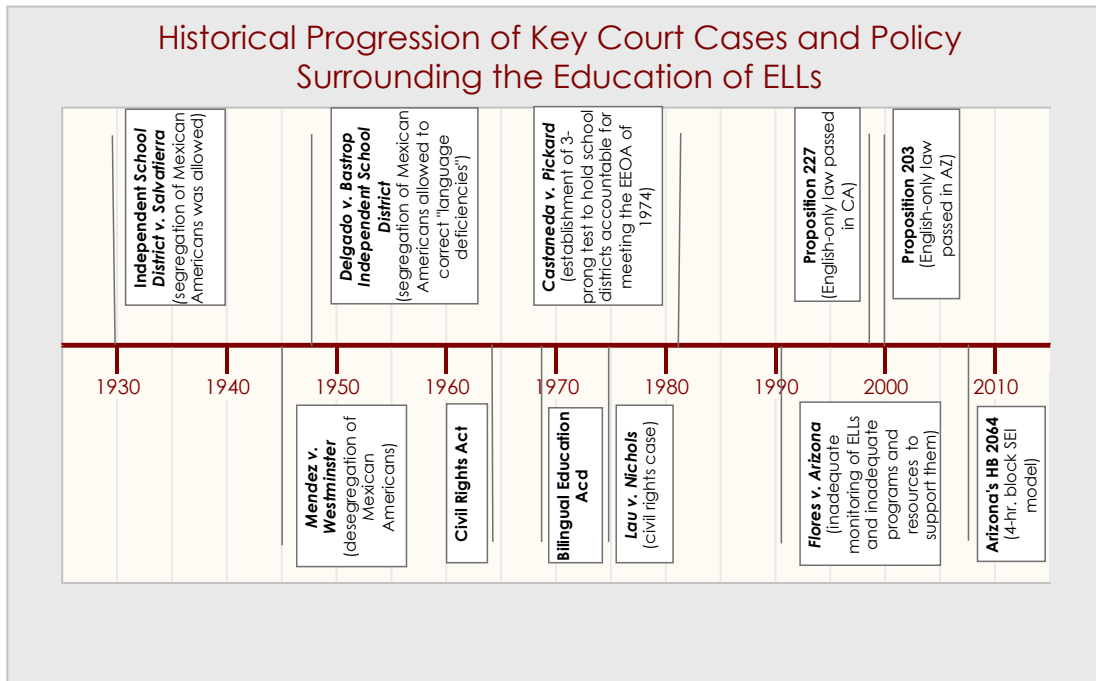
Sub-Questions

1. How are HB 2064 (4-hour Sheltered English Immersion model) program requirements being interpreted and implemented in elementary classrooms in the district? In what ways do teachers provide scaffolding, interactions, and other instructional supports for learning mathematics to ELL students?
2. What are teachers' beliefs, attitudes, and dispositions about HB 2064 and their ELL students (both as mathematics learners and ELLs)? How do teachers' pedagogical beliefs about teaching and learning ELLs manifest themselves in students' mathematics performance?

Historical Context

When examining the current educational and legal landscape of Latinos/as and ELLs in the U.S., it is crucial to consider the social, political, and historical realities that surround the educational opportunities that these students have afforded to them. The debate on the right of ELL students, primarily Mexican Americans, to receive an equitable education in the U.S. has historically been framed around issues of language and race. Typically, language has been used as a vessel to track and segregate ELL students (see Figure 1.1), as will be discussed in detail in Chapter 3.

Figure 1.1. Legal Trajectory of Key ELL Cases in the U.S.



Educational policies currently in place in states like Arizona closely mirror the language policies dating back to the 1930's and 1940's. For instance, in *Delgado v. Bastrop Independent School District* (1948), the courts ruled that a Texas district had the authority to segregate students to correct "English-language deficiencies," as long as students were not in separate schools. Presently, Arizona has in place a 4-hour block, which will be discussed in detail in Chapter 3, in which ELL students are tracked and segregated based on English language proficiency. Like the *Delgado* case, this segregation is within schools and therefore justified.

Arizona's 4-hour block, as well as its English-only policy restructured the manner in which ELLs are taught in public schools. In 2000, Arizona voters passed Proposition 203, titled 'English for Children,' with the intent of replacing most bilingual programs with English-only instruction. In the meantime, Arizona found itself as a defendant in the

courts in *Flores v. Arizona* (1992), for failing to properly monitor ELL students and failing to provide adequate resources and bilingual programs to support them. To address concerns about the level of support that the state was providing to its ELL student population, in 2006 Arizona restructured its Structured English Immersion (SEI) program to include a 4-hour block, also known as HB 2064, that consists of teaching morphology, phonology, syntax, semantics, and lexicon as separate subjects.

Overview of Dissertation

The research design for this study is small scale and one that involves the collection and analysis of both, qualitative and quantitative data. Four teachers and their classrooms were purposely selected from a group of elementary school teachers in a district serving large numbers of ELL students in Arizona. Since the study examines multiple constructs (policy, teacher beliefs, and practice) and their mutual relationship, data was generated from several sources, including classroom observations, field notes, a teacher beliefs survey, clinical and stimulated recall interviews with students and teachers, and district student mathematics assessments, to triangulate assertions made during the analysis phase. This allowed for validity checks of how the various constructs came together in the classroom and how this interaction affected access to educational offerings in mathematics for ELL students.

While small scale, this study provides a plausible descriptive model that can inform researchers, educators, and policymakers about the impact of language policy on the mathematics education of ELLs. By opening dialogue about how these three constructs interact within a given space, this research study has the potential to promote research in directions that critically examine the educational experiences of ELL students

in mathematics within a broader sociopolitical context. This dissertation is sectioned into the introduction, theoretical framework, literature background, methods, results, and discussion.

Chapter 2, Theoretical Framework, articulates my framework for the study, drawing from multiple theoretical lenses. In this chapter, I discuss critical race theory (CRT), Latino critical race theory (LatCrit) and sociocultural theory as perspectives that I bring to the study. I begin by discussing how CRT and LatCrit serve as appropriate frameworks for examining the broader sociopolitical discourses that help shape the educational experiences of ELL students, followed by a discussion on how a sociocultural perspective helps us prioritize the experiences of ELL students by focusing on resources and strengths rather than on deficits.

In Chapter 3, Background Literature, I start with a review of the relevant literature in the areas of educational policy in mathematics education, followed by the broader corpus on language policy, and conclude with specific research on second language teaching in mathematics. The focus of this chapter is not only to examine the relevant literature in the field, but to identify and uncover gaps in the given literature that give space for future scholarly work involving policy and mathematics education for ELL students.

In Chapter 4, Methods, I discuss the research design and how it was conducted. In this chapter, I discuss details of my working design, methods of generating evidence, methods for analyzing data, and the personal and interpersonal context for the study. I elaborate on the use of qualitative and quantitative data – classroom observations, interviews, survey, and students' mathematics assessments.

In Chapter 5, I present the findings of this study. I outline the themes that emerged across teachers and the various data sources. The results are broken down in the three broader categories that represent the constructs in this study. The results are then broken down further into smaller, more specific themes. Overall, the findings of this study suggest that the implementation of the 4-hour block does in fact place restrictions and limitations on teachers' mathematics instruction. These limitations, coupled with teachers' beliefs and practice about teaching mathematics to their ELL students impacts student opportunities to learn mathematics.

I conclude with Chapter 6, Discussion, where I present conclusions, implications, and areas of further research. In this chapter, I present the overall findings of this study and then discuss the significance of these findings in relation to the literature presented in Chapter 3. In addition, I discuss limitations of the study and conclude by discussing implications for future research.

Chapter 2

THEORETICAL FRAMEWORK

This study investigated multiple constructs (policy, teacher beliefs, and practice) that, collectively, provided a descriptive model of the structural processes and political systems undergirding the educational experiences of English language learner (ELL) students in a specific district in Arizona. This study examined the intersection of these various constructs within a specific space, namely the 4-hour block instructional model and its effect on the opportunities that ELLs have to learn mathematics. The nature of the 4-hour Sheltered English Immersion (SEI) model raises questions about the broader inequities experienced by Latinos/as and specifically ELL students in U.S. schools.

As discussed briefly in Chapter 1, Introduction, the right of Latinos/as and ELL students to an equitable education has been a subject of contentious debate, dating back to the 1930's. While the review of the relevant literature will be discussed in depth in Chapter 3, below is a brief discussion on the literature pertaining to the educational experiences of ELLs in U.S. public schools.

Language and race have historically been used to frame Latinos/as and ELLs as problematic and have been used as factors to segregate and subjugate Latinos/as and ELLs in U.S. public schools. For instance, in *Delgado v. Bastrop Independent School District* (1948), the courts ruled that students could be legally placed in separate classrooms within schools to 'fix' their "English language deficiencies" (Valencia, 2005). Arizona's 4-hour SEI model also tracks ELL students by English proficiency level, thereby limiting the exposure that students have to their English-speaking peers. Some researchers argue that by limiting the extent to which ELL students interact with their

English-speaking peers is a violation of the Equal Educational Opportunities Act (EEOA) (Guerrero, 2004), again raising concerns about access to an equitable education for ELLs.

Since this study cuts across multiple constructs, policy being one of them, it is important to situate current educational opportunities for ELLs within a micro-political context. Critical race theory (CRT) provides that framework for viewing laws and lawmaking using a historical and cultural context to analyze their racialized content (Crenshaw, Gotanda, Peller, & Thomas, 1995; Delgado Bernal, 2002). Therefore, CRT is the primary perspective that I bring to this study. Situated within this broader lens is Latino critical race theory (LatCrit), a particular focal area that centers on specific issues of language, immigration, ethnicity, and culture, among others, and elucidates the multidimensionality of Latinos/as. Specifically, using a LatCrit lens in this study allowed me to examine and theorize how race and racism have shaped and continue to shape the educational pipeline for Latino/a students, many of whom are ELL students. The viewpoints embodying CRT and LatCrit are useful theoretical frameworks for examining the broader discourses and inequities, implicitly and explicitly on the educational processes, structures, and discourses that affect Latinos/as (Solórzano & Yosso, 2001).

Critical Race Theory

There are five defining elements that form the basis of CRT and LatCrit (Solórzano, 1998; Solórzano & Yosso, 2001). The first defining element describes *the importance of transdisciplinary approaches*, emphasizing the power of educational researchers to draw from various disciplines, such as ethnic studies, sociology, history, law, women's studies, and other fields, to better understand and improve the educational experiences of students of color (Solórzano, 1998). In Chapter 3, I examine various lines

of inquiry, including legal studies to discuss the role of the construction of race in historically shaping the educational landscape for Latinos/as and ELLs across the U.S. Similarly, I examine education and language policies, in conjunction with literature in second language teaching and mathematics education to provide a more comprehensive view of the realities surrounding the education of ELL students in the space of mathematics education. Thus, being able to draw on the strengths and research methods of the various areas offers an avenue for better understanding the multidimensionality involved in understanding and improving the educational experiences of ELLs.

The second defining element of CRT and LatCrit is *the centrality of experiential knowledge*, which focuses on moving away from deficit views of students of color, and instead emphasizes the idea that these students are holders and creators of knowledge (Solórzano, 1998). For students learning mathematics while learning a second language, this means using students' experiential knowledge, of which language is a large part, to make mathematical connections and develop mathematical proficiency. One of the central constructs in this study is the role that restrictive language policies play in teachers' instructional practices, and understanding what aspects of the policy create inequities for ELL students. For example, the implementation of the 4-hour block prohibits the use of the students' first language as a means to learn and develop new knowledge. The extent to which this policy is carried out, and the means by which it is enforced in the classroom may prevent certain ELLs from meaningfully and effectively engaging in the learning process.

The third element involves *a challenge to dominant ideologies*. This may involve embracing ways of knowing that extend beyond that of formal schooling to

include students' cultural, linguistic, and experiential knowledge (Delgado Bernal, 2002). In other words, CRT and LatCrit provide a framework for rethinking the traditional idea of what counts as knowledge. In the context of this study, the fact that students are immersed into English-only classrooms and that teachers are not allowed to use students' first language for instruction exemplifies the dominant ideology that English is the only valuable language. For example, the language used to frame Arizona's Proposition 203 states that students must learn English to "fully participate in the American Dream of economic and social advancement" and to "become productive members of our society."

The fourth defining element of CRT and LatCrit is *the centrality of race and racism and their intersectionality with other forms of subordination*, meaning that while race and racism are at the core of critical race analysis, they usually intersect with other forms of subordination, such as sexism and classism (Solórzano & Yosso, 2001; Delgado Bernal, 2002). As will be discussed in Chapter 3, the historical legal trajectory of Latino/a students in U.S. schools, particularly those of Mexican descent, highlights this intersection, as race and language have been used to segregate this group of students.

The last element of CRT and LatCrit is *a commitment to social justice*, one that aims to empower students of color by seeking social and political change (Solórzano & Yosso, 2001; Delgado Bernal, 2002). An objective of this study was to draw attention to the deleterious effects of policymaking reflecting ideologies deeply rooted in deficit models of ELLs. While this dissertation was not designed to directly empower ELL students themselves, the intent was to open dialogue about the implications of language policy on ELL students' opportunities to learn mathematics.

Sociocultural Theory

CRT and LatCrit focus on the broader sociopolitical issues at the core of the highly contentious bilingual education debate and how they inform the broader issues of race and class. While the principal lens that I brought to this study was CRT, a sociocultural perspective allowed me to look at the enacted lives of children in classrooms and draw out the experiential factors that can be explanatory of the larger inequity commonly experienced by Latinos/as. Again, because this study cut across multiple constructs, practice being one of them, a sociocultural perspective allowed me to understand the interactions that took place in the classroom by looking at the function of language, race, culture, and policy as they were enacted and as they collided in a specific space. Therefore, while CRT and LatCrit embody my broader ideology, using a sociocultural, methodological perspective focusing on discourse and culture allowed me to understand the interactions in the classroom.

To better understand how teachers and students interacted and engaged with each other and the mathematics content, I used a sociocultural lens to examine how students participated in a community of practice. By community of practice I mean the idea of a group of people working together to achieve common goals within pre-established norms. This idea of how people work together in coherent communities has been thought of in different ways. For instance, Lave and Wenger (1991) come at it from an anthropological perspective by focusing on how humans interact and share behaviors. On the other hand, there is a linguistic and cultural perspective most recently articulated by Gee and Moschkovich that describes the participation and enculturation into a community of practice (Forman & McCormick, 1995; Rogoff, 1990) as discourses that

are linguistic and cultural in nature. For all intents and purposes, both linguistic and behavioral use of tools are all implicated and will be considered to be synonymous types of activities.

Participation in a community of practice that cognitive development processes and learning processes are a function of the social and cultural context surrounding the student. In other words, a sociocultural perspective begins to outline how people interact within particular community norms. In the case of this dissertation, I examined how the sociopolitical context, specifically the 4-hour block, functioned within this community of practice, and discussed the impact that it had on ELL students' opportunities to participate in authentic and meaningful activities.

The idea of students participating in local communities as communities of practice that tie into the larger communities can be thought of as Discourse. Another way to think about Discourse is to view it as a combination of language with other social practices such as values, ways of thinking, customs, and ideology within a specific group or community (Gee, 1996).

A Discourse is a socially accepted association among ways of using language, other symbolic expressions, and “artifacts,” of thinking, feeling, believing, valuing, and acting that can be used to identify oneself as a member of a socially meaningful group or “social network,” or to signal (that one is playing) a socially meaningful role (Gee, 1996, p. 131).

Using Gee's definition, participating in the Discourse of mathematics involves more than language or simply learning vocabulary. It involves ways of interacting, discussing, thinking, acting, reading and writing, as well as beliefs and values. In addition, it is important to emphasize that Discourse communities are not static nor do they function at an individual level. On the contrary, Discourses are created as students

and teachers engage in meaningful conversations and discussions as they bring multiple meanings and perspectives to certain situations, and as they engage in a ‘social network’ (Gee, 1996). Therefore, meaning is socially constructed within Discourse communities.

The idea that people exist in the nexus of communities and that there are multiple Discourses that vary across situations, communities, and purposes raises concerns about the potential mismatch between the Discourses that students and teachers bring to the mathematics classroom. This mismatch can create conflict between a student who is operating within their home Discourse and teachers operating within a different Discourse. While no particular Discourse is inherently better than another, this mismatch could result in the Discourse of power disadvantaging students as they try to move and negotiate their identity within it (Gee, 1996).

Researchers using a sociocultural perspective stress the fact that these multiple Discourses embedded within communities of practice must be acknowledged and defined to avoid framing students as deficient (Moschkovich, 2007). For instance, among the various Discourses are academic mathematical Discourse and everyday Discourse. Academic mathematical discourse refers to “using language and other symbols, systems to talk, think, and participate in the practices that lead to literate mathematical Discourse practice that are ‘the objective of school learning’” (Moschkovich, 2007, p. 28). Everyday Discourse practices, on the other hand, refer to practices outside of school that children engage in. Depending on the function, setting, or time, students and teachers will engage and access different Discourses that meet the specific purpose. That is not

to say that these Discourses are mutually exclusive. In other words, these multiple Discourses come together in the classroom as students and teachers engage in mathematical Discourse practices.

What is important about the idea of students engaging and participating in a nexus of communities of practice and by extension Discourses, is that generally, how we define Discourse practices frames how we view students' contributions to the mathematics classroom, and ultimately shapes the opportunities that are given to students to participate in that community of practice. For instance, a student who tries to engage in a community of practice and is unaware of the norms of that community will most likely perform poorly. Unless teachers are aware of this mismatch between what assets students bring to the classroom and what is valued as the Discourse of power in the classroom, students run the risk of being framed as deficient. From this perspective, the deficit is in regards to what the system and the teacher will allow. The question then becomes, pedagogically how do we change the norms so that we value what students bring to the mathematics classroom? Rather than focus on what mathematical language students cannot use, a sociocultural perspective shifts away from perceived deficiencies and instead focuses on students' resources and contributions to the learning process, making it a valuable lens to understand how individuals function within a community of practice.

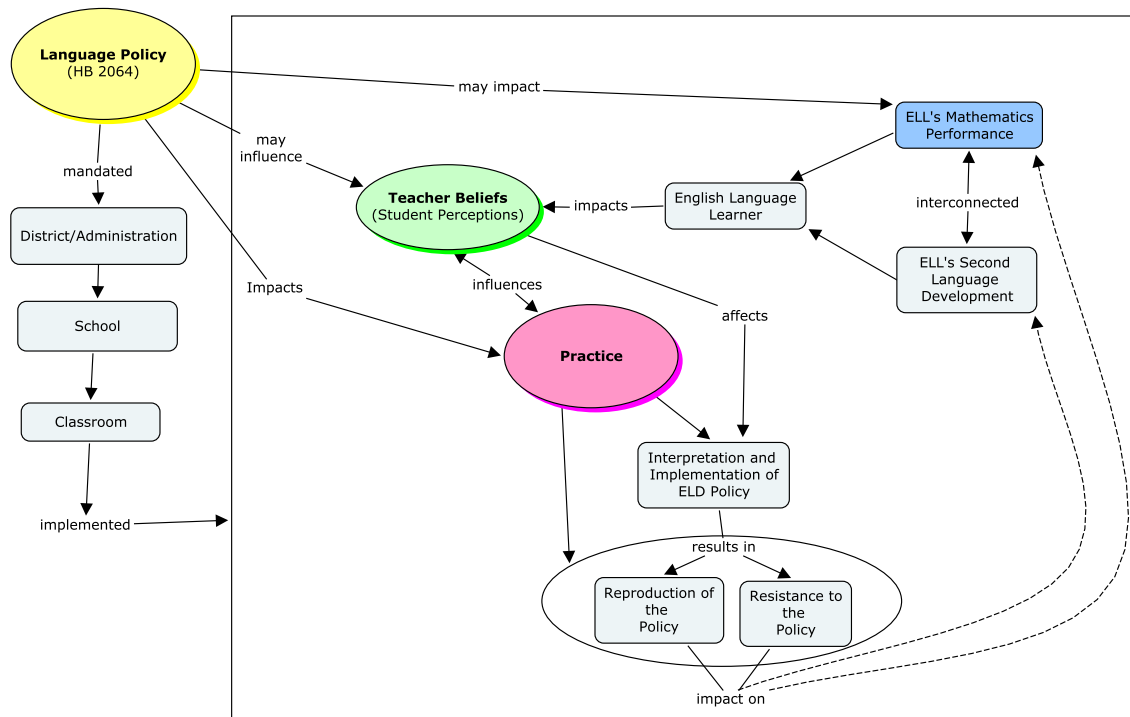
In summary, what CRT and LatCrit do at a broader level, sociocultural theory does at the classroom level. In this study, a sociocultural perspective allowed one to examine issues of power by examining the opportunities or lack thereof that students had

to participate in a community of practice. In addition, unlike CRT and LatCrit, sociocultural theory provided a lens to examine how mathematical Discourse practices took shape in the classroom. Nonetheless, while the focus of sociocultural theory and CRT and LatCrit may somewhat differ, both frameworks align in terms of prioritizing the experiences and voices of the underserved, making them valuable frameworks for this study.

Conceptual Framework

The following conceptual framework (Figure 2.1) is a visual representation of the various constructs embedded within my study. Specifically, the conceptual map outlines the association between language policy, teacher beliefs, and practice, and how I positioned them within this study. A narrative description of the various constructs, in the context of the study, follows the conceptual map. Positioning the different constructs in this fashion allowed me to examine the theoretical link between them, how they mediate each other and ultimately how they impact ELL students' opportunities for learning mathematics.

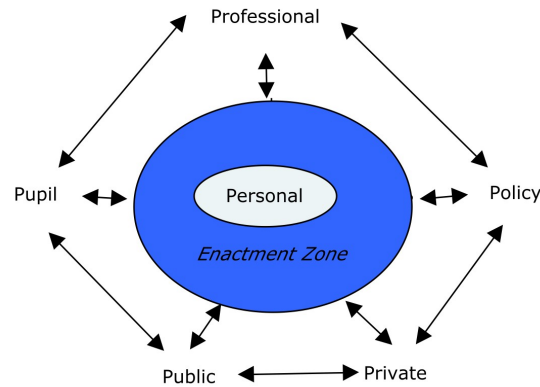
Figure 2.1. Conceptual Framework Map



As noted in Figure 2.2 below, there are multiple factors that influence how language policy is operationalized and enacted at the classroom level. There are external factors that function within *zones of enactment*, a space in which “reform initiatives are encountered by the world of practitioners and ‘practice,’ delineating that zone in which teachers notice, construe, construct and operationalize the instructional ideas advocated by reformers” (Spillane, 1999, p. 144) that also influence teacher practice.

While Spillane’s model defines the external factors within the *zones of enactment* as including *professional, pupil, policy, private, public, and personal* (see Figure 2.2) factors, this dissertation specifically addressed the policy and personal sectors. That is not to say, however, that the other external factors do not influence or should not be addressed, just that those factors are beyond the scope of the present study.

Figure 2.2. Enactment Zones and Teachers' Incentives and Opportunities to Learn and Change (Spillane, 1999)



Within the policy sector, the framework considers formal and informal federal, state, and local policies. The professional sector is defined as those formal and informal associations and contacts that can influence teachers' practice. In the context of this study, this sector includes the role of the district and schools as mediators of the ELD policy. Whereas the pupil sector refers to the influence that pupils have on teachers' practice, the public sector has to do with parent and community concerns. In contrast, the private sector refers to textbook and curriculum publishers that inevitably influence teachers' practice.

In addition to the 'external' factors bearing on local enactment of reform, teacher's personal resources, such as beliefs, dispositions, and knowledge about their students and the subject matter, as well as their own prior knowledge, work to mediate the rest of the external factors. In other words, teachers' personal resources are at the core of the enactment zone, helping reconcile the other external factors that also influence how policy and reform initiatives are implemented at the classroom level.

In the following sections, I detail how I conceptualized the framework with respect to this study. Specifically, I outline how I position the various constructs in this study, their function in relation to this study, and the affordances that they provided in answering the research questions posed.

Language Policy (HB 2064). The first construct in Figure 2.1 outlines the mandate of the policy at the district, school, and classroom level. In the context of this study, this dimension is critical as it helps frame how anti-bilingual rhetoric is espoused in policymaking and how such policy is formulated and disseminated, and helps frame the function of this policy on mathematics teaching and learning.

Ideally, educational policymaking should be a rational and democratic process that involves analyzing problems, considering options, setting goals, and ultimately creating solutions to specific issues in an effort to improve schooling for students (Crawford, 2004b). However, passage and enactment of recent policy affecting the education of ELLs indicates that policy formulation is often times a highly politicized process, susceptible to external factors, such as the current political rhetoric concerning the education of ELLs (Crawford, 2004b). “Decisions tend to be made on an ideological basis, appeasing passions of the moment with simplistic, one-size-fits-all solutions, rather than considering factual evidence about, say, which pedagogical approaches would work best for diverse groups of students” (Crawford, 2004b, p. 71).

Teacher Beliefs. The second construct in my conceptual map is teacher beliefs about the teaching, learning, and expectations that teachers hold about the ELL students that they teach. This level allowed me to understand how teachers perceived their ELL students’ mathematics abilities and second language development collectively, and how

those perceptions help shape, influence, and channel teachers' classroom practices, as well as help them negotiate broader narratives and discourses. In other words, it allowed me to understand how the beliefs teachers hold influence their perceptions and judgments, which, in turn, affect their behavior in the classroom. In addition, understanding teachers' dispositions about teaching and learning allowed me to better understand the broader narratives that teachers access or reject through the adoption of various beliefs, a central tenet of CRT/LatCrit.

Understanding the interpretive frames that teachers bring to the classroom is critical to understanding how they use these frames to channel their instructional practices. If we assume that all knowledge is belief (e.g., Middleton & Jansen, 2011), then it is this 'knowledge' that functions as an interpretive frame for how teachers behave in the classroom. Capturing the beliefs of teachers is important because they reveal how teachers view teaching, learning, and mathematics, and suggests how those beliefs are enacted in their classroom practice (Moore & Roehrig, 2007). First, while the teacher beliefs survey (see Appendix C) was used as a tool for sampling the four teachers, it was also a rich source of data during the analysis phase. Data generated from the teacher interviews was also used to more comprehensively understand what interpretive frames teachers brought to the classroom, how teachers used these frames to either adopt or reject broader discourses, and how those frames were manifested in the classroom, as evidenced by teacher behavior. The semi-structured interview format allowed me to access the thinking of teachers and to determine aspects of the teachers' thinking that could not be otherwise captured through observations or other forms of data collection.

Practice. Practice is the third layer embedded in my conceptual framework map. This level allowed me to study the meanings and actions of participants (teachers and students) within the classroom. It also allowed me to gain an understanding of how teachers implemented policy that reflects the broader societal ideologies about educating ELLs. In looking at teacher practice, I looked for a configuration of things, markers that are clearly mathematical in nature. For example, while there are no distinct boundaries between everyday discourse and academic discourse, for purposes of this study, I specifically looked at practices that entail students and teachers doing mathematics, some of which is talking about mathematical concepts. Observations, stimulated recall conversations, and clinical semi-structured interviews were gathered to elaborate and make sense of classroom practices and to understand how practice functions within the *zones of enactment*, specifically the policy and personal sectors.

The collection of observations, interviews, and beliefs survey helped me gain an understanding of the interpretive frames that teachers brought to the classroom, how teachers behaved and operationalized instructional ideas within the *zones of enactment*, and how that impacted student performance in mathematics.

Chapter 3

LITERATURE BACKGROUND

In this chapter, I review literature situated at the intersection of several areas of inquiry, including those involving policy, mathematics education, and second language teaching, all centered on issues of English language learners (ELLs) and positioned within a critical framework. I begin with a discussion on how educational policy has given little, if any, attention to addressing the needs of ELLs, followed by a discussion on language policies that have historically framed and problematized ELLs as deficient. I conclude with an examination of research, in and outside of the mathematics education community, about pedagogical practices for educating ELLs.

Educational Policy in Mathematics Education

It has been over two decades since the National Council of Teachers of Mathematics (NCTM) first published the *Curriculum and Evaluation Standards for School Mathematics* (1989), designed to outline what mathematics content students should learn and how to measure their learning. Since then, NCTM has published several other important publications, such as the *Principles and Standards for School Mathematics* (2000), and the *Curriculum Focal Points for Prekindergarten through Grade 8* (2006), with the intention of having these documents serve as guidelines for improving mathematics curricula, teaching, and assessment, as well as assisting teachers in identifying the most critical content for targeted attention.

In an effort to answer the question about how to close the achievement gap, NCTM (2005) states that all students “should have equitable and optimal opportunities to learn mathematics free from bias.” Although NCTM made an effort to include ELL

issues in mathematics education, such as the communication strand in *Principles and Standards for School Mathematics*, which states that communication is “important for all students, but especially critical for ELL students, to have opportunities to speak, write, read, and listen in mathematics classes, with teachers providing appropriate support and encouragement” (NCTM, 2008), it wasn’t until 2008, almost twenty years since its first major publication, that NCTM made their position statement about teaching mathematics to ELLs explicit. In fact, while NCTM has been working towards the goal of giving “mathematical power to all students,” the organization has been criticized for merely addressing equity issues at the superficial level, that is, by inferring that all students’ needs will be met with high expectations and implementing a one size fits all pedagogy (Lubienski, 2007; Secada, 1991). In 2000, NCTM made a concerted effort to give greater prominence to equity issues, as evidenced by one of the *Standards’* (NCTM, 2000) guiding principles. “Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students” (NCTM, 2000, p. 12). While differentiated instruction and “reasonable and appropriate accommodations” are emphasized in the equity principle, NCTM did not specify what these accommodations entail, nor how to provide effective instructional support for ELL students.

Since ELLs are the fastest growing student population in U.S. K-12 schools (Kohler & Lazarín, 2007; Leos, 2004), NCTM’s position statement marked a critical point in mathematics education for ELLs. In their position statement regarding ELLs, the NCTM emphasized that ELLs should not face special barriers to learning mathematics, that teachers should value and celebrate students’ cultural heritage, have an

understanding of the role of students' first language, and provide opportunities for ELLs to develop mathematical understanding and proficiency. What is important about the NCTM's position statement, delayed as it was, is that it formally recognized and valued students' cultural experiences and first language, and recommended that this capital be used as resources rather than remain in the periphery. While the NCTM standards have had a profound impact on curriculum, little is known about the impact, if any, that NCTM documents and standards have had on the mathematics performance of ELL students.

Interestingly, unlike NCTM's position statement that formally valued and recognized cultural and linguistic diversity, No Child Left Behind (NCLB, 2001), aimed at raising achievement and eliminating the achievement gap by race, ethnicity, special education status, and language, made no effort to formally use this capital as resources. The following section provides a general overview of NCLB and outlines some concerns about the impact of NCLB on the education of ELL students, particularly in mathematics.

No Child Left Behind (NCLB)

The adoption of NCLB (2001) brought about critical changes in educational policy for not only Latino/a students, but for ELLs as well. Under NCLB, the federal government mandates reform and sets in place an accountability system to, among other things, improve the academic performance of disadvantaged students and transition ELLs to English fluency. This top down approach to education requires states to develop statewide assessments in basic skills administered to all children. The stakes of NCLB include the removal of federal funding if students do not meet Adequate Yearly Progress (AYP) as defined by the State. This type of accountability framework focuses on outcomes rather than getting to the root of what causes the achievement gap and assisting

teachers to adapt instructional practices to meet the needs of their diverse students (Crawford, 2004a). With regards to ELLs, NCLB “does little to address the most formidable obstacles to their [ELLs] achievement: resource inequities, critical shortages of teachers trained to serve ELLs, inadequate instructional materials, substandard school facilities, and poorly designed instructional programs” (Crawford, 2004a, p. 2).

It is important to contextualize the educational learning of ELLs to fully understand the impact of an accountability framework that ultimately serves to stigmatize labels and impose punitive sanctions. Because existing assessments are generally unable to distinguish between language errors and academic errors, monitoring ELLs' progress is a complex process, resulting in an inadequate assessment of ELLs' knowledge (Crawford, 2004a; Hakuta, 2001). What typically results is schools feeding ELLs “a steady diet of basic skills” (Crawford, 2004a, p. 5) to make AYP on English-language achievement tests. It should be noted that while NCLB does not explicitly require English-only instruction, the push to meet AYP on a yearly basis is an indirect result of this approach to accountability (Crawford, 2004a). It is reported that 30% of schools held accountable for meeting AYP of ELLs under NCLB failed to make AYP for that subgroup in 2005-2006. What is more, a third of all schools reported that they needed technical assistance to help support and improve services for ELLs in 2005-2006 and 2006-2007, but only half of those schools requesting services actually received adequate support (Taylor, Stecher, O’Day, Naftel, & LeFloch, 2010).

While NCLB allows for reasonable accommodations, such as testing students in their first language for up to the first five years, there are concerns that arise with this call for accommodations. First, despite this allowance, most states have failed to offer

such tests in the students' native language (Wright, 2005), requiring students to pass tests in English. This difference in what the law stipulates and what states are actually doing highlights the importance of studying the enactment of the law since it is the actual implementation that affects students' access to an equitable education. Second, although the law was revised to exclude recently arrived ELLs (less than a year) from taking the reading test, all students, regardless of how long they have been in the U.S., are required to take the state's mathematics test. In a qualitative study conducted by Wright and Li (2008), the authors analyzed the linguistic demands of the Texas Essential Knowledge and Skills, or TEKS test and the opportunity that two Cambodian students had to learn the mathematics content before taking the TEKS, and found that NCLB's mandated expectations were unreasonable. More specifically, a lexical analysis was conducted to compare list of words appearing on the TEKS with the words appearing on the students' worksheets during class time, to determine their lexical and syntactic complexity. Their analysis suggests that rather than close the achievement gap, NCLB as enacted in these two students' cases functioned more as a language policy, as it failed to account for the time that it takes ELL students to learn enough English to participate in the same assessments as their English speaking peers.

Regrettably, NCLB has done little to improve reading and mathematics achievement across the nation (Lee, 2006). A look at the 2009 National Assessment of Education Progress (NAEP) results seem to show that the national average in mathematics has not changed significantly since the adoption of NCLB. What is more, based on the 2009 NAEP results, ELLs continue to score significantly lower in

mathematics than their non-ELL peers, indicating that NCLB has not moved the nation's practices closer to closing the achievement gap for these group of students.

Prior to NCLB, *A Nation at Risk: The Imperative for Educational Reform* (1983), issued by the National Commission on Excellence in Education prompted educational initiatives. Charged with critiquing the nation's schools in an effort to improve American schools, a task force created by President Reagan made recommendations to raise standards for students and teacher preparation programs. The findings in the report indicated that students at nearly every grade level were performing poorly and warned that American schools were "being eroded by a rising tide of mediocrity" (National Commission on Excellence in Education, p. 3).

Since then, a plethora of policy documents detailing difficulties that American public schools are having in mathematics education have been published, culminating with NCLB. The findings of *A Nation at Risk* prompted researchers to begin collecting data on race to help address issues of inequities in K-12 public schools. As a result, data on race, class and gender has shown that while some achievement gaps have closed, as is the case of gender with respect to standardized tests, other gaps have remained the same or widened, particularly for Latinos/as and ELLs, as discussed earlier.

Clearly, understanding the inequities surrounding the education of ELLs is complex and multi-layered. To fully understand ELL students' performance in mathematics, issues of race, ethnicity, class, and language need to be looked at collectively (Secada, 1992). However, this study focuses on issues of race and language, and how these constructs are fundamental in shaping the educational experiences of ELL

students in Arizona. The following section examines the literature on language policy in an attempt to frame ELLs' educational experiences using a socio-historical framework.

Language Policy

In the following sections, I first review the political and legal context that has historically surrounded and framed the educational opportunities of ELLs, primarily Mexican Americans across the U.S., and then provide an analysis of the educational landscape of ELLs in Arizona.

Historical Context of Mexican Americans and ELLs in U.S. Schools

To fully understand the educational opportunities for ELLs in U.S. schools, it is important to use a sociocultural and socio-historical lens to examine the political, ideological, and legal context in which these realities are situated. What follows is a historical progression of federal and local policy, as well as the legal trajectory of key court decisions that have helped set the stage for current language policies that continue to curtail bilingual education in U.S. schools.

For starters, it is important to examine three opposing orientations present in language policy debates, as these viewpoints help explain the ideological underpinnings of how educational language policies are constructed and enacted - (1) *language as a problem*, (2) *language as a resource*, and (3) *language as a right* (Ruiz, 1984).

Language as a problem is a viewpoint, championed by Richard Ruiz (1984) that positions bilingualism as a threat to the nation, predicting numerous negative consequences, including but not limited to: lowering the GNP, increasing civil conflict, raising political and social unrest and endangering economic stability (Baker, 2006; Stritikus & English, 2010). An example of this orientation is the recent political anti-

immigrant movement in which politicians from several U.S. states, including Arizona, aimed to amend the 14th Amendment to prevent children of undocumented immigrants from automatically becoming U.S. citizens. According to Pennsylvania state Representative, Daryl Metcalfe, the amendment to the Constitution is necessary to stop “nothing less than an invasion” (Kelly, 2011). While this example is not a formal example of educational policies for educating ELLs, it does, however, exemplify the undertone and rhetoric, framing immigrants, many of whom are ELLs, as problematic. As Wiley (1999) explains,

The prevailing language ideology in the United States not only positions English as the dominant language, but also presumes universal English monolingualism to be a natural and ideal condition....The English monolingual ideology sees language diversity as a problem that is largely a consequence of immigration, [and] it equates the acquisition of English with assimilation, patriotism, and what it means to be an ‘American’ (pp. 25-26).

As a result, an orientation framing linguistic diversity as a social ill can result in legislation limiting and/or restricting language and cultural diversity, as in the case of Proposition 203, which will be discussed later in this chapter.

Anti-bilingual legislation is not a recent phenomenon. On the contrary, the highly contentious debate about educating ELL students, particularly those that come across the Mexican border, has historically been driven by ideology deeply rooted in deficiency models, positioning language as a problem needing ‘fixing.’ For example, in *Independent School District v. Salvatierra* (1930), the court ruled that Mexican American children could be segregated to address the special language needs of students. Similarly, in *Delgado v. Bastrop Independent School District* (1948) the court again ruled in favor of segregating children to fix language deficiencies.

In contrast to those who embrace the ideological viewpoint of *language as a problem*, *language as a resource* supporters view students' native language as an avenue to enhance academic competence and value linguistic skills as cultural capital and assets. A common problem with education policy is that it only tends to focus on students' needs rather than on the cultural and linguistic resources that immigrant students bring with them to the classroom (Gándara & Rumberger, 2009). Research suggests that using students' cultural and linguistic resources in the classroom has a positive impact on students' literacy development in English. For example, two reviews recently published (2006) by the National Literacy Panel (NLP) and the Center for Research on Education, Diversity, and Excellence (CREDE) of the research on educating ELLs suggest that students' reading instruction in their first language facilitates higher levels of reading achievement in English. In their extensive meta-analyses review of close to 300 reports, documents, publications, and dissertations concerning ELLs ages 3-18, the NLP and CREDE found evidence suggesting that there is an important relationship between students' development in reading and writing in their first language and literacy development in English. Likewise, researchers argue that encouraging students to use their native language when doing mathematics seems to increase student engagement in the learning process, as well as gives them greater access to mathematical material (Gutstein et al., 1997; Khisty, 1995; Moschkovich, 2000). In addition, to maximize ELL students' learning of mathematics content, teachers need to build on students' prior knowledge and experiences, of which language is a large part (Garrison & Kerper Mora, 1999). More specifically, there exists a reciprocity between mathematics and language, and that mathematical content knowledge is developed through language, and that

language abilities can and should be developed through mathematics instruction (Garrison & Kerper Mora, 1999). Thus, language is viewed as an asset or resource on which to build new mathematical knowledge.

Language as a right, on the other hand, emphasizes principles of social justice, such as ensuring equal rights granted to all under the First Amendment. What is important about this orientation is that while it emphasizes an individual rights platform, it is commonly used to advocate equal protection for specific groups. For example, in *Lau v. Nichols* (1974), the plaintiffs positioned their suit using a *language as a right* orientation by successfully arguing that the students' rights, as a group of Chinese-Americans, were being violated under the Civil Rights Act of 1964. As a result, *Lau* was the first precedent-setting case that explicitly identified the rights of ELLs to have access to the mainstream curriculum. Since *Lau*, we have seen other court cases using this framework to argue for a more equitable education for linguistically diverse students. *Flores v. Arizona* (1992) represents another case in which the plaintiffs used the *language as a right* platform to argue that the state of Arizona was in direct violation of the Equal Education Opportunities Act (EEOA) of 1974 by failing to provide adequate resources for educating ELL students. Unlike the *Lau* case, however, *Flores* is yet to be resolved.

In many ways, thinking about these orientations is a useful tool for analyzing language policy outcomes and the thought processes behind them because they provide a way to categorize the policies formulated and enacted and their respective outcomes (Crawford, 2004b). However, they do not necessarily provide the rationale for why or how policies are formulated and enacted, therefore only explicating part of the story. With respect to language policies, this is because contentious debates about language are

usually less about language and more about socio-political conflict (Crawford, 2004b). For this reason, it is important to examine the surrounding political context in which the debate about teaching the ‘others’ is situated.

Early Court Cases

In 1930, a group of parents sued a district in the City of El Rio, Texas (*Independent School District v. Salvatierra*) claiming that their children were being segregated solely on the basis of race. At the time, Texas law determined that Mexican Americans were members of the white race, and as a result, the district argued that Mexican Americans were, in fact, not being segregated based on race or nationality since they were identified as white. Using this argument as a basis, the court ruled that it was permissible to segregate Mexican American children, as long as the segregation was based on linguistic difficulties and immigrant farming patterns. Since the courts had established the racial group identity of Mexican Americans as white (Martinez, 2000), the district maintained the authority to segregate Mexican American students on educational grounds, claiming that Mexican Americans had special language needs that required segregation. By limiting their analysis to race, the court failed to address the unequal resources and educational opportunities for Mexican Americans in segregated schools (Stritikus & English, 2010).

In 1945, a monumental desegregation case, *Mendez v. Westminster* was filed in California. Like *Salvatierra* (1930), the plaintiffs argued that Mexican American students were being segregated solely based on race. The “main defense was that the districts were not separating Mexican American children on the basis of race or nationality, but for the purpose of ‘providing special instruction to students not fluent in

English and not familiar with American values and customs” (Wollenberg, 1974, p. 362). While the *Mendez* case was not the first desegregation case, it was the first case that used the Fourteenth Amendment (equal protection under the law) to successfully end segregation against Mexican American students. The courts ultimately ruled in favor of the students, thus requiring that the district end the segregation of Mexican American students. While *Mendez* was successful in ending segregation, it did not overturn *Plessy v. Ferguson* (1896). Nonetheless, *Mendez* was pivotal in *Brown v. Board of Education* (1954), which ultimately overturned *Plessy*.

Eighteen years after *Salvatierra* failed to end segregation in Texas and using *Mendez v. Westminster* as a precedent, *Delgado v. Bastrop Independent School District* (1948) was filed in another attempt to end segregation of Mexican Americans in Texas schools. Unlike the *Mendez* case, however, the court ruled in favor of the school district, stating that first grade students could be segregated as long as they were placed in separate classrooms to correct their “English-language deficiencies,” but not in separate schools (Valencia, 2005). In other words, because Mexican Americans had language deficiencies that needed fixing then separating students within schools to fix the problem was permissible. As Stritikus and English (2010) explain, “Racial segregation was problematized, but segregating students for linguistic reasons was justified through the *language as problem* discourse” (p. 403).

Court Cases: 1970’s – 1980’s

Nearly 30 years after *Salvatierra* (1948), *Lau v. Nichols* (1974) was filed by a group of Chinese-American students claiming that the district had violated the Civil Rights Act of 1964 by discriminating against them on the basis of national origin. While

students were not segregated as in the previous cases outlined above, the argument in the case was that students were not receiving any linguistic support for learning English in school; therefore the district was in direct violation of the Civil Rights Act. Ultimately, the court ruled in favor of the students, stating,

Basic English skills are at the very core of what these public schools teach. Imposition of a requirement that, before a child can effectively participate in the educational program, he must already have acquired those basic skills is to make a mockery of public education (as cited in Gándara & Rumberger, 2009, p. 753).

As a result of the court ruling, the rights of ELL students to have access to the same curriculum as their English-dominant peers was recognized, and schools were then required to facilitate access to this same curriculum through whatever effective means they chose, including bilingual education. *Lau* adhered to language as a right framework, proposing little recommendations for accommodating linguistically diverse students. While *Lau* recognized that students' linguistic rights were being violated by immersing them in English-only classes with no support or accommodations, it did not specify what those accommodations would look like.

In 1981 the courts established vague guidelines for how programs should support and serve ELLs, as a result of *Castañeda v. Pickard*. The main argument of *Castañeda* was that the school districts were in direct violation of the Supreme Court's ruling in the *Lau* case by not providing sufficient bilingual education programs to support the linguistic needs of ELL students. After three years of litigation, the court ultimately ruled in favor of the plaintiff. The importance of the ruling was the establishment of a three-part assessment to hold school districts accountable for meeting the Equal Educational Opportunities Act (EEOA) of 1974.

The court established a famous three part test for determining whether a school district has taken appropriate actions to overcome language barriers confronting ELs [English Learners]: (1) the district (or local educational agency) must pursue a program informed by an Educational theory recognized as sound by experts in the field; (2) the programs and practices actually used by the district must be a reasonable reflection of the educational theory adopted; and (3) after a trial period, the success of the program in overcoming the language barriers that confronts students must be demonstrable (Mahoney et al., 2010, p. 50).

In other words, the program adopted must adhere to sound educational theory, be implemented in a form that aligns with the actual adopted program, and have demonstrable success over a trial period.

I now turn to the educational landscape for ELLs in Arizona, one of the five states with the highest concentration of ELL students. The following section examines the ideological and political underpinnings that drive initiatives, specifically in Arizona, designed to dismantle bilingual education at its core and ultimately shape the educational opportunities afforded to ELLs.

Educational Landscape for English Language Learners in Arizona

Arizona - one of the five states with the highest concentration of ELL students, along with California, New Mexico, Texas, and Alaska (U.S. Department of Education, 2000), -housed 147,721 ELL students, comprising approximately 14% of the State's total student enrollment in 2007-2008 (U.S. Department of Education, National Center for Education Statistics, Common Core of Data). It is reported that 81% of ELL students in Arizona speak Spanish (Davenport, 2008).

Three critical events changed the educational and legal landscape for educating ELLs in Arizona. Starting with the yet unresolved *Flores v. Arizona*, Proposition 203 (English-only instruction), and most recently with the addition of HB 2064 (4-hour ELD

block), we see a clear trend of language policies that closely mirror educational policies that have historically marginalized and subjugated ELL students. These events represent some of the latest policy moves in a contentious debate surrounding bilingual education.

Flores v. Arizona. The *Flores* case was filed in 1992 on behalf of a class of ELL students and parents in Nogales, Arizona. The plaintiffs' primary claim was that the state had failed to provide financial and other resources necessary for public schools to adequately implement state-mandated ELL programs. The basis of the complaint was that ELL students were being taught by under-qualified teachers, that ELL students were not being properly identified and monitored, and that the state was not providing adequate educational programs for these students (Mahoney, MacSwan, & Thompson, 2005). By failing to provide adequate resources for educating ELL students, Arizona was in violation of the EEOA of 1974, which requires districts to "take appropriate action to overcome language barriers that impede equal participation by its students in instructional programs" (Section 1703(f)). In 2009, the Supreme Court reversed the Appeals Court, which found that Arizona's funding was inadequate. As of today, *Flores v. Arizona*, is pending in Arizona's federal District court.

Using *Castañeda*, the plaintiffs in the *Flores* case argued that the state was not allocating appropriate resources and funding to effectively implement educational programs for educating ELLs. Ultimately, the state was fined \$500,000 per day for not complying with a 2000 ruling indicating that the Arizona district was, in fact, failing to provide the necessary services for ELL students to learn English and meet state proficiency requirements. An important consequence of the *Flores* judgment is that it prompted Arizona to re-examine the manner in which ELLs were being educated, which

ultimately influenced the implementation of Proposition 203 and HB 2064, discussed below.

Proposition 203 – “English for Children.” In 2000, Arizona passed the voter initiative Proposition 203, titled “English for Children,” modeled after California’s Proposition 227. Like Proposition 227, Proposition 203 replaced most bilingual programs with English-only Structured English Immersion (SEI) models. The main tenets of Proposition 203 are: 1) the government and public schools have a moral obligation to teach English; 2) instruction is only provided in English, placing restrictions on bilingual education and English as a Second Language programs in the state; 3) ELL students can easily acquire full fluency in English if they are “heavily exposed” to it at an early age; and 4) students are expected to become proficient in academic English in one school year.

This new initiative fundamentally changed the way in which ELL students could be instructed by ending the flexibility of school districts to use a variety of instructional models, including bilingual education, to educate ELLs. A fundamental stipulation of Proposition 203 is that students can only receive instruction in English, thereby barring any instruction in the students’ native language, with the exception of Indian communities where principles of tribal sovereignty apply. Research focusing on program effectiveness suggests that the use of students’ first language for instructional support is more beneficial than SEI, a clear contradiction to Proposition 203. For example, a meta-analysis study conducted by Rolstad et al. (2005a) comparing SEI to Transitional Bilingual Education (TBE), found TBE to be more beneficial to ELLs, and that students participating in long-term bilingual programs benefited even more from receiving

academic support in their native language than students in SEI or TBE. Additionally, a separate study also conducted by Rolstad et al. (2005b) found similar results when they examined a subset of the larger national sample in Arizona. An analysis of the Arizona subset studies found that TBE was an even more beneficial treatment for ELLs than SEI when compared to the national sample. The barring of students' native language and immersing them in English-only classrooms to accelerate their acquisition of English is yet another example of a *language as a problem* orientation that problematizes students' cultural and linguistic assets.

In addition to restricting students' native language as a resource for instruction, another guiding principle of Proposition 203 is that young children can easily acquire full fluency in English if they are "heavily exposed" to it an early age. However, this oversimplification of language learning is not supported by research. Research in the area of second language acquisition indicates that ELL students who do not have opportunities to develop literacy in their first language face greater obstacles in acquiring a second language (August & Hakuta, 1997; Hakuta, Butler, & Witt, 2000). Subsequently, because students do not have opportunities to develop initial literacy in their first language, developing literacy in a second language takes longer.

Educational researchers and experts in linguistics agree that on average an ELL entering first grade will reach academic English proficiency within five to seven years due to complex nature of developing the academic language for formal schooling (Cummins, 1981; Hakuta et al., 2000). Further, researchers claim that the time it takes ELL students both to learn English and to reach parity with monolingual students on measures of academic achievement may vary between two to eight years depending on

age, level of formal schooling in the students' native country, quality of input, opportunities to develop proficiency, as well as other factors (Cummins, 1980; Hakuta et al., 2000; Klesmer, 1993). A study conducted by Hakuta et al. (2000) revealed that even in districts considered the most successful in teaching ELL students, it still takes, on average, three to five years to develop oral proficiency and four to seven years to develop academic English proficiency. Another study conducted by MacSwan and Pray (2005) revealed that it took an average of 3.31 years for ELL students in Arizona to reach reasonable fluency levels of English proficiency. MacSwan and Pray (2005) found that only a small percentage (less than 3%) of ELLs they studied reached reasonable fluency in one year. Furthermore, after two years of being immersed in SEI, only about 20% of the ELLs that they studied attained parity with their English-speaking peers, while the rest of the ELL students reached parity in three to six years. Similarly, in a national study of school effectiveness for ELLs students' long-term academic achievement, Thomas and Collier (2002) found that the minimum amount of time it takes to develop academic English proficiency in a second language is four years, and that this is true for ELL students who have had at least four years of primary language schooling.

There is concern that placing a one year restriction on the time to become proficient in English will have a detrimental effect on ELL students given that ELL students placed in SEI classes will not be able to take full advantage of the academic content of the school curriculum due to their limited proficiency in English during the first years of schooling (Mahoney et al., 2005). Krashen, Rolstad, and MacSwan (2007) contend that,

The primary purpose of schooling for all children, including ELLs, is the development of academic subject matter knowledge. A curriculum which separates subject matter instruction from language teaching in an effort to focus on the latter will not only risk creating significant educational deficits in learners, but will also fail to provide meaningful contexts for language acquisition in school (p. 8).

In an analysis of the average mathematics 2007 NAEP scores for ELL students across the U.S. and those states with English-only policies, Losen (2010) found that ELLs in English-only states on average performed worse than ELLs from other U.S. states without restrictive language policies. What is more, Losen also concluded that ELLs in Arizona performed significantly worse on the same assessment when compared to all U.S. states, including those with English-only policies.

While studies on the impact of Proposition 203 on the educational performance of ELL students are limited, researchers have conducted studies on the impact of Proposition 227 in California. A 5-year longitudinal study conducted by Parrish, Pérez, Merickel, and Linqunti (2006) represents one of the most recent, largest, and thorough examinations of Proposition 227's impact. In addition to examining the impact of Proposition 227 on the achievement of ELL students, Parrish et al. (2006) also focused on the overall implementation of Proposition 227, effective practices for ELLs, and on the reclassification of ELL students. One of the main foci of the study was to examine possible changes in the performance gap between ELLs and non-ELLs following the implementation of Proposition 227 by analyzing test scores to gauge gains over time. Their findings suggests that while there had been a slight decrease in the achievement gap between ELLs and non-ELLs following the implementation of Prop 227, overall, the achievement gap remained fairly constant across most subject areas and across grades. In

a study following the Parrish et al. (2006) study, Wentworth, Pellegrin, Thompson, & Hakuta (2010) used CST data from 2003-2007 to examine student performance separately by grade level in an attempt to compare the achievement of ELL students to the achievement of other students following the passage of Proposition 227. They used linear regression to find the rate of change of the CST score on each year of testing, separately for ELLs and non-ELL students. Like Parrish et al. (2006), their findings suggests that while there were no definitive statements that could be made about the impact of Proposition 227, they found no “clear association between the implementation of Prop 227 and consistent achievement gains for English learners relative to English-only students” (p. 48), an argument used to support English-only models.

4-Hour Block– “The Model.” In 2007, Arizona adopted yet another language policy that placed stricter English-only regulations on the already existing Proposition 203. As a result of the passage of HB 2064, a Task Force was established to create a modified SEI grounded in educational theory (Arizona Department of Education, 2008). What resulted was a theoretically unsound, rigid 4-hour block model with the following stipulations: 1) ELL students receive English language development (ELD) instruction for a minimum of four hours a day; 2) ELD is separate from content-area instruction; and 3) ELL students are segregated into classrooms by English language proficiency level. Evidence that the 4-hour block is theoretically unsound will be presented in the following sections. As Gándara, Losen, August, Uriarte, Gomez, and Hopkins (2010) explain,

The Task Force defined English language development in Structure English Immersion classes as separate from content-area instruction, where “the content of the ELD emphasizes the English language itself” (Arizona Task Force, 2007). Students are to be grouped with other students of the same proficiency level, and the Task Force has specified the number of minutes to be spent on each element

of language and literacy instruction, with different time allotments at each level of proficiency. Thus, EL students in Arizona are segregated into classrooms with no exposure to English-dominant peers for 80% of the school day (4 hours), and the instruction they receive focuses on learning English over learning subject matter (e.g., mathematics, science, social studies) (p. 27).

An underlying component of the model is that ELL students and non-ELL students should not be integrated during the 4 hours of ELD instruction. Instead, ELL students are grouped by language proficiency level. What results is ELL students being segregated from their native English-speaking peers and not exposed to native speaker input, besides that of the teacher (Long & Adamson, 2012). According to Faltis and Arias (2012), “English learners who are placed for four hours with others who are at their level of English proficiency, on a long-term basis, are denied opportunities to interact with and learn from more proficient others” (p. 33). Guerrero (2004) argues that English-only propositions strictly limit the extent to which ELLs get to socialize into and internalize the English language by not having their native-English speaking peers model the English language for them. By restricting the interaction between ELL and non-ELL students, the model violates the EEOA, in which states are required to ensure that all students, regardless of native language, have the opportunity for “equal participation” in public education.

A recent ethnographic study examining the implementation and organization of the state mandated curriculum in the 4-hour block in 18 Arizona public classrooms in 5 different districts revealed that “ELLs are physically, socially, and educationally isolated from their non-ELLs peers,” and as a result places ELLs at a disadvantage for high school graduation (Lillie et al., 2010, p. 2). The focus of the study was on the effects of segregating ELL students by language proficiency, the delivery of instruction during the

4-hour block, the level of access that ELLs receive to grade-level curriculum, and problems with the reclassification of ELLs. The researchers found that ELLs were not exiting the program in one year, with the exception of kindergartners. The researchers also found that at the primary level, students received little instruction in subject matter, aside from English instruction, and that the subject matter failed to meet grade level standards. With regard to the level of exposure to more English-proficient peers, Lillie et al. (2010) explain:

When elementary ELLs left their classroom for specials such as Art or Music, and in one case for mathematics instruction, they remained grouped throughout the day with the students from their 4-hour block classroom. In short, ELLs in four-hour model classrooms were spending their entire day with their fellow ELL peers. They did not have contact with native English speaking students during academic or fine arts instruction. As teachers noted, this was an aspect of scheduling that meant there was a minimal amount of time in which these students could interact with English proficient peers. Lunch was the one exception where interaction could have been possible. Unfortunately, with the arrangement of the seats forcing classrooms to sit with one another, the segregation of ELL students from non-ELLs was complete. (p. 18)

While the study was the first of its kind, given the relatively new implementation of the 4-hour block, which was first implemented in the fall of school year 2008-2009, the potential impact of such policy on ELL students' mathematics performance is yet unknown. In addition, while the study offers insight into the implementation of the model in Arizona, it does so strictly using qualitative methods. It would have been valuable to examine the qualitative aspect of this study in conjunction with quantitative data to either help support or challenge the claims made by the researchers. Regrettably, there is a significant void in empirical research about the potential impact of restrictive

language policies on the opportunities that ELL students have afforded to them in mathematics in Arizona public schools.

Second Language Teaching in Mathematics

Mathematics curriculum and teaching standards have shifted in recent years, placing emphasis on discourse and communication, posing challenges for ELL students. What that means for ELL students is that they are now expected to engage in multiple forms of mathematical discourse practices (Gee, 1992), such as negotiating meaning, explaining solutions, and presenting arguments, all while simultaneously learning a second language (Moschkovich, 1999). However, studies have focused primarily on detailing difficulties that ELLs have in the mathematics classroom (Cuevas, 1984; Cuevas, Mann, & McClung, 1986; Mestre, 1981, 1988; Spanos, Rhodes, Dale, & Crandall, 1988), giving little attention to the current educational reforms that now require students to present mathematical arguments to support conjectures and negotiate their mathematical ideas using the specialized language of mathematics.

Given this shift, it is important that research account for this change in how we view mathematical discourse and communication, as failure to do so can potentially perpetuate a deficiency model of these students. Making that paradigm shift is critical for understanding ELL students' unique needs, focusing on their strengths, and moving away from conceiving of the teaching of mathematics as simply vocabulary (Moschkovich, 2007). In response to this prevalent oversimplification that teaching mathematics to ELL students only involves teaching vocabulary, researchers have begun to move in new directions that focus on ELL students' resources and competencies, thereby widening what counts as competence in mathematical communication. Recent research on

effectively teaching mathematics to ELL students and the complexities involved in doing so have begun to center on ELLs' linguistic, cultural, and personal experiences.

The following sections examine the literature in second language teaching using a sociocultural lens that emphasizes effective pedagogical practices for teaching mathematics to ELLs. I begin by discussing the importance of engaging ELL students in activities that allow them to access mathematical ideas in various ways to actively participate in substantive conversations about mathematics. Next, I discuss the importance of providing opportunities for ELL students to engage in mathematical discourse as they develop English and build conceptual understanding. I conclude by discussing the importance of cultivating a learning space grounded in students' cultural, linguistic, and personal experiences, in which students can develop conceptual understanding (e.g., Civil & Andrade, 2002; Lo Cicero, Fuson, & Alleksaht-Snyder, 1999; Moll, Amanti, Neff, & González, 1992; Moschkovich, 1996; Turner, Celedón-Pattichis, & Marshall, 2008).

The Standards for Mathematical Practice describe practices that teachers should seek to develop in their students. These practices rest on developing mathematical proficient students, meaning that students should be able to problem solve, reason abstractly, communicate using the language of mathematics, make mathematical representations and connections, develop conceptual understanding and productive disposition, and gain procedural fluency (Standards for Mathematical Practice, 2010). For ELLs, developing these practices can present challenges as they learn the content while simultaneously learning English. Like English-speaking students, ELLs need access to teaching practices that effectively support student performance in mathematics

while helping students develop and use the language of mathematics.

Effective teaching practices for ELLs involve the development and use of academic and everyday language, the symbolic language of mathematics, and their integration. Students need access to a classroom community that purposely and deliberately provides opportunities for students to actively engage in mathematical tasks that require them to communicate, reason, negotiate, justify, and make connections. This means structuring mathematical tasks and lessons in ways that allow students to access mathematical information in various ways – use of charts, graphs/diagrams, discussion of the multiple meanings of certain mathematical terms in context, and discussion of mathematical symbolism, all in relation to each other (Kang & Pham, 1995; Khisty & Chval, 2002). For example, in a study examining how a dual-language middle school mathematics classroom provided immigrant Latino/a students with opportunities to develop and apply reasoning in English and Spanish, McGraw et al. (2007), explicitly identified specific teacher strategies that supported language development by building on students' language resources. Specifically, the researchers identified the use of diagrams and images in assisting students to make sense of the mathematical task. In addition, the researchers also reported the importance of providing opportunities for students to describe their reasoning orally and in writing using the language more accessible and comprehensible to the students.

ELL students need opportunities to engage in mathematical discourse with their peers to construct mathematical meaning. Just like language is developed through communication and active participation with others, mathematical reasoning is developed through the use of mathematical communication and discourse – where students negotiate

meaning through justification and explanation of mathematical ideas. Moreover, to understand and substantively participate in discussions about mathematics, as well as to build conceptual understanding, students must be able to comprehend and manipulate the language of mathematics and comprehend and speak mathematically (Pimm, 1987). It is through this interactive process and community of practice that students begin to make connections between mathematical ideas and solidify their existing knowledge (Forman, 1996; Lave & Wenger, 1991; Moschkovich, 2007; Nasir, 2002). This emphasis on communication and reasoning is evident in reform efforts such as NCTM's standards stating that students should make conjectures, develop arguments, express their thinking process to their peers and teacher, and express mathematical ideas using language (NCTM, 2000).

A qualitative study conducted by Khisty & Chval (2002), on the nature of pedagogic discourse, suggests that the teacher plays a key role in engineering a learning environment where students can actively participate in problem solving, justification, oral and written communication, and independent thinking. Using a sociocultural perspective, the authors suggest that the teacher's role of the 'more capable other' (Vygotsky, 1978), inevitably influences student learning, and therefore must be closely examined to better understand the level of access that students have to academic discourse. What they found in their analysis of a fifth grade teacher and her Latino/a students was that students made significant academic gains in mathematics, which was attributed, in large part, to the teacher's effective use of academic discourse and the students' access to multiple opportunities to hear and use the language of mathematics. Similarly, McGraw et al. (2007) reported similar findings about the importance of giving students time to discuss

with their peers and sharing the ideas and questions raised in their groups with the whole class, again using the language of their choosing.

To be most effective, the opportunities that students are given to learn mathematics should be grounded in students' experiential, cultural, and linguistic knowledge. This means understanding the role of students' first language in the teaching and learning of mathematics. More importantly, it means understanding the relationship between mathematics instruction and language, as failure to understand this relationship can result in denying ELL students a high-quality education by failing to adequately support them (Khisty, 1993; Secada, 1992). A study conducted by Celedón-Pattichis (1999) highlights the importance of taking into account students' sociocultural and linguistic experiences when teaching ELL students. In this one-year qualitative study, Celedón-Pattichis analyzed how nine middle school ELLs of Mexican descent made sense of and constructed meaning on think-aloud protocols of English and Spanish word problems. What she found was that when the word problems mixed mathematical and natural language, students failed to construct meaning in both languages, highlighting the need of developing "knowledge of the mathematics register so that mathematics and bilingual educators can better serve the needs of second language learners" (p. 25).

Mathematical tasks and questions should incorporate, or at least acknowledge, the cultural and linguistic resources that students bring with them to the mathematics classroom and be seen as a source of knowledge on which to build new mathematical ideas. It means re-evaluating what counts as knowledge and how to capitalize on it. Failure to recognize this knowledge can result in "ignoring potential new strategies, conceptual understandings, or unique algorithms that they could offer a U.S. mathematics

classroom” (Gutiérrez, 2008, p. 361). Most importantly, this perspective shifts away from potential deficit views of students by putting in place a model that focuses on resources rather than deficits. This is particularly important, as we take into account the socio-political and historical context that surrounds the education of ELL students in the U.S.

In a qualitative study conducted by Turner, Celedón-Pattichis, & Marshall (2008), the authors studied classroom practices, including cultural and linguistic resources, that teachers of Latino/a children from low socio-economic status (SES) backgrounds drew from to support students’ learning. In their analysis of three kindergarten classrooms in schools with predominantly Latino/a students, the authors focused explicitly on practices that centered on the critical role of language, culture, and participation. Data collected from pre- and post-task-based clinical interview assessments, along with classroom observations, and teacher interviews were analyzed using the principles of grounded theory (Strauss & Corbin, 1990). One teaching practice that was highlighted in the study was the use of authentic, storytelling conversation to generate mathematical problems and discourse. According to the authors, “By framing problem solving around telling and investigating stories, teachers drew upon ways of talking and negotiating meaning that were familiar to students” (Turner et al., 2008, p. 27). As a result of this dialogic nature of the stories, students became active participants and contributors in their learning. This idea of mathematizing students’ stories is supported by the work of Lo Cicero, Fuson, & Allexaht-Snider (1999) that draws on a six-year project (Children’s Mathematics Worlds). Like Turner et al. (2008), the authors make a case for using students’ stories to support problem solving. What is important about this approach is that mathematical

learning is grounded in students' personal, cultural, and linguistic experiences.

The Turner et al. (2008) study found that students showed considerable learning gains, as measured on the post-assessment, and thus suggests that teaching practices that allow for repeated opportunities to participate in classrooms structured around practices that give attention to culture and language are in fact consequential. This study supports the literature, and my earlier argument, that for mathematics learning to take place it is important that ELLs engage in a community of practice that places students' experiential, linguistic, and cultural resources at the core of the learning process. However, while this study fills a critical void in the literature on how young Latino/as, some of whom are ELLs, learn to solve and discuss mathematical problems, it does so in a bilingual environment, leaving room for future research situated in a socio-political context that restricts use of students' cultural and linguistic resources. For example, how would this study play out in Arizona where students are segregated based on language proficiency, alienated from their English proficient peers for 80% of the day, and where teachers' instructional practices are severely curtailed by restricting the language of instruction to English?

The notion of using students' personal experiences and backgrounds as resources for teaching and learning mathematics is not new. In fact, there is a growing body of research focusing on utilizing students' funds of knowledge (Moll et al., 1992) and students' households as resources (González, 1995; Moschkovich, 1996) to support students' learning in mathematics (Civil, 2007). In an effort to understand the link between school mathematics and everyday experiences, Civil and Andrade (2002), conducted a study in which, through household visits, teachers were encouraged to learn

firsthand about students' lived realities and build relationships with students and parents, a community knowledge that was later used in the mathematics classroom, as modules were developed based on these experiences. The idea of involving 'parents as intellectual resources' by directly involving them as contributors to the curriculum was a way to directly link students' personal, cultural, and community knowledge with mathematical learning.

Another way to conceptualize the inclusion of students' personal, cultural, and linguistic resources as viable assets from which to build new knowledge is the idea of using culturally relevant teaching (Ladson-Billings, 1995; Gutstein et al., 1997). This method of teaching requires teachers to know and understand their students and their culture so that that knowledge can be used to effectively connect students' experiences with mathematical learning. In a two-year study, Gutstein et al. (1997) explored what culturally relevant teaching looked like, as well as examined how teachers used their connections with their students to build on their informal mathematical knowledge. First, all participants in the study were fluently bilingual. Second, all teachers participating in the study were selected based on the school's recommendation, which consisted of the following criteria: 1) they believed all children could learn; 2) they valued the culture and language of the children and their families; 3) they cared about all the children, and; 4) they saw their work as a calling. Standard ethnographic field methods were used for this study. What the researchers found was that teachers in the project made connections, implicitly and/or explicitly between mathematics teaching and social activism by building connections with students' families to create a classroom culture where students'

experiential, cultural, and linguistic knowledge was part of the curriculum aimed at empowering students and promoting cultural excellence and biculturalism.

In their study, Gutstein et al. (1997), propose a 3-part model of culturally relevant mathematics teaching focusing on building a set of connections that foster a critical approach to knowledge.

The main components of this model are (a) connections between becoming critical mathematical thinkers and viewing knowledge critically in a broad sense, (b) connections between building on students' informal mathematical knowledge and building on students' cultural and experiential knowledge, and (c) orientations to students' culture and experience (Gutstein et al., 1997, p. 718).

This 3-part model supports using a situated-sociocultural perspective to effectively teach Latino/a students, many of whom are ELL students. An important aspect of this study is that it emphasizes a model of resources, and utilizes these competencies as assets on which to build mathematical knowledge.

The Gutstein et al. (1997), study adds to the literature of culturally relevant mathematics teaching and offers a distinctive view of how this plays out in a Mexican American context. Like the Turner et al. (2008) study, this study was conducted in a bilingual setting, again, raising questions about the constraints and limitations of English-only legislation and the implications of not being able to use language as a source of knowledge when teaching mathematics. While this is not a limitation of the study, it does raise important questions about how the study's 3-part model would fit within the current socio-political context in Arizona, given that a critical component of the model is to use students' experiential and cultural knowledge, that of which language is a part of, to build mathematical knowledge.

Gaps in Literature

The extant literature on the deleterious effects of restrictive language policies on ELLs, particularly on the 4-hour block is, at best, thin. While a few recent studies have examined the organization and implementation of the new SEI block and have begun to call for intentional efforts by policymakers to re-examine current English-only policies, no study has critically examined the implications of such policy on the mathematics education of ELLs. There is much to be understood of how political, social, and educational processes coalesce and operate in an English-only setting under rigid guidelines. In addition, while there is a considerable amount of literature that examines teacher practices that support students' learning in mathematics (i.e., Carey, Fennema, Carpenter & Franke, 1995; Villaseñor & Kepner, 1993), little scholarship has been devoted to how these practices play out with Latino/a students, particularly ELL students, giving space for future research in this area.

It is clear that there is an immediate need for scholarly work focusing not only on the implementation of English-only policies, but also on the potential detrimental effects of language policies on the teaching and learning of mathematics. If we are to make significant gains in improving the access that ELL students have to an equitable mathematics education, then it is imperative that research move in new directions, ones that are at the core of the intersection of policy, mathematics education, and second language teaching.

In an effort to fill this gap in scholarly work, this dissertation explored how language policy, and teacher beliefs and practice mediate each other and how this mediation affects ELLs' access to mathematics instruction and curriculum. The

conceptual design of this study can be used to further research the ideological alignment of teachers and its impact on mathematics practice. Furthermore, because this study worked across multiple constructs, it allowed me to examine how institutional factors at various levels (state, district, school) impact teachers' practices and ultimately help shape the access that students have to mathematics instruction and curriculum.

Chapter 4

METHODS

Research Approach

The research approach used in this study involves the ethnographic study of multiple contrasting, but similar cases. To understand the nature of the relationship between language policy, teacher beliefs, and practice and answer the research questions, I employed a design that incorporates observations and interviews with students and teachers. I also performed descriptive statistics of the students' scores on the district's mathematics assessment to determine if there is a relationship between the various constructs in this study and students' mathematics performance. I obtained and analyzed both qualitative and quantitative data concurrently and integrated the data at several stages of the research (Creswell, et al., 2003).

Qualitative data analysis methods were used based on Erickson's interpretive approach. Interpretive research aims to find patterns of meaning and action that characterize a particular field setting and see how these patterns relate to a wider social structure. Erickson (1986) describes his work involving interpretive research as an "attempt to combine close analysis of fine details of behavior and meaning in everyday social interaction with analysis of the wider societal context – the field of broader social influences – within which the face-to-face interaction takes place" (p. 120). From an interpretive point of view, the researcher is the instrument whose job is to uncover the meaning behind social interaction and lift the veils to unravel the multiple layers of meanings represented by the participants involved in the scene of action. In the context of the classroom, Erickson suggests that the researcher begin by investigating what

actually happens between teachers and students, proceed by developing interpretations of what the actions may mean for participants, and conclude with assertions on how the actions and meanings may relate to a wider social structure. Similarly, quantitative methods were used to analyze some of the data sources. Specifically, descriptive statistics were used to examine students' mathematics performance, as well as to examine teachers' practices using the Classroom Assessment Scoring System (CLASS) protocol.

Situational Context

The situational context of this study is an urban PreK – 8 district in the metropolitan Phoenix area, serving a large population of English language learner (ELL) students, a setting where I had previously researched. The student population in the district is primarily Latino/a (approximately 95%). Forty six percent of the total population is designated as ELL, as determined by the Arizona English Language Learner Assessment (AZELLA), and 95% receive free/reduced lunch.

The site was selected for various reasons. First, because I participated in a 5-year longitudinal study at the district under an NSF grant, I had already established relationships and built rapport with students, teachers, and administrators. I was able to successfully transition the insider knowledge that I had gained from working and interacting with teachers and students into my dissertation study. Second, the high concentration of ELL students made the district a valuable resource for the study. And finally, having students self-contained, that is, having the same teacher teach the 4-hour English language development (ELD) block and the mathematics block, allowed me to examine the level of implementation of the language policy across the two dimensions.

Sampling of Cases

In an effort to test for the effects of various beliefs and practices on opportunities that ELLs have in the mathematics classroom, four contrasting cases were selected. Teachers and their students were purposely selected from the three NSF grant participating schools. Three of the four teachers taught at the same school and are teachers that I had observed and worked with in the past through the grant. The fourth teacher was at a different school, but I had worked with her in a different capacity, namely providing professional development over the course of two years.

To select teachers, a Likert-scale survey (Appendix C) about teachers' beliefs on bilingual education and teaching mathematics to ELLs was electronically sent to all third through fifth grade teachers ($n = 21$) from the three participating schools. An email describing the survey and the study was sent out to the 21 teachers, of which 16 completed the survey. In addition to the information obtained from the survey, recommendations were given by other graduate students participating in the NSF grant about potential teachers for this study. Data generated from the self-reporting survey, in conjunction with recommendations from other colleagues were then used to select the four contrasting cases (see Table 4.1).

Table 4.1

Teacher Ideological Alignment

	Language as a Resource - Views of ELLs	Language as a Problem - Views of ELLs
Teachers that Embody Research Practices for Teaching ELLs	Teacher believes ELL students are capable learners and views language as a resource on which to build new mathematical knowledge. Teacher believes her instructional practices should support student learning by adapting instruction to meet the linguistic, cultural, and cognitive needs of her ELL students.	Teacher believes ELL students have deficits that limit their learning of mathematics. Irrespective of these beliefs, teacher believes that mathematics instruction should accommodate her ELLs' linguistic and cultural needs.
Teachers that Do Not Embody Research Practices for Teaching ELLs	Teacher believes ELL students are capable learners and views language as a resource on which to build new mathematical knowledge. However, teacher believes that no differentiated instruction is necessary to accommodate the linguistic and cultural needs of ELLs.	Teacher believes ELL students have deficits that limit their learning of mathematics. In addition, teacher believes that no differentiated instruction is necessary to accommodate the linguistic and cultural needs of ELLs.

Questions for the Likert-scale survey were selected from Lightbown and Spada's (1999) survey of popular ideas about language learning and Shin and Krashen's (1996) survey of attitudes towards bilingual education. Questions were adapted to make them more relevant to teachers' beliefs about teaching mathematics to ELL students. However, when modifying questions to better align with this research study, Sudman and Bradburn's (1982) work on asking questions was used as a baseline. I used Sudman and Bradburn (1982) advice and formulated and structured questions in a way that was clear

and specific since “the terms ‘attitude,’ ‘opinion,’ and ‘belief’ all refer to psychological states that are in principle unverifiable except by the report of the individual” (p. 120). To help ensure validity of the instrument, the survey questions were tested with a different group of teachers from a different district to identify any potential issues before being given to the sample teachers. In addition to having teachers pilot the survey to provide feedback about the survey items, teachers were interviewed to ensure that I captured their thinking when responding to items. The teacher beliefs survey covered four general ideas: 1) view of students’ first language (L1) as a resource or problem when learning a second language and/or mathematics; 2) the role and use of students’ L1 in the teaching and learning of mathematics; 3) the role of bilingualism and biculturalism in school learning, and; 4) classroom practices.

In selecting the four teachers, attention was given to how teachers responded on particular questions on the survey. The objective was to try to place teachers’ ideological alignment with respect to language and teaching mathematics to ELLs on the matrix (Table 4.1). Since one of the key ideas on the matrix is how teachers aligned their ideologies with respect to students’ first language, I paid particular attention to those questions on the survey that addressed this issue. For example, the question on whether students’ use of their first language to solve mathematics problems hinders their ability to learn English was particularly interesting because it gave me insight into teachers’ ideological alignment with respect to students’ first language. Similarly, the question on whether most of the mistakes that ELLs make in mathematics are due to interference from their first language was also used to check for teachers’ language orientation.

The other key idea represented on the matrix is teachers' practice. To look at teachers' ideological alignment with respect to teaching mathematics to ELLs, I paid particular attention to those questions on the survey that addressed their practice. For example, I wanted to see if teachers' viewed differentiated instruction as a necessity for ELLs. Depending on their response to this question and other similar questions, they were placed on the matrix accordingly.

While the sample size was small and therefore not generalizable in the random selection sense, it did provide an opportunity to examine the impact of policy and teachers' beliefs and practice on student opportunities to learn mathematics in this study. In addition, the selection of cases in this way also allowed for the testing of the various positions of policy mediation, at least at a basic level. According to Erickson (1986), when making generalizations, the interpretive model does not seek to make abstract generalizations across cases. Rather, the researcher seeks to understand each case on its own and then attempt to make comparative statements and generalizations to other cases. Erickson claims that the primary focus of the researcher is particularizability, rather than generalizability. According to Erickson (1986),

The task of the analyst is to uncover the different layers of universality and particularity that are confronted in the specific case at hand – what is broadly universal, what generalizes to other similar situations, what is unique to the given instance(p. 130).

It is the job of the interpretive researcher to discover meaning behind actions and see how these actions and meanings may relate to a wider social structure.

Participants' Backgrounds

In this section, I provide a brief background about participants' educational experiences and my relationship with them to provide research context. A brief overview of teachers' ideological alignment with respect to teaching mathematics to ELL students is also presented. Data supporting these ideological alignments is presented in detail in Chapter 5. Pseudonyms were used to protect participants' identities.

Of the 21 teachers that completed the survey, six teachers were identified as potential participants. Emails detailing the study and their involvement were sent out to those six teachers, asking for their participation. Of the six potential participants, two declined to participate. It was agreed that I would observe them over the course of eight weeks, and in that time conduct one semi-structured interview and several informal stimulated recall interviews.

Ms. Rivas. Ms. Rivas is a Latina, bilingual teacher with eight years of teaching experience. She taught the third/fourth grade combination ELL class. Her ELL students ranged from beginning to intermediate, as determined by the AZELLA. Her ideological alignment with respect to teaching mathematics to her ELL students shifted across dimensions. By this I mean that although she may have used instructional practices consistent with current research, at times she displayed, to some degree, deficit views of her students, particularly of their ability to do mathematics. Other times, however, her practice was simply consistent with the institutional compliance set forth by the State, district, and school. I had worked with Ms. Rivas for the past year as part of the NSF grant. As a graduate research assistant, I observed Ms. Rivas for the past year once a week, as well as provided her with feedback regarding her instructional practices.

Ms. McDonald. Ms. McDonald is a white teacher with four years of teaching experience. She taught the fourth grade mainstream class, although 10 of her students had just recently transitioned to proficient, as measured by the AZELLA. Unlike Ms. Rivas who shifted between dimensions, Ms. McDonald's ideological alignment with respect to teaching mathematics to her students can be characterized as consistently embodying teaching practices consistent with research, as well as having positive views of students' mathematics abilities and their cultural and linguistic capital. She consistently and effectively used instructional practices that engaged students in conversations about mathematics. While I had not formally worked with Ms. McDonald in the classroom prior to this study, she had participated in many of the professional development sessions that were provided for teachers participating in the NSF grant.

Ms. Moore. Ms. Moore is a white teacher with one year of teaching experience. She taught the fourth grade mainstream class. Unlike Ms. McDonald who had a positive view of students' cultural and linguistic capital, Ms. Moore viewed students' first language as an obstacle and hindrance to their success. With respect to instructional practices, Ms. Moore promoted an environment with limited opportunities for students to engage in conversations about mathematics. I had the opportunity to work with Ms. Moore for the past year as part of the NSF grant. My role as a graduate research assistant allowed me to gain insight into Ms. Moore's teaching practices and interactions with her students by observing her once a week for the school year.

Ms. Cohen. Ms. Cohen is a white teacher with one year of teaching experience. Although she taught the fifth grade mainstream class, the majority of her students had just recently transitioned to proficient, as measured by the AZELLA. Her ideological

alignment with respect to teaching mathematics to her ELL students also shifted between dimensions. There is evidence to support the idea that Ms. Cohen was not opposed to students' use of their first language when solving mathematics problems. However, the evidence also suggests that, to some degree, Ms. Cohen had deficit views of her students' abilities to do mathematics. Like Ms. Rivas and Ms. Moore, I had worked with Ms. Cohen for the past year in the same capacity. I had the opportunity to work with many of her students last year when they were still in the ELD program, but with a different teacher.

Of the four teachers, Ms. Rivas was the only teacher required to teach the 4-hour block, while the other three were required, at the district level, to teach a 2-hour iteration of the block, consisting of uninterrupted reading and writing. This 2-hour block was put into place as a result of the district being in corrective action, meaning that the district had been in school improvement for at least two years and still has not made Adequate Yearly Progress (AYP).

In addition to either teaching the 4-hour or 2-hour block, teachers were also mandated to incorporate several curriculum intervention programs and routines. The first consisted of mathematics wall, a series of test preparation problems that students were given at the beginning of mathematics time each day. Mathematics wall was implemented at the district level, so all four teachers incorporated this routine into their mathematics instruction. A second curriculum intervention involved the implementation of the Otter Creek Institute program, which entailed mastering mathematics facts and streamlining word problems. However, this program was only implemented by Ms.

Rivas, Ms. Cohen, and Ms. Moore, as it was put into place by the principal at their school.

The program's daily component for mathematics facts consisted of students testing each other, with the goal of answering 40 problems correctly in one minute (see Appendix E for a sample mathematics facts handout). The other component of the Otter Creek program focused on streamlining word problems by having students set up the problem in the same way each time, then choosing an arithmetic operation based upon the location of the unknown in the formula (see Appendix D for a sample word problem handout). In this model, students are given step-by-step procedures for solving problems, leaving no room for students to negotiate meaning, reason through problems, try a variety of strategies or use visuals and/or manipulatives to solve problems. In fact, the authors of the program explicitly stated in their curriculum that using manipulatives or other concrete representations to solve mathematics problems is unreliable, time consuming, and a disservice to students. Instead, the program calls for a one-size-fits-all model that categorizes word problems, and then provides a rote process for finding the answer.

Gaining Access

My role as a research assistant provided me with access to the setting and its participants. Letters were electronically sent to the prospective teachers informing them of the study and requesting their participation. Participants were informed of their right to withdraw from the research project at any time and/or right to refuse to answer any questions during the interview.

Observation Process

I was thorough and reflective when describing everyday events in the classroom

setting and when making interpretations and inferences of actions in the events from the various points of view of the participants themselves. According to Erickson (1986), participant observational fieldwork should involve:

(a) intensive, long-term participation in a field setting; (b) careful recording of what happens in the setting by writing field notes and collecting other kinds of documentary evidence (e.g., memos, records, examples of student work, audiotapes, videotapes); and (c) subsequent analytic reflection on the documentary record obtained in the field, and reporting by means of detailed description, using narrative vignettes and direct quotes from interviews, as well as by more general description in the form of analytic charts, summary tables, and descriptive statistics (p. 120).

To capture, interpret, and make meaning of the interactions taking place between teachers and students, classes were observed once a week over the course of eight weeks. During the observation process, I took detailed field notes of the transactions occurring in the classroom during the designated mathematics time. During observations, interactions and dialogue taking place between the teacher and her students, as well as the interactions and dialogue between students were recorded. At times I simply observed the complex happenings around me, recorded them, and then analyzed them in an effort to make meaning of the transactions occurring between participants and their environment. Other times, I became a participant by engaging in activities in small groups or assisting the teacher with different parts of a lesson.

To document classroom practices, I employed traditional ethnographic observation methods to better understand the diverse perspectives and the interplay among them. Observations were audiotaped to ensure that teacher-student and student-student discourse and dialogue were accurately captured. Erickson (1986) describes systematic classroom observation approach as a way to study a particular behavior of

interest. Using this approach, the researcher can establish reliability by observing the same behavior in the same classroom and across different classrooms. There are four general areas that encompassed the classroom observations: 1) scaffolding – mathematics and language development; 2) cultural/linguistic support; 3) discourse and communication; and 4) student participation/engagement.

The first area that was examined was the extent to which scaffolding occurred, both for mathematics and language development. I looked for instances where the teacher provided the linguistic and content support (i.e., addressing academic and specialized mathematical language, use of graphic organizers, etc.) that are necessary for understanding the mathematical concept (Kang & Pham, 1995; Khisty & Chval, 2002). For instance, when introducing new terms, I looked for instances where the teacher may have explicitly identified and reviewed terms that have a unique meaning in mathematics (i.e., odd, square, etc.) by using visuals, prompts, gestures, conjugates, etc. Other instances may have included the teacher connecting symbolic representations to word definitions by posting examples and symbols next to word definitions. Additional evidence would have entailed the teacher using appropriate speech to students' language proficiency level, such as slowing down and enunciating potentially difficult words. Other forms of evidence may have included the teacher revoicing students' responses by providing additional information to clarify students' intended meaning, and thereby allowing the student to hear and use appropriate mathematical language to convey meaning. In addition, I focused on the extent to which students had opportunities to develop their listening, speaking, reading, and writing skills in the context of learning mathematics. For example, there might have been instances where the teacher asked

students to restate other students' explanations or comments by asking questions to elicit elaboration, thereby providing opportunities for students to develop their listening and speaking skills in the context of mathematics.

The second area of focus is the extent to which there was evidence of cultural and linguistic support for students as they learned new mathematical concepts. For instance, were students allowed and encouraged to use their first language as a source of knowledge (Thomas & Collier, 1997; Turner & Celedón-Pattichis, 2003) when learning new mathematical concepts? Evidence of this would have been the teacher using cognates to teach mathematics. For instance, when teaching about geometric shapes, the teacher and/or students used terms such as 'triángulo' and 'cuadrilátero,' as a means to make sense of the language of mathematics. Counterevidence would have been the teacher writing mathematical terms on the board without any explanation and/or information (i.e., visuals/diagrams/pictures in conjunction with a description of the terms).

The third area that was examined involves opportunities for students to engage in discourse and communication centered on learning mathematics. For example, I looked for instances where there was a collective sharing of ideas that required students to interpret, make sense of, and engage in doing mathematics (Khisty & Viego, 1999; Khisty & Chval, 2002; Moschkovich, 1999). In addition, I looked for instances where students had opportunities to hear, use, interpret, and make sense of the academic discourse. Evidence of this could have included students going up to the board and sharing their solutions with the whole class. By sharing their solutions, I mean students justifying and explaining the thought process by which they arrived at their answer. By

extension, this could have entailed the teacher encouraging more elaborate responses, such as, “What do you mean by . . . , Can you walk us through how you got your answer? How did you get that?,” so that students had opportunities to explain and justify their answers and strategies using the language of mathematics.

The last area that was focused on is the level of engagement and participation of students with the mathematics content. I view this area as an extension of discourse and communication because discourse functions as a mechanism to actively engage in the learning process. For example, I looked for instances where students had opportunities to work in pairs or small groups when working on mathematical tasks and problem solving, such as think-pair-share. Additional evidence of student engagement could have entailed students contributing to the mathematical task by reporting out orally and/or in writing. In addition to looking at student engagement, I examined the teacher’s role as students engaged with each other and the mathematics by examining the questioning and guidance that she/he provided to students during small group and whole group instruction. Engaging in mathematical tasks and discussions by speaking, listening, reading, and writing is consistent with findings on effective mathematics instruction for ELLs (Moschkovich, 1999). Therefore, the extent to which students had opportunities to become producers of mathematical practice (González, Andrade, Civil, & Moll, 2001) was a focus.

To gather validity evidence for the classroom observations, I provided confirming and disconfirming evidence in each of the four general areas of focus, as well as conducted informal interviews with students and teachers. These stimulated recall interviews functioned as an extension of the observations as they allowed me to gain

insight into student and teacher intentions and perceptions about particular incidents, mathematical discourse used, and practices.

In addition, the CLASS protocol was used to collect standardized information on the quality of classroom environments of the four teachers. Specifically, the CLASS protocol was used to identify and measure the following dimensions: 1) positive climate; 2) negative climate; 3) teacher sensitivity; 4) regard for student perspective; 5) behavior management; 6) productivity; 7) instructional learning formats; 8) concept development; 9) quality of feedback; and 10) language modeling. The CLASS measure was used on three different occasions during the 8-week observation period for each of the teachers. The three sets of scores were then compiled and averages were taken of each of the dimensions in an effort to get a typical picture of teachers' practices. Findings and implications of the CLASS measure will be discussed in detail in Chapter 5.

Interview Process

The interview protocols were designed using descriptive questions that allowed participants to engage in dialogue about their experiences. "Descriptive questions form the basis for all ethnographic interviewing. They lead directly to a large sample of utterances that are expressed in the language used by informants in the cultural scene under investigation" (Spradley, 1979, p. 90).

Interviews were digitally recorded and then transcribed. Once transcribed, interviewees received a copy of the interview transcript to ensure accuracy. I guaranteed confidentiality to interviewees by assuring them that pseudonyms would be used to report any data collected.

Student Interviews. Two students from each of the participating classrooms were selected for one semi-structured interview. Teachers were asked to identify two students that I could interview for this study. Specifically, they were asked to identify one student at the 25th percentile and one at the 75th percentile in an effort to ensure that I represented a broad range of mathematics abilities. The purpose of student interviews was to gain insight into ELL students' dispositions, reactions, and perspectives about how they perceived what was taking place in their classrooms. Specifically, questions were asked to gain an understanding of how students thought about mathematics problems, what language they used to solve the problems, what difficulties they had as they solved the problems, and any scaffolds that the teacher used to make the problems accessible to them (see Appendix B). While students' perceptions are not necessarily an overarching construct in this study, these interviews helped situate classroom practices within the broader classroom context and allowed me to better understand student perceptions of particular incidents. Although there were some overarching questions about how students viewed their mathematics abilities, strengths and struggles with mathematics, and teacher efficacy, the student interview questions were primarily informed by my observations. For example, questions about what specific instructional practices teachers used to provide access to students revolved around specific problems that they were doing in the classroom. This allowed me to make questions relevant by contextualizing them with problems they had just worked on.

Teacher Interviews. The purpose of the teacher interviews was to open dialogue about the interpretation and enactment of the language policy, and to gain insight into teacher beliefs and dispositions about ELL students and their abilities, both as learners of

English and mathematics. First, the interviews worked to give me a sense of the frame of mind of the teachers during mathematics lessons and helped me better understand the nature of intent and the thought process of the teachers as they conducted their mathematics lessons. Second, the interviews served as a reliability check for the classroom field notes. The interviews allowed me to better understand how teachers' instructional practices are influenced by their perceptions and beliefs of their ELL students.

One semi-structured interview was conducted with each of the teachers. All interviews were conducted during the teachers' Special period, and ranged from 22 to 50 minutes. Like the student interviews, the teacher interview questions had overarching themes, but were primarily informed by my classroom observations (see Appendix A). Excerpts from classroom observations were used, as well as teachers' responses to the teacher belief survey to probe teachers' thinking during instruction. Throughout the interview process, I made an effort to be an interviewer who is "gentle and open to what is said, follows up sensitively, and steers the interview in the direction of what she wants to know about the learning experience" (Kvale, 1996, pp. 149-150). Grand tour questions (Spradley, 1979) were used for each of the questions. The interview questions explored three main themes, or pre-established categories (Miles & Huberman, 1994): 1) language policy; 2) student ideology; and 3) instructional change.

The first area focused on capturing teachers' knowledge and views of the language policy. For example, teachers were asked specifically what they knew about the policy and whether they supported any component of the policy. Teachers were also asked to express their views on the 1-year language proficiency expectation, grouping

students by English proficiency level, and the role of the district and school as mediators of the policy.

The second category focused on teachers' beliefs about teaching mathematics to their students and their beliefs on the role of students' first language in the teaching and learning of mathematics. Specifically, teachers were asked to describe their students' strengths and weaknesses with respect to mathematics to gain a better understanding of how teachers viewed their students' abilities. A theme that emerged in this category was the idea that teachers view word problems as particularly challenging due to the language demands. Another theme that cut across all four teachers was that mathematics is a universal language, although teachers varied in the manner in which they believed mathematics should be taught to ELL students. In addition, teachers were also asked to discuss how they viewed the role of their students' first language in the teaching and learning of mathematics. Questions surrounding teachers' beliefs about their students' first language allowed me to better understand what framework teachers embraced with respect to students' language and culture.

The last category focused on examining how the policy had impacted teachers' instructional practices. To this end, teachers were asked to describe any instructional change as a result of the policy. Themes that emerged in this category were that the policy has caused some teachers to teach in isolation and that mathematics instruction has shifted to be more vocabulary-focused. In this category, teachers were also asked to describe their instructional practices, such as how and to what extent they incorporated visuals, manipulatives, concrete representations, extra-linguistic cues, and multiple representations in their mathematics instruction.

Data Analysis

The analytical framework used in this study is Erickson's interpretive approach. I believe that an interpretive approach to this study would be the most appropriate because I was interested in looking at the cohesive analysis of interactions between teachers and students, and how their actions together amount to environments for one another. Since classroom settings are places in which formal and informal systems continually interconnect, Erickson (1986) suggests that observations of classroom settings should document social and cultural organizations of the events observed. Using an interpretive model also provided me with the flexibility to change my line of inquiry in response to any potential changes in my perceptions about the phenomenon. Erickson (1986) states that,

...the researcher pursues deliberate lines of inquiry while in the field, even though the specific terms of inquiry may change in response to the distinctive character of events in the field setting. The specific terms of inquiry may also be reconstrued in response to changes in the fieldworker's perceptions and understandings of events and their organization during the time spent in the field (p. 121).

Once the data was collected, I used analytic induction to analyze the data. A systematic examination of similarities between the various data was conducted to develop concepts and ideas. I began by organizing all of the corpus data, as a whole, then reading through the data multiple times to try to get an overall understanding of the actions taking place in the classroom, followed by close examination of the individual pieces of data to see what inferences could be made. I wrote notes and memos to record questions, reactions, and emerging themes that arose from the data reduction. Through this process of data reduction, I began to generate preliminary assertions.

The first step in the analysis process was transcribing the interviews and observations myself. I felt that it was important for me to familiarize myself and engage with the data through the transcription process to better understand codes and themes as they emerged.

To provide reliability for this study, a doctoral student from Rutgers University was brought on board as a second coder. A remote meeting was scheduled to discuss the study and his role as a second coder. He was charged with creating a coding scheme that cut across the various data sources rather than by teacher. After transcribing the interviews myself, the transcripts, original audiotapes of all interviews and observations, and the interview protocols were then sent to the second coder for analysis. It was agreed that we would each examine all of the data individually and create preliminary codes. Specifically, I would analyze the data by teacher whereas he would analyze it by data source. The objective was to reach inter-rater reliability of greater than 90% to ensure accuracy of the findings.

The first step in obtaining inter-rater reliability was to agree on the codes that we both generated. To do this, we both generated tables with the codes we had generated and met to discuss any similarities and differences in codes. This consisted of back and forth exchanges between the second coder and myself about how to interpret the data and which codes to keep or eliminate. First, tables were created to organize the data by teacher and by data source. Second, these tables containing preliminary categories and themes were then negotiated between the second coder and myself. This process continued until we reached agreement on what became the final themes. Once we reached 90% consistency in our coding schemes (codes and inferences made about those

codes) across data sources, I then engaged in a detailed examination of the data and looked for data to confirm or disconfirm my preliminary assertions and instantiate or eliminate constructs of the conceptual framework. I then began looking at linkages between the categories or conclusions to see what assertions could be made about the study. A preliminary report detailing the consistencies and contradictions across data sources was done for each of the teachers. These individual preliminary reports were then combined to examine themes that cut across all four teachers.

In addition to analyzing the qualitative data, I performed descriptive statistics to examine students' mathematics performance on the district's benchmark assessment, which is administered to students quarterly. The third quarter assessments were used to look at student performance. Given the small sample size, I took the median absolute deviation (MAD) to better make sense of statistical dispersion within the classrooms. Taking the MAD score rather than the standard deviation helped account for any potential outliers that may have influenced the dispersion within the classrooms. I then used this data to either support or challenge any assertions made about how language policy, teacher beliefs, and practice impacted students' mathematics performance, as well as to triangulate my data as a whole. Specifically, I used students' scores on the districts' mathematics assessment to look for consistencies between students' mathematics performance and teacher variables (beliefs and practice). In addition to analyzing students' scores on the district mathematics assessment, an estimate of internal consistency of the Teacher Beliefs Survey was conducted. Using Cronbach's alpha, the study calculated the internal consistency of the survey as .651. While the estimate does not necessarily show sufficient reliability, this might be due to the fact the sample size

was small (n = 16). Nonetheless, this was adequate to separate teachers' ideological alignment with respect to teaching mathematics to their ELL students given that the instrument was used descriptively rather than quantitatively. Moreover, composite CLASS scores were taken to measure classroom processes across different dimensions.

Grounded Rationality, Comprehensiveness, Care, Accuracy, Precision, Etc.

Drawing from confirming and disconfirming evidence from various data sources warrants the assertions that emerged in this study. The data, which consists of field notes, memos, interview transcripts, surveys, and students' mathematics scores were analyzed for events and instances that instantiate or repudiate the assertions established. For each assertion, specific examples are provided to either confirm or disconfirm the assertion. Providing examples of events and instances of disconfirming evidence is important because it helps establish internal validity. Erickson (1986), claims that, "the best case for validity, it would seem, rests with assertions that account for patterns found across both frequent and rare events" (p. 149). Additionally, Erickson emphasizes the importance of looking for disconfirming evidence to establish validity within a research study. As patterns start to emerge from the interactions observed, the researcher should deliberately look for situations or cases in which disconfirming evidence appear within the study. According to Erickson, casting a wide net (confirming and disconfirming evidence) is an integral part of establishing validity within a research study.

Experience of the Researcher

In my quest to understand what actions meant for the various participants involved, it was important to reflect on my personal experience and the influence this experience had on this study. First, my experiences as a Mexican American, former ELL

student having gone through a successful bilingual program inevitably influenced my views about bilingual education. Like the research that supports the idea that students' experiential, linguistic, and cultural knowledge are rich sources of knowledge, I too believe that to be most effective, these resources must be acknowledged, valued and integrated when teaching ELL students. Second, having taught mathematics to ELL students in the past has given me a students' perspective of the challenges they face when learning mathematics and a second language simultaneously.

My personal experience as a researcher, former ELL student, former teacher of mathematics, and a fluent Spanish speaker gave me access to data at multiple levels, as well as insider knowledge that would otherwise not have been available to me.

First, my previous experience as a researcher at the site made the site a valuable resource in and of itself. The positive relationships and rapport that I had built with teachers and students allowed me to gain access and develop new and different relationships with the participants. Second, having experienced first hand the difficulties embedded in learning a second language while simultaneously learning mathematics allowed me to establish credibility, both with teachers and students. Third, having taught mathematics to ELL students allowed me establish trust and credibility with teachers and have genuine discussions with teachers about their beliefs and practice. And lastly, being a native Spanish speaker allowed me to understand and communicate with ELL students. The ability to have meaningful conversations with students allowed me to have a comprehensive understanding of how students interpreted and made sense of the actions as they interacted with their environment.

Ethical Considerations

Due to the fact that this study emerged from the NSF grant, which stipulated that graduate student dissertations would result from the study, I used that Internal Review Board (IRB) approval as an umbrella for covering this study. The IRB was notified of this study.

Power of Participants to View/Counter the Findings

Participants were not provided with any collected data or the completed dissertation study, with the exception of their transcribed interview to ensure accuracy and precision of statements made. After being transcribed, interview transcripts were electronically sent to teachers to verify the content. All teachers responded to state that the information contained in the transcripts was true and accurate. Having participants check for accuracy is a way to ensure validation of the study.

Validation

An important aspect of this study is my experiential knowledge and how this knowledge could help validate the findings of my study. Rather than separate my technical knowledge, research background, and personal experiences from my research, I used this experiential knowledge as a source of insight, hypotheses, and validity check (Maxwell, 2005). Reason (1988, 1994) describes this ‘critical subjectivity,’ as

a quality of awareness in which we do not suppress our primary experience; nor do we allow ourselves to be swept away and overwhelmed by it; rather we raise it to consciousness and use it as part of the inquiry process (1988, p. 12).

As a former ELL student and teacher of ELL students myself, I found it necessary to address and understand how this critical subjectivity might influence the manner in which I studied, perceived, interpreted, analyzed, and made meaning of the data.

Maxwell (2005) proposes using a researcher experience memo to write down one's expectations, beliefs, and assumptions about the study and its constructs, "as a way of identifying and taking account of the perspective that he[she] brought to the study" (p. 29).

The analysis of multiple types of data also helped establish the reliability of this study by warranting the assertions in various ways. Analyzing the different data sources allowed me to examine how all the smaller pieces fit together to form a larger picture, thus contributing to the truth of each of the assertions. Comprehensiveness is an important part of establishing validity. Erickson discusses multiple forms of data collection (observation, interviews, tape recordings, etc.) as a way to establish triangulation, which in turn provides warranty for the assertions made. Maxwell (2005), states that triangulation "...reduces the risk that your conclusions will reflect only the systematic biases or limitations of a specific method, and it allows you to gain a better assessment of the validity and generality of the explanations that you develop" (p. 75). Again, patterns were detected and inferred from multiple data sources, contributing to the validity of this study. For example, while the teacher survey was used for selection purposes, it also functioned as a datacheck for consistency and reliability, as I specifically looked for overlap between the survey and the teacher interview. In addition, classroom observation field notes were analyzed in conjunction with teacher interviews to either confirm or disconfirm assertions made. Similarly, students' mathematics scores were analyzed and juxtaposed within teachers' self-reported survey answers, interviews, and field notes to see if there was a relationship between teachers' beliefs, classroom practice, and student performance.

While this dissertation is limited to four specific cases, the assertions derived from the study can be used to test transferability against other similar cases. For example, the findings in this study can be used to compare and contrast the implementation of the language policy to other cases with similar circumstances and in similar settings, to see if similar patterns emerge in other cases.

Summary of Methods

Table 4.2 below is a summary of the methods used in this study to answer the research questions.

Table 4.2

Summary of Methods

Research Question	Source of Data	Analysis
How do language policy, and teacher beliefs and practice mediate each other and how does this mediation affect the access that ELL students have to mathematics instruction and curriculum?	Classroom Observations Teacher Interviews Student Interviews Teacher Beliefs Survey CLASS District Mathematics Test Scores	Analytic Induction (with second coder) Descriptive Statistics
How is the 4-hour block being interpreted and enacted?	Classroom Observations Teacher Interviews	Analytic Induction (with second coder)
What are teachers' beliefs, attitudes, and dispositions about the 4-hour block?	Teacher Interviews Teacher Beliefs Survey	Analytic Induction (with second coder)
What are teachers' beliefs, attitudes, and dispositions about teaching	Teacher Interviews Teacher Beliefs Survey Classroom Observations	Analytic Induction (with second coder)

mathematics to ELL students, as well as their views on bilingual education?

Do teachers' pedagogical beliefs about teaching ELLs manifest themselves in students' mathematics performance?

District Mathematics Test Scores

Descriptive Statistics
Median Absolute Deviation (MAD)

Chapter 5

RESULTS

In this chapter, I present the findings of this study using data from the various sources to substantiate themes and assertions that emerged after analysis of the data. The results are broken down into three main categories to represent the three constructs in this study: policy, teacher beliefs, and practice, although there is overlap between the various categories.

The data suggests that the 4-hour block, places restrictions and limitations on teachers' instructional practices, resulting in limited opportunities for students to learn mathematics. Moreover, some teachers reported concern that grouping students by English language proficiency results in multi-grade ELL classrooms and large numbers of special education students placed in those same ELL classrooms. The extent to which teachers supported or opposed the policy and its various components varied across teachers. While some teachers reported no instructional change as a result of the policy, the data suggests that teachers' instructional practices have in fact shifted in focus, placing an emphasis on teaching vocabulary. This shift in focus has resulted in teachers teaching mathematical vocabulary in isolation and out of context. In addition, teachers reported having limited to no time to spend on other subject matter, such as science and/or social studies.

To start, I present a brief overview of each of the teachers to provide context for the findings of this study.

Ms. Rivas

Ms. Rivas's mathematics instruction was typically characterized by a strong focus on vocabulary. Per policy guidelines, she conducted all of her lessons in English, with the exception of the clarification that she provided to her one Spanish-only speaking student. While she did not support the 4-hour block structure for teaching students English, she did support the use of English-only instruction.

Ms. McDonald

Overall, Ms. McDonald embodied effective research practices for teaching ELLs and valued students' linguistic and cultural capital as rich sources for learning. Her classroom environment was consistently characterized by a constant exchange of ideas, where communication was the focus. Students constantly engaged in using the language of mathematics to negotiate, justify, and explain their thinking.

Ms. Cohen

Ms. Cohen's mathematics instruction can be characterized as having a focus on computation, with limited opportunities for her students to negotiate meaning of mathematical ideas using the language of mathematics. Ms. Cohen did not oppose students' use of their first language during mathematics instruction, as long as they could communicate with her in English.

Ms. Moore

Ms. Moore's mathematics instruction can be characterized as teacher-focused with a strong focus on computation, leaving limited opportunities for students to engage in conversations and discussions about mathematical ideas. Ms. Moore viewed English

as the proper and ideal language and adamantly opposed students' use of their first language in the classroom.

Policy

Knowledge and Views of the ELD Policy

Knowledge of the 4-hour ELD block varied across teachers. Data from the teacher interviews suggest that Ms. Rivas and Ms. McDonald are very knowledgeable about the 4-hour ELD block, its components and mandates, while Ms. Moore and Ms. Cohen have a limited knowledge of the policy. When asked during the interviews to describe their knowledge of the 4-hour ELD block, both Ms. Moore and Ms. Cohen referred to the policy as a set of school-wide policies put into place by the Principal, Mr. Hernandez, at their school.

With regards to the ELD policy, Ms. McDonald openly shared her lack of support for any component of the block. She stated that it was the state of Arizona's "way of thinking" with the purpose of having students acquire English in one year, which she later stated was a "ridiculous" expectation. Similarly, Ms. Rivas also commented on her lack of support for the policy, although her primary reason for not supporting it was that the four hours of ELD block left little to no time for other subject matter, and often times cut into her mathematics instruction.

Time for Other Subject Matter

Ms. Rivas and Ms. McDonald both expressed concern about the specific mandates of the policy and the limitations that it placed on their practice. One of the limitations they discussed entailed the lack of time to teach social studies and/or science, as well as taking time away from teaching mathematics. During her interview, Ms. Rivas

stated that the 4-hour block “takes up the whole day” and as a result takes time away from mathematics. “The thing about the four hours...it’s spread out through the whole day. Kind of takes up the whole day.....It’s hard. The whole hour, the 4-hour block does take away from the math time” (Ms. Rivas).

The sentiments expressed by Ms. Rivas about the policy leaving limited time to teach mathematics and other subject matter was evident in her observations. Of the eight observations that were conducted in Ms. Rivas’s classroom during mathematics instruction, on only three occasions did Ms. Rivas teach the core curriculum stated in the Arizona mathematics standards. On the five additional observations, Ms. Rivas taught mathematics facts, the Otter Creek problem solving curriculum, and mathematics wall, all curriculum interventions put into place by the district and school as a result of the district being in corrective action. Table 5.1 below shows the number of times that all four teachers were observed teaching the core curriculum during mathematics instruction.

Table 5.1

Teaching Grade-Level Standards

	Rivas	McDonald	Moore	Cohen
Times Observed Teaching the Core Curriculum	3/8	7/8	4/8	7/8

Ms. McDonald also indicated during her interview that the policy curtails the time she can spend on social studies. During her interview, she stated that although she teaches science, the 2-hour block limits her ability to teach social studies on an everyday basis.

....social studies they [students] don't get it. We have to spend so much time....even though I don't have a 4-hour block, I still have a mandatory 2-hour. Everyone is required a 2-hour reading block, which incorporates all that. I do at least an hour of math and then we have specials. I mean, we get to science, but we don't get to social studies every day. We've been pushing that off now that AIMS is over, which is really sad. There's just so much and we're supposed to do with the writing assignment included in the reading block. So time runs out quick (Ms. McDonald).

Similar sentiments were expressed by Ms. Moore, who stated that social studies and science get pushed to the “back burner” and as a result “you just kind of squeeze it [social studies and science] in where you can” (Ms. Moore). Ms. Cohen was the only teacher who did not voice any concern about the lack of time to teach science and/or social studies. During her interview, she stated that she teaches science about once every week and a half, and social studies for 30 minutes a day, which she incorporates into her 2-hour block.

1-Year Language Proficiency Expectation

With regards to the 1-year proficiency expectation, Ms. Rivas and Ms. McDonald both expressed concern that the given 1-year timeframe is “unrealistic.” During her interview, Ms. McDonald stated that the 1-year timeframe is “ridiculous” and cited some of the well- established research on second language learning that states that it takes students between four to seven years to reach proficiency in English. While Ms. Rivas also agreed that one year would not be sufficient for students to become proficient, she emphasized the role of the Arizona English Language Learner Assessment (AZELLA) in preventing her students from transitioning out of the ELL program.

Rivas: I know some of these students that have been in the ELL class for a couple of years now, so [laughs] when they say they're going to reach proficiency in one year I don't think that's even....

Researcher: Realistic?

Rivas: Realistic because I know my class personally. I have a lot of low readers.

Researcher: Okay.

Rivas: They're even lower in writing. I know one of the components in the AZELLA test is the writing. They're not passing it because of that and I don't know if they ever will.

On the other hand, Ms. Cohen stated in her interview that the 1-year expectation is adequate. Similarly, Ms. Moore also stated that reaching proficiency in one year is feasible as long as students are "heavily exposed" to the English language all day.

That's a wonderful aspiration [reaching proficiency in one year], but I don't think it's feasible. Not if you want them to understand concepts on top of things. If it were a year of just solid English learning, I would say that it's probably pretty possible. If it was in the morning till three in the afternoon, English, English, English, they could probably do it, the majority of them. But if you're expecting them to learn math, science, social studies, and whatever else.....It's too complicated of a language to expect them to just pick it up and be proficient on top of all the other expectations (Ms. Moore).

Interestingly, in the Teacher Belief Survey, Ms. Moore responded that she does not believe students must learn English as quickly as possible, even if it means losing their native language. The excerpt above seems to indicate that Ms. Moore supports the idea that students must be heavily immersed in English to reach proficiency in one year. This position is also substantiated by her observations and interview, which will be discussed later in the Beliefs section. Not surprisingly, on the question of whether ELLs in English-only classrooms will learn mathematics better, Ms. Moore agreed.

Views on Grouping by English Language Proficiency

Teachers' views on grouping students by English language proficiency also varied across teachers. Ms. Moore and Ms. Cohen did not necessarily voice support for

grouping students by English language proficiency, nor did they challenge it. Ms. Moore indicated that while it's a good idea to have a "mix" of students with different language proficiencies, she "see[s] the reasoning" behind the groupings. On the other hand, Ms. McDonald and Ms. Rivas both expressed their lack of support for grouping students according to language proficiency. During their interviews, they indicated that grouping students in this manner results in tracking students, often times resulting in ELD classrooms with large numbers of special education students. When asked whether having a large number of special education students in her ELD classroom was coincidental, Ms. Rivas responded:

No [not coincidental], because they're ELL learners. See that's another thing that I don't [know if] they'll ever transition out of the ELL [program] because they've...I'm pretty sure they started as English language learners but because of their disability they're never going to pass that AZELLA and transition out. To me, they're just going to be in the same classroom year to year and I don't know if eventually when they get to the upper grades, it's going to end up being a class with more special ed students than normal. That's another struggle (Ms. Rivas).

On the other hand, when asked if a year was adequate time for reaching proficiency, Ms. Cohen equated passing the AZELLA with proficiency. Unlike Ms. Rivas who stated that the AZELLA presents challenges for her ELL students, Ms. Cohen referred to the AZELLA as "straightforward" and "primary knowledge," therefore making it possible for students to reach proficiency in one year.

In her interview, Ms. McDonald also pointed out several English-only speaking students that were placed in ELD classrooms because they were special education students.

I have a student whose parents don't even speak Spanish. I have no idea how he got lumped in there. He's got a speech thing or whatever, so he's considered an ELL. But he gets tested and there's a lot of kids like that.....I can think of five

[students] off my head that are in ELL classes and have English speaking parents. They don't know any Spanish. I think that's stupid (Ms. McDonald).

While both Ms. Rivas and Ms. McDonald raised concerns about grouping students by English language proficiency, it is clear that their perspectives differ considerably with regards to how they view ELLs. For example, Ms. Rivas alludes to the idea that special education students were at one point ELLs and might potentially never transition out of the ELL program. On the contrary, Ms. McDonald makes reference to how students' disabilities result in them being placed in ELL classrooms even when they are English-speaking, simply for the fact that they are special education students.

Another issue that was raised by Ms. Rivas and Ms. McDonald was the idea that grouping students according to English language proficiency limits the amount of exposure that ELL students get to "peer models" who speak more fluent English.

I think it's stupid to group them according to language abilities because research also shows that you learn language best by speaking it around a mixture of people. Ms. Navarro's kids are all....two of them are straight from another country. One is from Guatemala and one is from Mexico. She knows no English. She's pre-emergent and she's surrounded by basic, intermediate kids who are still really learning to grasp the language. How is she going to be moved up if she's not around good [English speakers].... (Ms. McDonald).

Ms. Rivas shared similar concerns:

Rivas: I don't like it [grouping students by English language proficiency].

Researcher: Why? Tell me a little bit about why you don't agree with it.

Rivas: I just feel that they [students]...we don't have....The only English model is the teacher and I don't know. To me, they don't have those other English speaking students to model the English and then to help them out.

Researcher: Right.

Rivas: I don't know. I don't agree with it. I kind of just go with it because I know we have to do it, but.

In the excerpt above, Ms. Rivas points to the fact that although she does not agree, nor support grouping students by English language proficiency, she is mandated by the state to implement the various components of the policy and is inevitably institutionally coerced to reproduce the policy. Later in her interview, Ms. Rivas went on to say that part of the reason why students do not transition out of the ELL program is because they remain with the same cohort of students, year after year, not exposed to more English-proficient peers.

Administration's Implementation of ELD Policy

With regards to the role of the district and schools as mediators, all teachers commented on the fact that the implementation of the 4-hour or 2-hour blocks was strictly enforced and monitored by the administration, forcing institutional compliance. Ms. Rivas stated that in addition to being required to submit her schedule detailing the various components of the ELD block, she is also required to submit lesson plans, which are then crosschecked with the schedule to ensure that she is implementing the block with fidelity. The rest of the teachers also echoed this sentiment. For example, in her interview, Ms. McDonald stated that due to the fact that the district is in corrective action, walkthroughs were a common practice, whether it be for the 2-hour block or the 4-hour block. Interestingly, based on teachers' statements about the institutional oversight to enforce compliance of the policy, the focus appeared to be simply on whether teachers were complying with the policy, rather than on how effective the policy actually was.

Summary of Policy Results

Table 5.2 below summarizes the themes that emerged with respect to the policy and where teachers fall within these themes.

Table 5.2

Summary of Policy Themes by Teacher

Theme	Rivas	McDonald	Cohen	Moore
Knowledge of Policy	Knowledgeable Does not support it	Knowledgeable Does not support it	Limited No support or opposition	Limited No support or opposition
Time for Other Subject Matter	Impacts the amount of time she can spend on other subject matter, including mathematics	Impacts the amount of time she can spend on other subject matter, excluding mathematics	Impacts the amount of time she can spend on other subject matter	Impacts the amount of time she can spend on other subject matter
1-Year Language Proficiency Expectation	Unrealistic Attributes students' lack of transitioning out of the ELL program to the mandates of the AZELLA	Unrealistic	Adequate	Not feasible unless they are heavily exposed to English
Views on Grouping by English Language Proficiency	Does not support it ELL students are not exposed to English-speaking peers Creates multi-grade classrooms with large numbers of special education students	Does not support it ELLs are not exposed to English-speaking peers	No support or opposition	No support or opposition
Administration's Implementation of ELD Policy	Rigid monitoring by school and district Institutionally coerced to comply with policy	Rigid monitoring by school and district	Rigid monitoring by school and district	Rigid monitoring by school and district

Beliefs

Student Ideology

How teachers viewed their students and their abilities varied considerably across teachers. When asked to describe their students' strengths, Ms. Moore, Ms. Rivas, and Ms. Cohen stated that their students' strengths lay in computation, such as addition, subtraction, multiplication and division problems. For instance, when explaining why she supports the Otter Creek curriculum for problem solving, Ms. Rivas stated that,

...they're [students] thinking now if it's addition, subtraction, multiplication or division instead of just seeing the numbers and doing whatever they feel like. They're thinking more about the problem.

Similarly, Ms. Cohen also commented on the usefulness of the Otter Creek curriculum in helping her students solve problems, again focusing on the operation used to solve it.

"It's helping them to pull apart the different...what do I put where. Am I going to have to multiply, divide, subtract, add...whatever" (Ms. Cohen). When asked why she supports the mathematics facts routine, Ms. Moore indicated that it has helped her students get the answer more quickly.

I've noticed a lot of improvement. If we're doing any kind of addition, subtraction, multiplication, anything on the board now. The students who normally would sit there and wait for the one or two who know their math facts to pop up with them. They're starting to shout them out faster and I've noticed it in pretty much every aspect of the math, whether it's in class when we're doing it together or individual. They know them a lot quicker. For them right now, it's more the addition, subtraction, but a lot more are picking up the multiplication....I would love to continue that. Yeah, I will always do that even if it's not required because I think it's really a good thing for them.

In contrast to the other three teachers, Ms. McDonald described her students as strong in all areas of mathematics, including problem solving. She went as far as to say that "anything that they're [her students] struggling with is my fault because I haven't

done enough” (Ms. McDonald). Ms. McDonald consistently described her students as intelligent and capable learners.

They’re geniuses. I can’t believe that they can figure and explain stuff like that. I don’t know. These kids are so smart and anyone who says they can’t learn are just idiots because these kids are just...I get all teary eyed because they’re so smart (Ms. McDonald).

Her response aligns with her observations, where she consistently used motivational talk and praise with her students. The excerpts below were taken from several observations and highlight the positive perspective Ms. McDonald has of her students and their abilities:

- | | |
|-----------------------------------|--|
| Observation 1
(March 21, 2012) | McDonald: I’ve got a genius class. I get lucky with the smartest class every year and the best looking, always. |
| Observation 2
(March 28, 2012) | McDonald: Here’s where it gets nitty-gritty, but I know you can do it. |
| Observation 2
(March 28, 2012) | McDonald: You guys are so smart it’s disgusting. |
| Observation 4
(April 11, 2012) | McDonald: I’ve seen your scores. I’ve seen you guys in class. I know what you can do. Right now is not the time to doubt yourselves. You can do it. You can. I know you can do it. Don’t stress. |
| Observation 5
(April 24, 2012) | McDonald: Maria managed to come up with the equation again because I’m starting to think that she’s smarter than me. Maria is now going to be the teacher. I’m firing myself. It’s hard. I mean, you guys are good with the whole drawing the pictures. I’m going to draw the pictures too. It’s one thing to draw the picture. It’s another thing to be able to explain it, which you can do. And it’s another thing to attach a number sentence to it. This is really heavy stuff, okay. So Maria is going to come up here |

and show what she did, which is pretty stinking genius. I want to hear exactly how you came up with the equation, little Ms. thing.

Of the four teachers, Ms. McDonald was the only one to explicitly comment on the importance of maintaining high standards and rigorous curriculum for her students. When asked whether she would use the same strategies across different English language proficiency levels, Ms. McDonald responded, “I’m not going to dumb things down for them just because they’re ELL. They are not stupid, they’re just learning a new language” (Ms. McDonald). She went on to say that she would not water down the curriculum, nor avoid or eliminate giving her students word problems or teaching them the academic language needed to make sense of the mathematics. Instead, she would enrich her students’ learning by using a variety of strategies that would help give them access to the mathematics. The variety of strategies used by Ms. McDonald will be discussed later in the Instructional Practices section.

Whereas Ms. McDonald’s ideology of her students and their abilities can be characterized as positive, Ms. Cohen and Ms. Rivas alluded to their students’ deficits and the pedagogical challenges that those deficits pose. Researchers warn that focusing on students’ deficits rather than on what assets they bring to the classroom can result in framing students as deficient and ultimately impact the learning opportunities that they have to learn mathematics (i.e., Moschkovich, 2007). During their interviews, both Ms. Cohen and Ms. Rivas commented on the low reading abilities of their students. For instance, in her interview, Ms. Rivas stated, “I have a lot of low readers. They’re even lower in writing. I know one of the components in the AZELLA test is the writing.

They're not passing it because of that and I don't know if they ever will." While Ms. Rivas made an explicit connection between students not passing the AZELLA and their low reading abilities, Ms. Cohen focused on the pedagogical difficulty of having such a large gap in her students' reading abilities. In her interview she stated,

...like the students with the lower reading abilities... Sometimes they'll be the ones who sit there and don't understand or [put] less effort towards it, but they're all good workers. They're all trying to learn at what they can. It's been kind of a struggle having such a big gap. Having so many that are proficient, so many that are below. You can do what you can do, but... (Ms. Cohen).

Ms. Cohen's description of her students' reading abilities and the level of effort that they put into their learning raises questions about the various Discourses that teachers and students bring to the mathematics classroom. As discussed in Chapter 2, Theoretical Framework, this type of mismatch between Discourses can create conflict and can potentially frame students as deficient (Moschkovich, 2007).

Whereas Ms. Cohen and Ms. Rivas explicitly made reference to their students' deficits, Ms. Moore described her students as "capable" and as "really hard workers." During her interview, she stated that mathematics is their "biggest struggle" and something they continue to work on. However, when probed about students' use of their first language during mathematics instruction, it became apparent that the deficit lied in the students' first language. In other words, she viewed Spanish as a deficit that students must overcome if they are to become productive citizens and be successful. This language ideology appears to be consistent with Ms. Moore's practice and with her survey response questions, which will be discussed more in detail later in the Language Ideologies section of this chapter.

Challenges of Word Problems

A theme that appeared to cut across all four teachers is that word problems tend to be challenging for students. All four teachers commented on how word problems present specific challenges for their students due to the language demands, particularly for ELLs. When asked to describe her 11 newly proficient students, Ms. Moore indicated that word problems tend to be especially difficult for those students.

It affects them very much because sometimes they get caught up with the words themselves that they get frustrated and by the time that they get to the math, they just don't even know what to do. Or they're so burnt out mentally from trying to break down what they're saying that they just gasp because they don't know what else to do" (Ms. Moore).

Ms. Cohen shared similar views about the language demands of word problems. When asked to describe her students, she stated that of the 32 students in her class, 22 were at risk students, ranging from first to third grade in reading level. When probed further, she stated that her students' low reading levels affected their ability to make sense of word problems, particularly when they encountered unfamiliar words.

Observations also support this common theme that word problems are difficult for students. For example, during one of the observations, Ms. McDonald made the following comment to her students, "I give you a picture and I ask you to tell me the area and perimeter, and you guys do awesome. I give you a word problem and we have a dispute." Ms. Moore made a similar comment to her students when solving a word problem.

Observation 2
(April 4, 2012)

Moore: These are the kind of problems that you look at it and you just guess. You don't

want to do this.

Student: I do.

Moore: You do? You're supposed to but you guys don't want to. And you guys get frustrated when you don't understand it. You're going to have to take more than two minutes on a problem like this. It will not happen. Even while you guys were working on this, I was in my head starting to figure it out. It probably took me at least five minutes to figure out how to do this problem. It should take you guys at least ten. Don't get frustrated if it does.

Mathematics as a Universal Language

Whether teachers supported aspects of the policy or not, one theme that emerged and cut across all four teachers was the idea that mathematics is a universal language. The data suggests that all four teachers view mathematics, its symbolic notation and operations as universal. However, the manner in which teachers view teaching mathematics to their ELL students varies across teachers. For example, Ms. McDonald stated in her interview that although numbers and the ideas behind mathematical concepts are universal, the manner in which you teach mathematics varies, depending on the needs of the students. When asked if she would teach mathematics using differentiated instruction to accommodate her ELL students, she stated that, "Numbers are numbers. That's a universal thing. Math is math. The way you teach it is different...the way you would approach it would be different" (Ms. McDonald). This is consistent with her survey response to whether differentiated instruction is necessary in the mathematics classroom for students not yet proficient in English. When probed about the specific scaffolds and supports that she uses to help make the mathematical concepts

and ideas accessible to her ELL students, she stated that her instruction is “just good teaching” which benefits all students, although it is particularly helpful to her ELL students. The specific strategies used by Ms. McDonald will be discussed later in the section on Instructional Practices.

While Ms. Moore also commented on the universality of mathematics, she made a clear distinction between mathematics and language. While she did state that mathematics and language are not two completely separate entities, she did comment on the need for students to be able to distinguish between the two. Specifically, she stated that although “there’s going to be language around math” and “math around language,” students need to be able to focus on either the mathematics or the language, whatever the goal is. She stated that one way in which she helps students focus on the mathematics is by teaching them to focus on key words that will help them determine which operation to use when solving a problem. When describing her own personal experience in mathematics she stated,

If I knew how to pick up those key words and didn’t focus on all the other junk in the middle, I don’t think I would have been as frustrated. So for me, just teaching them, ‘this is the math, you need to focus on the math part of it, not the reading (Ms. Moore).

This key-word focus supports the idea that students do not need to actively engage with mathematical and everyday language to reason and negotiate through mathematical tasks and word problems. Instead, students learn to categorize word problems based on key words and perform a pre-determined operation based on that category. As discussed in the literature review, effective teaching practices for ELLs involve the development and

use of academic and everyday language, the symbolic language of mathematics, and their integration, practices not consistent with Ms. Moore's beliefs.

Language Ideologies

It was interesting to see how teachers varied considerably in the manner in which they viewed students' first language (L1). Of the four teachers, Ms. Moore was the only one who openly voiced her lack of support for students' use of their L1 in the classroom. This was evident in her interview when she was asked how she felt about students using their L1 in the classroom.

....If they're talking slang or talking Spanish to their friends or family. You're at school. It's a professional environment. Just like when you grow up and get a job, you speak proper English. You go home, talk slang all day. They need to learn to associate, because it's socialization too (Ms. Moore).

It is evident that Ms. Moore draws a parallel between Spanish and slang when she uses the terms slang and Spanish interchangeably. In doing so, she implicitly equates slang to Spanish. This seems to support the idea that Spanish is an inferior language to English. In addition, her statement about the need for students' "need to associate" English with a "professional environment" and Spanish with a language spoken only at home reinforces her view that English is the ideal language. This position is consistent with what Wiley (1999) explains as the "natural and ideal condition,"

The prevailing language ideology in the United States not only positions English as the dominant language, but also presumes universal English monolingualism to be a natural and ideal condition....The English monolingual ideology sees language diversity as a problem that is largely a consequence of immigration, [and] it equates the acquisition of English with assimilation, patriotism, and what it means to be an 'American' (pp. 25-26).

In addition to drawing parallels between Spanish and slang, Ms. Moore views Spanish as a problem and an obstacle in her students' education. This viewpoint is consistent with Ruiz' (1984) framework on language policies, specifically on viewing *language as a problem*. The following excerpt exemplifies Ms. Moore's view that until students have a "complete grasp" of the English language, they will not be successful in other subject areas, including mathematics.

...the language is just their biggest barrier for them and it's the one thing that stands in the way of everything else in their education. Until they have a complete grasp of it, it's their biggest hurdle. It just comes down to comprehending it properly.....It just comes back to language really. It does because they just really are so focused on getting that language down that it really gets in the way of their success in math and other subjects. Yeah, it really comes back to language (Ms. Moore).

Not surprisingly, during her interview, Ms. Moore indicated that until students have a solid understanding of the English language, they will be unable to participate in mathematical discussions, arguments, and explanations.

Well, they need to be able to explain themselves and to completely understand the concept and speak about it in English. There's no way that I'm going to be able to ask them a question if they aren't proficient in English. How did you get this answer? They need to be able to explain it and thoroughly understand it to explain it to me. They need to have a good grasp on English to focus on...especially if you expect them to read it in English and solve it with English thinking. They need to be able to explain it as well (Ms. Moore).

Ms. Moore's view of *language as a problem* is also evidenced in several of her observations. In the following excerpts, Ms. Moore makes it clear that Spanish is not a language appropriate for the classroom.

Observation 2
(April 4, 2012)

Moore: Boys, English! Spanish at home.

Student: ¿Porqué?

	Moore:	Because.
Observation 7 (May 9, 2012)	Carlos:	Quince. Dieciseis....
	Moore:	Stop! Speak in English in the classroom. Turn that off!

In the first example, two students were having a non-math related conversation in Spanish. When Ms. Moore became aware of the situation, she immediately told them that Spanish was for home, not for school. This is consistent with her interview response when she associated Spanish with slang and English with the more formal, professional, and ideal language that students must use in the classroom. In the second example, a student was counting in Spanish when passing out bingo chips to his classmates. Ms. Moore immediately instructed the student to “turn that off,” referring to his use of Spanish. Interestingly, during her interview, Ms. Moore commented on the usefulness of cognates to help students remember the number of sides of polygons. Specifically, she stated that a student was very clever in relating quadrilateral to ‘cuatro,’ which she pointed out, is related to Spanish. When asked in the Teacher Beliefs Survey if students must learn English before they can participate in mathematical discussions, she strongly agreed.

The extent to which she expects students to talk, think, and learn only in English, epitomizes Ms. Moore’s position that the only legitimate language for learning is English. This belief that students cannot participate in mathematical discussions until they are proficient in English is in complete opposition to research studies that have shown the importance of providing opportunities for students to describe their reasoning orally and

in writing using the language more accessible and comprehensible to them (i.e., McGraw et al., 2007).

Evidence supporting Ms. Moore’s position on the use of students’ L1 is also substantiated in her responses in the Teacher Beliefs Survey. When asked if allowing a student who is not yet proficient in English to use his/her first language to solve mathematics problems would hinder his/her ability to learn English, she strongly agreed. Not surprisingly, she also stated in her survey that she did not support the idea that ELL students should be in a classroom learning mathematics in their first language. In addition, when asked if she believed that most of the mistakes that ELL students make in mathematics are due to interference from their first language, she strongly agreed. Her responses are corroborated both by the interview, in which she stated that students must only use English in the classroom, and her observations, in which she clearly defined her position by explicitly telling students to “turn that [Spanish] off.”

In addition to not allowing students to use their L1 in the classroom, Ms. Moore also emphasized the importance of using proper English in the classroom. The following excerpts highlight how Ms. Moore addressed students’ grammatical mistakes.

Observation 1
(March 29, 2012)

Gricelda: Ms. Moore, what are we upposed to be doing?

Moore: What are we ‘upposed’ to be doing? ‘Upposed’ to is not a word! What are we ‘supposed’ [enunciates the word] to be doing and if you don’t know Gricelda, I’m imagining this homework is going to be pretty difficult.

Observation 4
(April 26, 2012)

Researcher: John asks Ms. Moore a question and he uses the word ‘axing.’ Ms. Moore corrects him [irritated] and tells him that it is not

‘axing.’

Moore: Say it John. It’s asking. [John repeats it after her.]

These instances substantiate Ms. Moore’s earlier statement about the importance of students using proper English in the classroom and learning to associate English with the more ideal language. Moschkovich (1999) warns of the dangers of simply focusing on what students cannot do rather than on the competencies that they bring to the classroom.

If all we see are students who don’t speak English, mispronounce English words, or don’t know vocabulary, instruction will focus on these deficiencies. If instead, we learn to recognize the mathematical ideas these students express in spite of their accents, code switching, or missing vocabulary, then instruction can build on students’ competencies and resources (p. 90).

In stark contrast to Ms. Moore is Ms. McDonald who supports students’ use of their L1 when learning mathematics. This viewpoint is consistent with Ruiz’ (1984) *language as a resource* ideological viewpoint, which views students’ native language as an avenue to enhance academic competence and values linguistic skills as cultural capital and assets. Research indicates that encouraging students to use their native language when doing mathematics seems to increase student engagement in the learning process, as well as gives them greater access to mathematical material (Gutstein, Lipman, Hernández, & de los Reyes, 1997; Khisty, 1995; Moschkovich, 2000). Of the four teachers, Ms. McDonald was the only one to strongly agree, on the Teacher Beliefs Survey, that the inclusion of ELL students in mainstream classes benefits all students. Unlike Ms. Moore, Ms. McDonald does not support the idea that a student’s use of L1 to solve mathematics problems hinders his/her ability to learn English. In fact, during her interview, she stated that some of her students still use Spanish as a rich source for

making sense of the mathematics. This idea that students' L1 is a valuable resource for learning is also supported by some of the student interviews. For instance, when asked why she uses more Spanish than English when talking with her tablemates, Graciela, a student of Ms. McDonald, indicated, "For me, when I talk...when I explain it in Spanish in my head I get it more than in English." However, it should be noted that not all students that were interviewed indicated a specific preference in language. In fact, more than half of them indicated that they use both, Spanish and English, when thinking about mathematics.

In addition, unlike Ms. Moore who explicitly corrected her students' grammatical mistakes, Ms. McDonald believed in promoting a safe environment where students could make mistakes. According to Ms. McDonald, she established discourse norms early on to ensure that students engaged meaningfully around each other and around the mathematical language.

Yeah, I think it helps them feel more comfortable speaking, but the thing is that I think in any other classroom, yeah, but I think that I focus a lot on...very early on, on norms, and culture and discourse. I plant that early on, so my kiddos are really comfortable speaking around each other, except for Brian. They're fearless, and they'll shout something out and they're not afraid to make mistakes because I established that at the beginning. I think that if you don't have that warm environment, then yeah, I think it's totally helpful because kids who aren't as comfortable sharing or a little bit nervous, having them build that up and hearing the language spoken. They get called or they get called to present, they'll be successful. I think a lot of what goes into helping them be successful is the environment. You need to have that comfortable environment where they're not afraid to make mistakes grammatically or not speak at all. They have to work in groups, especially if they're really struggling (Ms. McDonald).

In her interview, Ms. Cohen indicated that she is not opposed to students using their L1 as long as they can explain their solutions to her in English. This is consistent with her observations and survey responses. For example, students regularly used code-

switching during mathematics instruction, a practice that Ms. Cohen did not discourage.

This happened particularly when working in small groups.

Observation 2
(April 5, 2012)

Researcher: Okay, so what are you guys trying to find?

Camila: We're trying to find an Euler circuit.

Researcher: A what? What's an Euler circuit?

Camila: Where you have to go through the path and you can only touch the line once.

Researcher: Do you have to start or end anywhere in an Euler circuit?

Camila: No, you have to start where you started and end where you started.

Camila: Lets start here. We can go here and then that way and that way. [They work together as a group to find the different paths.] One, two, three, four, five, and luego six.

Eduardo: ¿Y ésta qué?

Camila: Well, then don't....

Observation 3
(April 11, 2012)

Eduardo: No, pues es que no sabía como hacer este shape.

In the first example, students were asked to find an Euler path given a particular diagram.

As students discussed the possible paths, they used code-switching as they negotiated

how to find an Euler path. In the second example, Ms. Cohen was having a discussion

about the degree of a vertex given a vertex-edge graph, when Eduardo turned to his

tablemates to tell them that he was having trouble drawing the graph. In both examples,

students used a combination of Spanish and English to convey their understanding of the

mathematics. Also, in both instances, Ms. Cohen did not discourage students from using

their L1. These observations are also consistent with her interview and her survey responses. For instance, in her interview she stated that,

I don't mind it. What I told them at the beginning of the year is that I don't mind when you're working with each other if you're speaking Spanish because it might help them...they might be able to explain it to each other better in Spanish, as long as...they'll actually tell me if they're saying something bad...but I don't mind it as long as they...when I'm talking to them, they're able to explain it to me in English, then I don't mind (Ms. Cohen).

Her response on the Teacher Beliefs Survey seems to indicate that Ms. Cohen supports the idea that students' L1 is a resource for learning mathematics, again consistent with her interview and observations. For instance, when asked on the survey whether students' use of their first language to solve mathematics problems hinders their ability to learn English, she disagreed. Furthermore, on the question of whether students can participate in mathematical problem solving, including providing arguments and explanations, she strongly agreed.

While Ms. Rivas did not support the 4-hour ELD block, she did voice her support for students only using English when speaking to each other in the classroom. When asked during her interview why she did not allow students to speak Spanish during mathematics instruction, she responded, "Because they have to learn the English [laughs] language." However, she did state that she allows students to use Spanish only when speaking to a student who recently arrived from Mexico and knows no English. She went on to say that the policy allows her to clarify instructions to the student in Spanish, but that whole class instruction must be conducted in English. This perspective of only teaching in English is consistent with Ms. Rivas's observations. While the whole class instruction was in English, she did use Spanish when working with the one Spanish-only

speaking student individually. In her survey response however, she did not support the idea that an ELL student's use of their L1 to solve mathematics problems hinders his/her ability to learn English.

Summary of Beliefs

Table 5.3 below summarizes the themes that emerged with respect to teachers' beliefs and where teachers fall within these themes.

Table 5.3

Summary of Beliefs

Theme	Rivas	McDonald	Cohen	Moore
Student Ideology	Some degree of deficit perspective Computation is their strength	Positive Capable and intelligent High expectations	Some degree of deficit perspective Computation is their strength	Some degree of deficit perspective Computation is their strength
Mathematics as a Universal Language	Views mathematics as a universal language	Views mathematics as a universal language, but believes ELLs need differentiated instruction to have access to it	Views mathematics as a universal language	Views mathematics as a universal language Clearly distinguishes between mathematics and language
Language Ideology	Does not support the use of students' first language for whole class instruction	Believes students' first language is a resource for learning mathematics	Allows students to use their first language as long as they can explain their solutions to her in English	Adamantly opposes students' use of their first language Views Spanish as an inferior language to English and as an obstacle to her students' success

Practice

In the following sections, I discuss themes that emerged with regard to teachers' practices. Classroom Assessment Scoring System (CLASS) scores are reported to provide some context for the results in this section. First, I report instructional changes caused by the policy and how in some cases those changes caused teachers to teach in isolation. I then discuss how institutional compliance at the state, district, and school level impacted how teachers either challenged or reproduced the policy. Next, I report how teachers used and promoted mathematical discourse and how that in turn influenced the opportunities that students had to learn mathematics. I conclude by reporting the various instructional practices that teachers used and the learning opportunities that they provided to their students.

CLASS Scores

In an effort to measure teachers' practices and to capture classroom nuances that were not captured in the other data sources, means were taken of the three CLASS scores for each teacher (see Table 5.4 below). For each of the dimensions, the maximum score is 7.00, indicating that that specific practice was present to a large extent during the three CLASS observations. The data suggests that Ms. McDonald displayed all dimensions to a high degree. Conversely, the other three teacher's scores seem to indicate that they all displayed about the same level of practices in each of the dimensions, well below those displayed by Ms. McDonald.

Table 5.4

Average CLASS Scores of Teachers

Dimension	Rivas	McDonald	Moore	Cohen
Positive Climate	4.33	7.00	4.00	3.67
Negative Climate	2.33	1.00	3.33	3.33
Teacher Sensitivity	4.00	6.67	3.67	2.67
Regard for Student Perspective	4.33	7.00	3.00	2.67
Behavior Management	2.67	7.00	4.33	1.67
Productivity	4.00	6.67	4.00	2.00
Instructional Learning Formats	3.33	6.33	3.33	2.67
Concept Development	4.00	7.00	3.67	3.00
Quality of Feedback	4.00	7.00	3.67	3.00
Language Modeling	4.00	7.00	3.33	3.00

Instructional Change Caused by Policy

Teachers reported varying degrees to which the ELD policy has changed their instruction. For instance, Ms. Moore and Ms. Cohen both stated during their interviews that the policy had in no way changed their instruction. Perhaps this is due to the fact that both teachers were first year teachers, and had only taught with the policy in place. However, when probed further during the interviews, all four teachers indicated that the 4-hour or 2-hour block did in fact cut into their time for teaching other subject areas, such as science and/or social studies, at a minimum. When asked if the 2-hour block had changed her instruction, Ms. McDonald stated that the block didn't have an affect on her

mathematics teaching because she covered the 2-hour block by engaging students in conversation, reading, thinking, and speaking during mathematics time. In other words, she viewed mathematics as an opportunity to engage students in discourse as they learn new vocabulary and academic language. She went on to say that, “I don’t care whether it’s the 4-hour block or not, they’re getting an hour of math everyday.” Contrary to Ms. Rivas who was institutionally coerced to reproduce the policy, Ms. McDonald openly challenged the policy and its components by integrating the various grammar components of the 2-hour block into her mathematics instruction.

On the other hand, Ms. Rivas stated that the policy had had a significant impact on her instruction. For starters, because the 4-hour block took up the majority of the day, she was left with little to no time to teach anything else. During her interview, Ms. Rivas stated,

Rivas: We’ve had to revise my schedule particularly at the fourth grade level a lot during the school year because of that [4-hour block]. They recently changed our math block to include the problem solving and math facts and math wall, and they want 50 minutes of the core curriculum instruction.

Researcher: Meaning the standards?

Ms. Rivas: Yeah. It has been difficult to fit in all of it, including the ELD.

Researcher: In my mind I’m trying to picture this. You have the 4 hours of the ELD block. That leaves you with what, 2 hours, if that?

Ms. Rivas: If that.

Researcher: And they expect you to do fifty minutes of the core curriculum and then the other stuff.

Ms. Rivas: They say that the problem solving is supposed to take 10 minutes. No. Especially in my having the ELL learners, it does not take

them ten minutes [laughs]. Math wall is supposed to take 30 minutes. That has gone over for me too, more than 30.

Ms. Rivas's statement about the challenges of incorporating the curriculum intervention routines is supported by her observations. As noted in Figure 5.1, there were only 3 instances in which Ms. Rivas was observed teaching the core curriculum during mathematics time. In the remaining observations, she only covered mathematics wall, mathematics facts, and Otter Creek problem solving. Often times, Ms. Rivas spent a significant amount of time pre-teaching vocabulary that was unfamiliar to students. According to Ms. Rivas, this is a significant shift in the manner in which she has taught in the past. During her interview, she stated, "I know I've had to do a lot of explaining of terms during math. I feel like I've done more, spent more time just explaining vocabulary" (Ms. Rivas). When probed further, she explained that since the implementation of the 4-hour block, her mathematics instruction has shifted in focus to one that involves primarily teaching vocabulary, often times teaching it in isolation. When asked why she focused so much on pre-teaching vocabulary during mathematics time, she stated,

Throughout the year, like I said, I found that if I don't do that [pre-teach vocabulary], they'll...I guess they lose focus and those words will throw them off and then I can't get them back to focus on the question. That's why I do that at the beginning and address all the words that they don't understand before we even attack the question. Like what happened with the whole love seat earlier [laughs]. I couldn't get them to focus back on the question. So now I try to avoid that by doing that (Ms. Rivas).

This shift in instruction is also evidenced in Ms. Rivas's observations. For example,

Observation 6
(May 4, 2012)

Rivas: I'm going to go over a couple of words in the problem first. The first one that we need to remember is 'inequality.' Remember, this word means an equation that is not equal

because it has this prefix right here ‘in’ means not. So it’s not equal. The sign right here, it means equal. Because it has the line down there – that’s the equal and then it has your less than sign. Does anybody remember how we would say that sign right there? Because it’s not just a less than or and it’s not just a greater than. It has an equal in there. See if you remember – less than or equal to. This sign means less than or equal to. That means that it could be both. So you have eight is less than or equal to p. And p is going to be these numbers right here. You want to start with letter A. You’re trying to find the numbers that are less than or equal to eight. Look at the four sets of numbers. They’re asking you to find which of these numbers is less than or equal to p. Go ahead and try...lets try letter A actually and then I’ll let you try B, C, and D with a partner

While Ms. Rivas often times spent a significant amount of time pre-teaching or defining mathematical terms, she also found herself having to define everyday terms embedded within word problems. For example, in her earlier statement, she talked about how the term ‘love seat’ had diverted students’ attention from the mathematics. Defining not only mathematical terms, but also everyday terms was a common practice for Ms. Rivas. This was also the case for Ms. Cohen. Like Ms. Rivas, she too found herself having to go over and discuss everyday terms embedded within word problems. For example, the term ‘bed-and-breakfast’ appeared to be unfamiliar to students, so Ms. Cohen found herself having to spend some time going over its meaning.

Observation 7
(May 8, 2012)

Cohen: So, they have a bed-and-breakfast. Do you know what a bed-and-breakfast is?

Students: Yes.

Cohen: Yeah, what is it?

- Simon: When they take you breakfast to bed.
- Cohen: Well, they might take you breakfast to bed. Anyone else?
- Horacio: When you sleep and you wake up and you don't want to make breakfast, so it's already set up for you. Somebody can bring it to you when you're still in bed.
- Cohen: It's kind of like a motel, but it's in someone's house.
- Students: Like room service.
- Cohen: There's only a few rooms and kind of imagine it like you're staying in someone's house. They are renting the room for the night and they'll provide breakfast for you in the morning. Okay. So they have a bed-and-breakfast.

There was only one reported incident in which Ms. Moore went over the multiple meaning of a term. During mathematics wall, students were asked to find the mean of a set of numbers, when a student brought it to her attention that the word had a different meaning in everyday English. Ms. Moore acknowledged the student and reiterated that the term 'mean' does in fact have two different meanings, depending on the context. During her interview, she did, however, comment on the idea that students should be exposed to words in different contexts so they understand that they have multiple meanings, depending on the context in which they are working in.

Teaching in Isolation

Another theme that emerged with regards to instructional change is the idea that the 4-hour block causes teachers to teach in isolation. This is particularly evident in Ms. Rivas's interview.

To me, the 4-hour block makes you teach it in isolation....Which I personally don't like, but [sighs]. I don't like the 4-hour block thing because it makes you teach it in isolation, including the writing because I think the writing and the grammar go together and it's an hour of writing and an hour of grammar separately.Even vocabulary. I think it goes with the reading, but they want an hour of just vocabulary instruction. I don't know. I've been finding it difficult to separate it. I'm used to just incorporating it all into the different subjects and it seems like with the 4-hour block everything is... (Ms. Rivas).

When probed further, Ms. Rivas stated that she teaches some of the mathematics vocabulary during the vocabulary hour of the ELD block, resulting in teaching the terms in complete isolation from the content. Rather than have students engage with the vocabulary by negotiating meaning and developing working definitions of mathematical terms, she often times found herself having to give students the terms and their definitions.

On the other hand, Ms. McDonald's focus is more on students' conceptual understanding of mathematical ideas than it is on terminology. However, while her focus is on engaging students with the mathematics, she understands the role that mathematical vocabulary plays on standardized assessments. During her interview, she stated,

I knew that they had to know the properties but I think it's stupid that...Eventually the words come. I'm less focused on them knowing every single word as I am for them to be able to work through it. When they get those tests they need to know those words (Ms. McDonald).

Later in her interview, she stressed the idea that while she wants students to use the mathematical vocabulary, she wants them to learn it in context and develop conceptual understanding of the mathematical ideas they represent.

I want them to be using that vocabulary, but you can't just be like, "today the word perimeter, write down the definition and this is what perimeter is.".....They'll say things like, "What's the commutative property of multiplication?" and I never sit up there and say, "today were going to learn about the commutative property." You teach them about that....When you're teaching them about that...skip counting or repeated addition is multiplication and then you show that $2 + 2 + 2$ is six or three plus three is six. You draw that array. That's when you're teaching the commutative property. Eventually I'll give them that name, but they do a lot of that stuff for a long time before they even realize that they're doing it. Then I give them that name because they need to know that name because of this test (Ms. McDonald).

Resistance to or Reproduction of the Policy

Of the four teachers, Ms. McDonald was the only teacher to explicitly challenge the policy, as it is structured. Her opposition to the policy is consistent with her observations and teacher interview. For example, one of the components of the 4-hour block is to teach vocabulary in isolation from content, something that Ms. McDonald refused to do. "They're [ELD teachers] not allowed to integrate because it has to be an hour on just vocabulary. How does a teacher do a science lesson if you're just supposed to be teaching vocabulary for an hour" (Ms. McDonald). Instead, Ms. McDonald consistently promoted mathematical discourse through contextualizing and meaningfully integrating mathematical vocabulary during mathematics instruction. For example,

Observation 2
(March 28, 2012)

McDonald: Are there any of these that look really, really super familiar to you that you know right away will work? You should all be raising your hand. There's one out there that should be so familiar to you it's not even funny. You dream about this in your sleep.

Marcos: A.

McDonald: A. Why?

Marcos: Because you have 50 groups of 20 and then 9 groups of 20.

McDonald: So it's kind of like the what?

Marcos: Like the array.

McDonald: Well, yeah you can draw an array. In fact you guys have drawn like this. If you guys did 59×20 you would absolutely break it up into $50 + 9$, right? Then you guys would do 50×20 , right? Then 9×20 . Then you would do what?....It's also like the game plan. That's like the distributive property.

The idea of challenging policy that she does not support is not new for Ms.

McDonald. During her interview, she stated for the past three years, she has not used textbooks for reading or mathematics. Instead, she developed a progression of where she wanted her students to go and developed her own lessons that focused on conceptual understanding. According to Ms. McDonald, "I'm not one of those that's just going to sit there and complain about it and let my kids suffer, so I have to go out and find different things to make it work." Her focus on conceptual understanding is manifested in her students' scores on the district's mathematics assessment. For example, when compared to the other three classes, her class outperformed the other three by a significant amount (see Table 5.5). This seems to suggest that teachers' pedagogical decisions have a significant influence on student achievement.

Mathematical Discourse

The opportunities that students had to engage in the discourse of mathematics varied considerably across all four teachers, and consequently influenced the opportunities that students had to learn mathematics. As discussed in the theoretical framework, mathematical discourse refers to the use of language and other symbols, ways of talking, thinking, and participating in practices that are the target of school learning (Moschkovich, 2007). The manner and extent to which teachers used and embedded mathematical language in their instruction dictated, to a certain degree, how students engaged with the language and mathematics themselves. Of the four teachers, Ms. McDonald was the only one to consistently encourage students to share their thinking, use multiple representations when solving problems, and meaningfully and effectively negotiate meaning with their peers. For instance, she purposefully and deliberately asked students with different strategies to share their thinking. In doing so, she encouraged students to look at similarities and differences between solutions, encouraged students to question each other's thinking, encouraged students to make connections between different representations, and restated students' responses to highlight and recapitulate important mathematical ideas. In addition, she consistently used mathematical language when teaching a new concept and effectively recapitulated students' responses, giving students continuous opportunities to hear and use the language of mathematics. These practices are reflected in Ms. McDonald's CLASS scores on the dimensions of instructional learning formats, concept development, quality of feedback, and language modeling (see Table 5.4). Effectively and meaningfully using and providing opportunities for students to use academic discourse is consistent with research that

shows that students make significant academic gains in mathematics when there are ample opportunities for them to hear and use the language (i.e., Khisty & Chval, 2002). Not surprisingly, her students' scores on the district's mathematics assessment were considerably higher than the scores of the other three teachers' students on the same assessment (see Table 5.5).

Table 5.5

Students' Scores on District's Mathematics Assessment

	Rivas	McDonald	Moore	Cohen
Median Score	31.88	78.08	57.53	48.53
Median Absolute Deviation (MAD)	7.245	8.22	7.53	4.41

While Ms. Cohen consistently used mathematical language when teaching mathematics, she was not very effective in getting her students to use it meaningfully and effectively. Perhaps this is due to the fact that she was a first year teacher and had poor classroom management. As a result, much of the time spent on mathematics instruction was devoted to dealing with disruptions, limiting the opportunities that students had to effectively engage with the mathematics. This is consistent with her 1.67 and 2.00 CLASS average scores on the dimensions of behavior management and productivity, respectively. This seems to suggest that although teacher use and modeling of mathematical language is important, equally important is providing opportunities for students to meaningfully engage with the language as they reason through problems. A study by Khisty and Chval (2002) underscores the importance of not only effectively using academic discourse, but also engineering an environment where students have

access to multiple opportunities to engage with the language of mathematics. While Ms. Cohen consistently used mathematical language, she was ineffective in creating a conducive environment for students to effectively use academic discourse.

Ms. Moore demonstrated little consistency in the manner in which she used mathematical language. Often times she failed to use the appropriate mathematical terms when referring to mathematical concepts. This was particularly evident when she taught decimals and fractions.

Observation 8
(May 14, 2012)

Moore: Now, when you say a decimal...is that two hundred and three?

Students: No.

Moore: No. Point two, zero three. You say each individual digit. Two, zero, three. It's not twelve point twenty-three.

Maria: But that is Ms. Moore.

Moore: Those ones you do, one hundred, eighty-six thousand, two hundred and forty-one. But on a decimal you say, twelve, point two, zero three.

When teaching decimals, she stressed the idea that students should be able to read decimals, although she failed to use the appropriate mathematical language when referring to the decimals by not attaching place value to them. On a different occasion (Observation 5, May 1, 2012) while teaching addition of fractions with different denominators, she consistently referred to the numerators and denominators as the “bottom” numbers and the “numbers on top,” rather than by their mathematical names. This is consistent with her 3.33 average CLASS score on the dimension of language

modeling. However, there were two instances in which she did use the more formal mathematical language. For example,

Observation 2
(April 4, 2012)

Moore: To find the quotient. What is the quotient Juan? When I'm asking you for the quotient, what am I asking you to do?

Juan: Put them in piles.

Moore: What do we call that? What's another name for that? Addition, subtraction, multiplication, division?

Students: Division.

Moore: Division. The answer to a division problem is the quotient.

Observation 3
(April 12, 2012)

Moore: Oscar, what did you notice about this graph?

Oscar: It didn't have the numbers on the...

Moore: What are the numbers on the left hand side called?

Maria: The y-axis.

Moore: Well it is the y-axis. You're right, but what is it called when we put those numbers there?

Students: Scale.

Moore: So now that you're seeing the scale, what is the interval?

Maria: Ten.

Like Ms. Moore, Ms. Rivas also demonstrated little consistency in the manner the in which she used mathematical language. For example, a problem on area and perimeter prompted Ms. Rivas to pass out pattern blocks so that students could explore the concept using concrete materials. However, when referring to the various shapes, Ms. Rivas used

their color rather than their geometric names. When asked during a stimulated recall interview (April 4, 2012) why she did not refer to the shapes by their geometric names, she stated,

I know I should be using the formal names, but I was already doing the lesson as a tangent of the math wall. I know most of them still don't know the proper names and we didn't cover it much in class yet either, so to avoid yet another tangent of me getting into names of shapes, I figured it be easier to just say the color and move on for the sake of covering area and perimeter and not names of shapes. We didn't get into geometry until recently, but I am covering that during math vocabulary time and fitting it in into that time. Since we have to do an hour of vocabulary for ELD block, I do 30 minutes during reading and 30 minutes during math.

Ms. Rivas's statement about covering geometric terms during her 30-minute vocabulary allotment appears to support her perspective that the ELD block causes her to teach in isolation. Rather than holistically integrate geometric concepts and the related vocabulary, she is forced to teach the two separately and in isolation from one another.

The type of questioning that teachers used also influenced the opportunities that students had to develop mathematical discourse. For example, Ms. McDonald consistently used open-form questioning during mathematics instruction, giving students time to be critical and independent thinkers. There were constant exchanges of dialogue between teacher and students and between students themselves, all centered around mathematical language and mathematical reasoning and communication. This is consistent with her mean scores of 7.00 in the categories of quality of feedback and language modeling, which measure the extent to which teachers ask students to explain their thinking and the extent to which teachers use academic language to extend students' responses, respectively. Below are several typical exchanges between Ms. McDonald and her students.

Observation 5
(April 24, 2012)

McDonald: I want you here and I want you here and I want you to draw what you did, circle your answer, and you're going to talk about it. The rest of you guys are going to either finish the problems, you're going to watch and when they're talking you're going to do what, Ana?

Ana: Listen to them.

McDonald: You're going to pay attention. You're going to listen and ask questions. Thank you.

Observation 6
(May 3, 2012)

McDonald: Antonio, why don't you agree with Carlos?

Antonio: Because on the two left over pancakes, he's supposed to cut them up into thirds because there's six kiddos.

McDonald: Did you hear what he said, Cesar?

Cesar: Yeah.

McDonald: So what's your response to that?

Cesar: Yeah, but I was too lazy to do that.

McDonald: I want to show you something. Those of you that think that they're both right...Cesar could have done this, mijo. He could have...he's saying – as long as everyone gets an equal amount.

Marcos: But Cesar does have it right cause if you put one line in the middle, they'll each have two.

McDonald: They'll each have two sixth pieces. Way to go, Marcos. Awesome! They're both right. So that's when we start dealing about equivalent fractions. Remember how we said that $\frac{4}{4}$ is equal to...?

Students: A whole.

McDonald: One whole. And like $3/6$ is equal to...?

Students: Half.

Observation 7
(May 7, 2012)

McDonald: We are going to watch what Rodrigo and Daria are doing and then we are going to talk, as usual. Listen and talk. Listen and talk.

The questioning used by the other three teachers, particularly when working on word problems, was much more closed-form, giving little to no room for students to make interpretations, reason through their thinking, and justify their solutions. This is reflected in their mean CLASS scores, particularly on the quality of feedback and language modeling dimensions (see Table 5.4). Below is a typical exchange between Ms. Moore and her students when solving word problems. Ms. Rivas and Ms. Cohen also consistently used this type of exchange, particularly when using the Otter Creek curriculum.

Observation 1
(March 1, 2012)

Moore: Which one is the comparing sentence?

Adriana: Today they sold 139 less than their best day?

Moore: Why is that the comparing sentence?

Adriana: Because it says less.

Moore: It says the word less, so you underline that sentence. The one that's more goes at the...?

Students: End.

Moore: End. Which one is more? How much they sold today or how much they sold on their best day?

Students: Best day.

Moore: Best day is more. So underneath it, how are we going to label it? Do we add or subtract?

Students: Subtract?

Moore: Why?

Students: Because we know the sum.

Moore: Yes, because we know the sum.

Key-Word Focused Approach

Like Ms. Moore, Ms. Cohen and Ms. Rivas also engaged in key-word focused instruction. As a result, students solved word problems via a rote process that failed to engage students in meaningful mathematical communication. This is consistent with Ms. Rivas's average CLASS score of 4.00 in the dimension of concept development. For instance:

Observation 1
(March 30, 2012)

Rivas: This is what kind of problem?

Esteban: Comparing.

Rivas: Comparing. You need to find your comparing sentence and underline it. Okay, remember the steps in the comparing. You need to look for the words 'more than' or 'less than.' Find those in the problem. More than or less than. Okay, circle them. Now underline that whole comparing sentence. How do you know that this is a comparing problem? Because it has the word 'more.' So you want to find that and circle it before you start anything. 'More than,' that is your comparing sentence. You underline that sentence. So in your comparing sentence, is there a number?

Students: No.

Observation 2
(April 5, 2012)

Rivas: No, so if there is no number, then you have to get which one is more and which one is less from the rest of the information in the problem. Because your comparing sentence does not have a number, what do we put in the difference?

Antonio: A variable.

Cohen: Step number two says to underline the sentence that has either 'each,' 'every,' or 'per.' Which sentence has one of those words? Sebastian? The last sentence. It says, how many toys went into each box? Step three says to take the word right after our signal word and put it where? It's on your paper. What is step three?

Students: Word right after in the first blank.

Cohen: Step number four says, what is our things per group? Our things go underneath our blank thing, but what is our thing?

Students: Boxes per toys.

Cohen: What is our thing?

Students: Toys.

Cohen: Toys. Toys goes under the third blank. Good job. Number five says to put...In the middle line what do we put?

Students: Things per group.

Cohen: Things per group. What is our things per group? Toys per box.

Although Ms. Cohen consistently engaged in this type of exchange with her students when working on the Otter Creek curriculum, there were instances in which she shifted

away from the key-word emphasis and focused instead on the students understanding what the problem was asking them to do. For example,

Observation 3
(April 11, 2012)

Cohen: So, what is it asking us to do? What is that question asking us to do?

Estevan: Divide.

Cohen: What does it say? What does it say? It says, What equation can be used to find the cost of one bag of concrete? So what do we need to do? What do we need to do?

Estevan: Multiply.

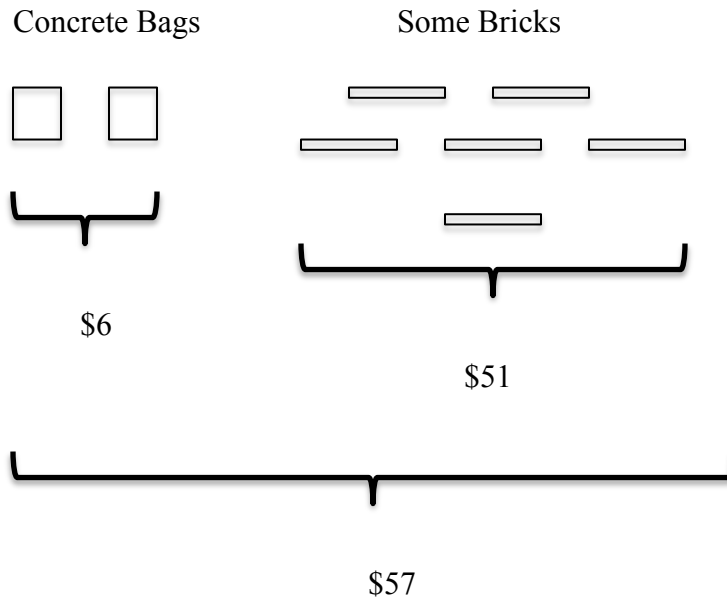
Cohen: I'm not asking for multiplication or division. What does it say? What do we need to do?

Estevan: Add.

While in this example Ms. Cohen moved away from using a key-word focus, when going over the solution, she wrote the equations on the board and solved them for the students. Although there were exchanges between Ms. Cohen and her students about how to set up the equations and what the variables represented in the context of the problem, the emphasis was on solving the equations, which resulted in closed-form questioning by Ms. Cohen. By this I mean that she asked questions specifically about how to isolate the variables to solve to the cost of one bag of concrete.

Interestingly, I had the opportunity to work with Estevan (the student referenced in the excerpt above) on this particular problem, and his approach to solving it involved the use of a visual aid. Together, Estevan and I came up with the following visual and then used it to solve for the cost of one bag of concrete.

Figure 5.1. Visual Aid Used by Estevan



Having solved the problem differently than Ms. Cohen, Estevan asked to share his solution with the class, but was ignored by Ms. Cohen. This is consistent with her CLASS average score of 2.67 on the dimension of regard for student perspective, which measures, in part, the extent to which teachers incorporate students' ideas.

One of the implications of this type of key-word focus is that it limits students' opportunities to engage in meaningful and substantive conversations about mathematics, and as a result impacts students' opportunities to learn mathematics and develop mathematical discourse. For example, the following problem proved to be confusing for one of Ms. Rivas's students, particularly because she was engrained with the idea that multiplication is always attached to the term 'each.'

The members of a cycling club cycled 276 miles in two days. They cycled the same number of miles each day. What operation can they use to find how many miles they cycled each day?

Student Interview
(May 7, 2012)

Blanca: When I see 'each,' I see that it's multiplication.

Researcher: Could it be division?

Blanca: Yeah, but most of the time I did multiplication. I thought it would be multiplication again.

Researcher: So you're thinking it's multiplication. Can you tell me what makes you think it's multiplication and not division? You said that the word 'each' tells you. So if it's multiplication, how would you solve that problem?

Blanca: You have to multiply the two numbers.

Researcher: What two numbers?

Blanca: Two and the 76.

Researcher: When you're multiplying it by two, what is it that you're trying to find? Lets go back a little bit. Can you tell me what you're trying to find in this problem? What are they asking you to do?

Blanca: To find the number of days that they cycled.

Researcher: What operation can they use to find how many miles they cycled each day? So what do you think that means?

Blanca: You have to multiply to find it out.

Researcher: Okay so you can multiply. If you multiply 276 times two and you're going to get this number. What does that number tell you?

Blanca: Each time you go to find something it's multiplication.

Blanca's response exemplifies the danger in simply using a key-word focus when solving mathematics problems. As discussed in the Literature Background, students need access to a classroom community that purposely and deliberately provides opportunities for students to actively engage in mathematical tasks that require them to communicate, reason, negotiate, justify, and make connections, something that is limited by this type of instructional focus.

Ms. McDonald was the only teacher who did not use a key-word focus approach when teaching mathematics. Instead, she consistently encouraged students to reason through problems by negotiating with their peers. One of the ways in which Ms. McDonald engaged her students in mathematical discourse was by deliberately and purposefully asking students to explain, justify, and reason through their thinking. The following excerpts exemplify Ms. McDonald's focus on communication.

Observation 3
(April 5, 2012)

McDonald: I have a question. We have $4\frac{2}{3}$ here and we have $14\frac{2}{3}$ here. I want you to look at them and tell me who is right. Don't just make up your mind. You're going to have to explain why. Ana, what do you think?

Ana: Antonio.

McDonald: You think Antonio is right. Why do you think that Antonio is right?

Ana: Because he used all of them except for $\frac{1}{3}$. Rodrigo – he just wasted three bows and $\frac{1}{3}$.

McDonald: You're saying that since he didn't shade in the spot right here...you're saying he wasted three bows and a third of a bow. Actually a half a bow...Cesar, what do you think?

Cesar: I think they're both right.

McDonald: Ooh, Cesar thinks they're both right. Why do you think that Cesar?

Cesar: Because if you can count by three, it's going to be four. If you put the two thirds, it's going to be the same.

McDonald: Can you go up and tell me what you're talking about.

Observation 6
(May 3, 2012)

McDonald: Actually, what Ana did is really awesome and I would love to hear her explain it and you guys need to tell me whether or not you agree with her, and if so why or why not? Ana, please.

Observation 2
(March 28, 2012)

McDonald: I want to know which expression will not solve 59×20I told you to go ahead and solve all four problems, but you verbally had to tell me why these would work and which didn't. We're going to discuss why or why not some of these will work.

Observation 7
(May 7, 2012)

McDonald: Monica is going to come up here and share what she did. Never fear Monica. What you did is up here on this board. Tell me how you solved it and I'll show you how it fits. Don't you dare just write *some numbers on the board and sit down. Tell me what you did.*

Contrary to Ms. McDonald's communication focus, Ms. Moore's classroom was characterized by teacher-focused instruction, leaving little to no room for students to engage in meaningful discussions. Even on those occasions where she had students work in pairs, the focus was primarily on sharing the answer or the operation used rather than on explaining their thinking process. This is consistent with her survey response in which she indicated that when ELL students are allowed to work in groups or pairs, they

learn each other's mistakes. Furthermore, these limited opportunities for discussions and activities that encourage analysis and reasoning are also consistent with her CLASS average score of 3.67 on the dimension of concept development.

Instructional Practices

The manner in which teachers used instructional supports, such as sentence frames, extra-linguistic cues, visuals, manipulatives, and concrete representations also varied across teachers. Of the four teachers, the only one that did not use manipulatives during mathematics instruction was Ms. Moore. Not surprising, during her interview she stated that she does not use manipulatives when teaching mathematical concepts because it distracts her students. Her limited use of manipulatives and other concrete representations is consistent with her CLASS average score of 3.33 on the dimension on instructional learning formats. In addition to not supporting the use of manipulatives or other concrete representations during mathematics instruction, Ms. Moore also discouraged students from using visuals and other representations. For instance, when Ms. Moore asked students to multiply 73 times four, she made it clear that they were not to use any visuals when finding the product. "I don't want to see anymore pictures. You guys are about to go on to fifth grade. You should be able to multiply those numbers" (Ms. Moore). Interestingly, when she solved the problem 73 times four on the board, she used the area model to show the product, a contradiction to her statement that students should not, at this point, be using any visuals to find the product of two numbers.

While Ms. Moore did not incorporate the use of manipulatives or encourage students to use visuals for solving mathematics problems, one instructional practice that she used on several occasions was Total Physical Response (TPR), particularly when

going over mathematical vocabulary. For example, during one observation she used arm gestures to symbolize the mean of a set of numbers. When asked during her interview why she used TPR, she stated,

It helps them remember with the properties and trying to find a way for them because they cannot for the life of them...and I always have problems too...associative, commutative and distributive. So we were trying to come up with a total physical response for that (Ms. Moore).

On the other hand, Ms. McDonald strongly supported and encouraged the use of visuals for solving mathematics problems. According to Ms. McDonald, fourth grade students are “still very concrete people,” and visuals are a way to gain mathematical understanding by connecting the abstract with the concrete. She also stated that while visuals are helpful to her and her students, they are especially helpful for ELLs because it allows them to access mathematical information in various ways. This is consistent with research detailing effective practices for ELLs, namely that the use of diagrams and images assist students in making sense of mathematical tasks (i.e., McGraw et al., 2007).

Ms. McDonald’s support for visual representations during mathematics instruction is strongly supported by her observations. She consistently used visuals herself when teaching mathematics and also encouraged students to use them when solving mathematical tasks. The following excerpts highlight her support for the use of visuals:

Observation 1
(March 31, 2012)

McDonald: I demand a pictorial representation.

Observation 3
(April 5, 2012)

McDonald: This is why I don’t want you guys straying away from the pictures just yet because a lot of you guys assumed – like when we were doing all fair sharing...the last problem it was appropriate to just add $\frac{2}{3} + \frac{2}{3} + \frac{2}{3}$

or multiply. A lot of you guys thought that's all you had to do this time and that's not appropriate. I need to see that you're reading the problem, [that] you understand what it's asking you, and that you know how to go about solving it.

Other instructional practices used by Ms. McDonald include the use of sentence frames, multiple representations of mathematical concepts and ideas, recapitulating students' responses, using extra-linguistic cues to demonstrate understanding, and conducting read-alouds for word problems. According to Ms. McDonald,

You take where your kids are at and you move them forward. You keep in mind that they're learning English. The sharing with a partner, thumbs-up, thumbs-down, draw, using hands on manipulatives. I feel that all that helps my English language learners, but it also helps my English-only.

The following excerpts highlight the several of the strategies that were captured during her observations.

Observation 1
(March 21, 2012)

Student: Do I need to put my answer in a complete sentence?

McDonald: You can just say...Yeah, why don't you use a sentence frame. "Each child will get ____." Put it in a complete sentence.

Observation 6
(May 3, 2012)

McDonald: Draw what you did. Explain what you did. It's not like doing anything different than normal.

Observation 7
(May 7, 2012)

McDonald: Everyone. I'm going to read the problem with you one more time. The problem is that you guys might move school next year or heaven forbid I'm not your teacher next year. Is there going to be someone there to read the problem to you all the time?

Students: No.

McDonald: No. So it's very important....I know that this

is a little bit longer problem than what you're used to dealing with, but you guys should have all been able to be successful in solving this problem, especially because I read the problem to you and gave you a visual aid. Now, look up here again. We're going to do a cloze reading again. Ready. A theatre has 3 sections of seats, a middle section, a left section and a right...

Like Ms. McDonald, Ms. Cohen also supported the use of manipulatives, visuals, and other concrete representations during mathematics instruction. When asked why she encouraged students to use manipulatives when solving mathematics problems, she stated that doing so appeals to different modalities of mathematical learning, as well as gives them an opportunity to “see how it works.” This practice of consistently using visuals and manipulatives is strongly supported by her observations. For example, when teaching multiplication of fractions, she used the area model to show the cross product (Observation 6, May 3, 2012). On a different occasion, she modeled and had the students use fraction strips when dividing a whole number by a fraction (Observation 8, May 10, 2012). On yet another occasion she removed the analog clock from the wall to show students elapsed time (Observation 1, March 28, 2012).

Ms. Rivas also used manipulatives fairly consistently during mathematics instruction. However, when asked during her interview why she used them, she stated that her students have not yet transitioned from using the concrete to the more abstract. She then compared her ELL class to other fourth grade mainstream classes and suggested that those mainstream classes transition to the abstract at a much faster pace. This seems to suggest that Ms. Rivas has, to a certain degree, a compensatory perspective of manipulatives. In other words, her students, for the fact of being ELL students, need the

manipulatives because they are unable to transition to the more abstract mathematical concepts.

Summary of Practices

Table 5.6 below summarizes the themes that emerged with respect to teachers' practices and where teachers fall within these themes.

Table 5.6

Summary of Teachers' Practices

Theme	Rivas	McDonald	Cohen	Moore
Instructional Change Caused by Policy	Reported significant shift in the way she teaches	Reported no change in her mathematics instruction	Reported no change in her mathematics instruction	Reported no change in her mathematics instruction
Teaching in Isolation	Focus is on vocabulary Reported that the policy has caused her to teach content out of context and in isolation	Contextualized mathematical concepts and vocabulary	Did not report any concern that the 2-hour block caused her to teach in isolation	Did not report any concern that the 2-hour block caused her to teach in isolation
Resistance/Reproduction of Policy	Institutionally required (state, district, and school) to reproduce the policy	Challenged the 2-hour block by incorporating it with other content areas	Institutionally required (district and school) to reproduce the policy (2-hour block)	Institutionally required (district and school) to reproduce the policy (2-hour block)
Mathematical Discourse	Some degree of closed-form questioning Inconsistent in her use of mathematical language	Open-form questioning Ample opportunities for students to justify, explain, and reason through problems	Closed-form questioning Inconsistent in her use of mathematical language	Some degree of closed-form questioning Consistent in her use of mathematical language
Key-Word Focused Approach	Strong emphasis on key-word instruction	Consistently recapitulates students' responses and ideas No key-word focused instruction	Strong emphasis on key-word focused instruction	Strong emphasis on key-word focused instruction
Instructional Practices	Used some instructional supports, such as visuals, manipulatives and read-alouds Supports mathematics facts and Otter Creek curriculum	Used visuals, sentence frames, and multiple representations Does not support mathematics facts and Otter Creek curriculum, although she is not required to teach it	Discouraged students from using visuals Used TPR to help students remember the definition of mathematical terms Supports mathematics facts and Otter Creek curriculum	Consistently used manipulatives Supports mathematics facts and Otter Creek curriculum

Summary of Results

Policy

Teachers' knowledge and views of the 4-hour block varied across teachers. Ms. Rivas and Ms. McDonald showed an extensive level of knowledge about the policy and indicated their lack of support for any component of the policy. Conversely, Ms. Cohen and Ms. Moore had limited knowledge of the 4-hour block and therefore did not express support or opposition to the policy. Interestingly, their understanding of policy consisted of additional curricular intervention policies put into place by the district and school. This raises questions about the complicity of the district and school in adding additional layers of policy and forcing institutional compliance.

Another theme that emerged was that the 4-hour and 2-hour blocks placed restrictions on teachers' practices by limiting the amount of time that they had to teach other subject matter. Teachers often times found themselves unable to teach science and/or social studies due to the demands of the 4-hour or 2-hour blocks.

Teachers' perspectives on the 1-year language proficiency expectation varied considerably. Ms. McDonald and Ms. Rivas both indicated that the expectation is unrealistic, although both cited different reasons for this. Ms. Moore, on the other hand, indicated that reaching proficiency in one year is possible only if students are heavily immersed in English without the demands of any other subject matter, such as science, social studies, and mathematics. Ms. Cohen was the only teacher to indicate that the one-year expectation is adequate.

In terms of grouping students by English proficiency level, the findings of this study suggest that segregating students in this fashion resulted in multi-grade

combination classes with high levels of special education students in those classes, creating additional instructional challenges for teachers. In addition, some teachers reported that this grouping mechanism limits the exposure that ELL students have to their English-speaking peers. As a result, the only English-speaking model in those classrooms is the teacher.

And finally, there was a consensus that the district and schools played a significant role in how the policy was institutionally enforced. In addition to forcing compliance of the 4-hour block, the district implemented a 2-hour iteration of the block, raising questions about the role of the district in engineering language policies that conflict with current research for effectively educating ELLs. The findings also suggest that the implementation of the curricular intervention program put into place by one of the schools significantly limited the opportunities that students had to reason through problems and justify their thinking.

Beliefs

Teachers' beliefs about their students and their abilities varied considerably. Of the four teachers, Ms. McDonald was the only one to explicitly comment on the importance of maintaining high expectations and rigorous curriculum for her students. She had a positive view of her students' abilities and described her students as being strong in all areas of mathematics. Conversely, the other three teachers pointed to computation as their students' strengths, and at times implicitly referenced their students' challenges as the source of weakness.

In terms of language ideologies, again teachers varied considerably. The manner in which teachers viewed students' first language influenced the opportunities

that students had to use their first language as a source of knowledge. Ms. Moore viewed students' first language as an obstacle and adamantly opposed the use of students' first language in the classroom. Similarly, Ms. Rivas also opposed the use of Spanish in the classroom, although she did not express any disdain for the language. On the other hand, Ms. Cohen and Ms. McDonald did not oppose the use of Spanish in the classroom.

All four teachers shared the belief that mathematics is a universal language, although how they viewed the relationship between mathematics and language varied between teachers. For example, while Ms. McDonald believed that mathematics is a universal language, she indicated that differentiation was necessary to make the language embedded in the mathematics accessible to ELL students. On the other hand, Ms. Moore clearly distinguished between language and mathematics and the idea that one can separate one from the other when problem solving.

Practice

In terms of instructional change, teachers varied in the way in which the policy influenced their teaching practice. Ms. Cohen and Ms. Moore both indicated that the policy had not changed their instruction in any way, although the data suggests that the 2-hour block limited the amount of time they could spend on other subject matter. Ms. McDonald indicated that the policy had not changed her mathematics instruction, but did affect the time that she had to teach social studies. Ms. Rivas indicated that the 4-hour block had fundamentally shifted the manner in which she taught. From limiting the amount of time to teach other subject matter, to focusing on vocabulary when teaching mathematics, her practice was impacted by the policy. She also stated that policy had

caused her to teach in isolation, which she described as teaching subject matter out of context, and teaching discrete language skills.

The manner in which teachers promoted mathematical discourse also varied across teachers. How teachers used and embedded mathematical language in their instruction influenced the opportunities that students had to engage in mathematical discussions. These opportunities to hear and use the language of mathematics were impacted by the curricular intervention program that Ms. Rivas, Ms. Moore, and Ms. Cohen were required to do. Again, this raises questions about the role of this added layer of policy and the implications to student learning.

Chapter 6

DISCUSSION

In this chapter, I present the overall findings of this study and discuss their significance and their implications in the context of the literature discussed in Chapter 3. I continue by having a discussion on the limitations of the study and end by suggesting directions for future research.

Arizona's 4-hour English language development (ELD) block fundamentally changed the way in which my teachers could teach English language learner (ELL) students in their schools. By the same token, it had an impact on students' equitable access to learn mathematics by placing restrictions and limitations on teachers' practices mediated through district policies and culture. The results of this study suggest that depending on teachers' beliefs and the manner in which the policy was enacted, which was, in part, influenced by the State, district, and school, policy such as this created disparities in opportunities to learn for students in mathematics in one Arizona district. The contrast in cases exemplified the ways in which the policy, which was enacted differently in the various classes, restricted teachers' practices, and in some cases resulted in inequitable opportunities to learn mathematics for ELLs.

Overall Findings

Overall, the findings revealed five key factors with respect to the implementation of the policy. First, there was an overall consensus that the 4-hour and 2-hour blocks limited the amount of time available to teach other subjects, such as science and/or social studies. One teacher reported having less time to teach mathematics due to the rigid structure of the 4-hour block. Second, the 4-hour block significantly shifted the manner

in which some teachers taught mathematics to ELL students by focusing on vocabulary rather than on developing mathematical proficiency and conceptual understanding. This disparity in how teachers provided opportunities for students to learn mathematics and develop conceptual understanding raises questions about the complicity of the state, district, school, principal, and teacher in implementing policy. Third, segregating students by English language proficiency level resulted in multi-grade classrooms, and placing large numbers of special education students in those classrooms, presenting additional pedagogical challenges for teachers. Fourth, because ELL students are segregated by English proficiency level, they have limited opportunities to interact with their non-ELL peers. One teacher reported that, in part, this grouping mechanism makes it more difficult for ELL students to transition out of the ELL program. And finally, there was a unanimous sentiment that the district and schools played a significant role in how the policy was institutionally enforced, again, raising questions about the role of the district, schools, and principals in creating and enforcing policies that conflict with current research for educating ELLs.

With respect to teachers' beliefs about teaching mathematics to their ELL students, two main themes emerged. First, teachers' language orientations significantly impacted the opportunities that students had to use their first language as a resource for learning mathematics. And second, there was a consensus across teachers that mathematics is a universal language that transcends cultural and linguistic differences. However, the extent to which teachers viewed mathematics as a non-linguistic body of knowledge varied considerably. For example, while Ms. McDonald viewed the symbolic

form of mathematics as universal, she believed that you could not separate the language from the mathematics if you wanted students to become mathematically proficient.

With respect to teachers' practices, a look at how teachers promoted mathematical discourse in their classrooms revealed that the manner and extent to which teachers used and embedded mathematical language in their instruction dictated how students engaged with the mathematics themselves. The data also suggests that the curricular intervention program used by three of the four teachers, a highly prescriptive program focusing on basic mathematics facts and categorizing word problems, significantly limited the opportunities that students had to hear and use the language of mathematics meaningfully. Again, because this intervention program was implemented by only three of the teachers and put into place by the principal of the school, questions remain about how this additional layer of policy impacted students' mathematics achievement.

Significance of Findings in Relation to Literature

The results of this study appear to confirm the findings in a recent study of the implementation and organization of the state mandated curriculum in the 4-hour block (Lillie et al., 2010). While the Lillie et al. (2010) study focused on examining the actual 4-hour block curriculum, this study aimed to examine, not only the impact of the 4-hour block on students' access to mathematics, but also understand how the language policy, coupled with teachers' beliefs and instructional practices mediated each other to create learning environments for students. Like the Lillie et al. (2010) study, the results from this study also support the idea that students at the primary level received little instruction in subject matter, aside from English instruction, and that the subject matter often times failed to meet grade level standards. For example, Ms. Rivas, the only teacher who

taught the 4-hour block taught the curriculum outlined in the Arizona mathematics standards only 38% of the time. Similar results were obtained for Ms. Moore who only taught the core curriculum 50% of the time. What is interesting about these results is that while Ms. Moore taught the 2-hour block, she still often times neglected to teach grade level standards, raising questions about the role of teachers' beliefs and practices as mediators of the policy. One of the benefits of studying multiple constructs, as outlined in the conceptual framework in Chapter 2, is that it allowed me to look across these constructs to better understand how, together they contribute to the learning opportunities of students. Unlike the Lillie et al. (2010) study however, this study also examined teacher beliefs in hopes that it would provide a more comprehensive perspective of the impact of restrictive language policies and how the ideological alignment of teachers impacts these opportunities.

The results also indicate that grouping students by English language proficiency resulted, in part, in multi-grade level classrooms and resulted in placing large numbers of special education students in those ELD classrooms, creating unique instructional challenges for teachers. This is not surprising given the extensive literature detailing the over-representation of ELLs in special education classes (i.e., Artiles, Kozleski, Trent, Osher, & Ortiz, 2010). Of the four teachers, Ms. Rivas, being the only teacher who taught the 4-hour block, was the only one to teach the third/fourth grade combination class. In addition to having limited time to teach subject matter other than English, Ms. Rivas often times found herself having to split her third and fourth graders to teach two different mathematics lessons. That might help explain why she taught the grade-level standards only 38% of the time. Ms. Rivas also attributed the inclusion of special

education students in her ELD class, as well as the fact that her ELL students did not interact with their non-ELL peers to the fact that her students were not transitioning out of the ELD program. While the reasons for failing to transition out of the ELD program might differ, the results of this study are consistent with the Lillie et al. (2010) study in which the researchers found that ELLs were not exiting the program in one year, with the exception of kindergartners. The results are also supported by research on second language learning that has consistently shown that on average, it takes four to seven years to develop academic English proficiency (i.e., Hakuta, Butler, & Witt, 2000). While this study did not specifically focus on issues related to exiting the ELD program, the results appear to support the idea that acquiring academic English proficiency takes several years, and not one year as stipulated in the policy.

One of the goals of this study was to unveil teacher beliefs about teaching mathematics to their ELL students to better understand how those beliefs served to mediate teachers' practice. Through the multiple data sources, I was able to expose teachers' language beliefs, as well as their perspectives of policy and their role as mediators of the policy. For example, Ms. Moore openly voiced her support for English-only instruction, one in which students are "heavily exposed" to the English language and barred from using their native language in the classroom with the goal of "associating" them into the American culture and language. This supports the idea of barring students' native language and immersing them in English-only classrooms to accelerate their acquisition of English, a position clearly contradicted by the well-established research in second language acquisition (i.e., Hakuta, Butler, & Witt, 2000; Thomas & Collier, 2000). In addition to supporting English-only instruction, Ms. Moore's ideological

framework about students' native language included positioning students' native language as an obstacle in their education. This is consistent with Ruiz's (1984) language orientations, namely *language as a problem* that problematizes students' cultural and linguistic assets. First, this *language as a problem* orientation is in direct opposition to what researchers in the area of second language acquisition claim, namely that ELL students who do not have opportunities to develop literacy in their first language face greater obstacles in acquiring a second language, and subsequently take longer to develop literacy in a second language (August & Hakuta, 1997; Hakuta, Butler, & Witt, 2000). Second, from a historical perspective, Ms. Moore's framework directly maps to the broader ideological perspective that problematizes students as having "English-language deficiencies," as was the case in *Delgado*. Like the early court cases discussed in Chapter 3, this orientation positions students' native languages as a deficit and in need of fixing. Not surprisingly, this is the same ideological framework used by the Task Force in Arizona who mirrored the 4-hour block to the segregative and restrictive language policies of the past.

While it is important to bring to the forefront deficit views that teachers may hold of their students, equally important is to highlight the impact that positive perspectives have on framing opportunities for ELL students to learn mathematics. For example, Ms. McDonald is a teacher whose ideas reflected her role as an advocate for her students and who consistently created opportunities for students to meaningfully engage in mathematical discourse in whatever language was most comfortable and comprehensible to them, including their native language. This idea of using students' linguistic capital for learning is supported by research on effective practices for educating ELL students

(i.e., Khisty, 1995; McGraw, 2007, Moschkovich 2006, 2007). When teachers focus on students' strengths and competencies rather than on deficits, such as mispronounced words, they widen what counts as knowledge and thereby value students' cultural and linguistic capital as rich resources from which to build new knowledge (Moschkovich, 2010).

The teacher interviews provided an in-depth analysis on how teachers viewed their students and their abilities, and the mathematics that they teach. Not surprisingly, students in classrooms where teachers focused on students' strengths, resources, and competencies, and who openly challenged the policy, as expressed by their instructional practices and their interviews, performed significantly better on the district's mathematics assessment. For example, the median score in Ms. McDonald's classroom on the district's mathematics assessment was 78.08, with a median absolute deviation score of 8.22, significantly higher than the other three teachers. Apart from scoring significantly higher on the mathematics assessment, Ms. McDonald's students consistently engaged in mathematical discourse during mathematics instruction, a practice that was not consistent in the other three classrooms, and often times absent. In fact, when the other three teachers worked on problem solving, for example, the exchanges between students and teachers consisted of rote dialogue about where to place numbers and what operations to perform. Opportunities for students to be independent thinkers who could derive meaning, negotiate, justify, and communicate mathematical ideas were limited. In light of the expectations set forth in the Common Core State Standards and the Standards for Mathematical Practice, providing these opportunities for students to develop mathematical proficiency is critical. Failure to provide these opportunities can result in

inequitable practices for ELLs by limiting the level of access that they have to learn mathematics. For example, when one looks at the mathematics performance of these students on the district mathematics assessment, it is no surprise that their median score is considerably lower than that of Ms. McDonald's class who focused on engaging students in mathematical discourse.

An analysis of how teachers and students engaged with each other when communicating mathematical ideas revealed that those classrooms characterized by open-form questioning and constant negotiation of ideas and mathematical representations between students and teacher reflected higher scores on the mathematics assessment. By the same token, classrooms characterized by closed-form questioning and little to no opportunities for students to engage in substantive conversations about mathematical ideas revealed that students in those classrooms performed significantly lower on the same assessment. This is consistent with the literature on the nature of pedagogic discourse that suggests that the teacher plays a key role in promoting a learning environment where students can actively and meaningfully engage in problem solving, justification, oral and written communication, and independent thinking (Khisty & Chval, 2002). In analyzing how teachers engineered this type of learning environment, one idea that I examined was how teachers recapitulated students' ideas as a form of promoting mathematical discourse. The data appears to be consistent with the Khisty and Chval (2002) study that attributed, in large part, Latino/a students' academic gains in mathematics to the teacher's effective use of academic discourse and students' access to multiple opportunities to hear and use the language of mathematics.

As expected, the ability to create this type of learning environment characterized by ample opportunities to hear and use the language of mathematics was severely restricted by the 4-hour block because the policy clearly separates English instruction from content instruction. The data suggests that the rigid nature of the block placed limitations on some teachers' ability to engineer a community of practice where students substantively participated in discussions about mathematics. This was evident in the classroom observations of Ms. Rivas, who also stated that her instruction had shifted significantly to the form of teaching vocabulary out of context and in isolation. The idea of taking mathematical terms and simply feeding students definitions without the proper context of the mathematical ideas that they represent fails to provide that conceptual understanding that is so critical in developing mathematical proficiency. As a result, you have a situation where mathematical vocabulary is deliberately separated from the mathematical ideas they represent, limiting the opportunities that students have to hear and use the language of mathematics meaningfully. As discussed earlier, limiting the opportunities that students have to communicate using the language of mathematics can be problematic, at best, given the demands of the Common Core State Standards. If we want students to become mathematical proficient students who can problem solve, justify, and reason abstractly using the language of mathematics, then it is important that state, district, and school policies reflect practices that support student learning. Unfortunately, policies such as the 4-hour block limit and restrict the opportunities that teachers have to create learning spaces for students to meaningfully engage in mathematical discourse.

This separation of language and mathematics perpetuates the idea that there is no significant relationship between mathematics instruction and language. One of the issues with this perspective is that teachers who support this idea run the risk of aligning their mathematics instruction with the problematic instruction supported in the policies put into place by the state, district and schools. For example, the 4-hour block specifies that content instruction is separate from English instruction and that vocabulary should be taught separately during the vocabulary block. Furthermore, the Otter Creek curriculum promotes a key-word focus and a one-size-fits-all approach, rather than view mathematics as a discourse. An implication with this is that failure to understand mathematics as a discourse can result in inequitable practices by failing to support ELL students with a high-quality education (Secada, 1992; Khisty, 1993). The findings in a recent study examining the intersection of the 4-hour block and mathematics professional development suggests that teachers' views of mathematics as a non-linguistic body of knowledge impacted how they taught mathematics to their ELL students (Battey et al., 2013). Battey et al. (2013) suggest that this separation of language and mathematics perspective is institutionally supported by the policy.

To a certain extent, the idea that mathematics is a universal language supports this separation of language and mathematics. As stated earlier, teachers shared the sentiment that the symbolic nature of mathematics made it universal, and ultimately influenced how they taught mathematics. For example, when teaching word problems, three of the four teachers consistently used a key word focused approach. The problem with using this type of instructional practice is that it has the potential to limit students' opportunities to negotiate meaning and engage in mathematical discourse because the focus is on

attaching an operation to specific key words. Data from the student interviews underscored the potential damaging effects that using this type of instruction can have on student understanding. When asked how to solve a division word problem a student automatically responded that she had to multiply the numbers because the problem contained the word ‘each.’ When probed further about what the problem was asking her to do rather than on what operation to perform, she simply reiterated that anytime you see the word ‘each’ you multiply. Relating this back to the idea that mathematics is universal, one can see the potential implications that failing to see the complex relationship between language and mathematics can have on student learning.

Conclusion

In conclusion, the rights of ELL students to have access to the same curriculum as their English-dominant peers have been at the center of a highly contentious debate. While there is no question that the 4-hour block closely mirrors the policies that have historically segregated and framed ELLs as problematic, the results of this dissertation suggest that the manner in which the policy is enacted has profound implications on student learning in mathematics, as seen in one Arizona district.

Ironically, the 4-hour block was established, in part, to address the fact that districts were not adequately meeting the needs of ELLs and as a result violating the Equal Educational Opportunities Act (EEOA) of 1974. The results of this study suggest that rather than “take appropriate action to overcome language barriers that impede equal participation by its students in its instructional programs” (Section 1703(f)), the enactment of the 4-hour block created disparities in opportunities to learn mathematics for ELL students. One can argue that by failing to provide equitable educational

opportunities to ELLs, the 4-hour block violates the EEOA, which codified the essence of *Lau* (1974). The results of this study have shown that in addition to creating disparities in learning opportunities, students' access to other subject matter, such as science and/or social studies were also limited as a result of the policy; therefore impeding equal participation by students. To this end, a complaint has been filed with the U.S. Department of Education Office of Civil Rights.

Limitations of the Study

There are several limitations to this study. First, because the study was limited to one district, generalizability of the findings of this study is not possible. Thus, generalizations of the findings can only be extended to similar districts with similar conditions given the small sample size. However, the ideological alignment of teachers used to select the cases for this study can be used to sample teachers in other studies to examine the impact of their ideological alignment on their practice.

Second, the selection of teachers was done, in part, through a self-reporting instrument, which can also be a limiting factor to this study since such self-reporting instrument can generate a desirability effect. In addition, while the internal consistency of the instrument was only 0.651, this could be due, in part, to the small sample size. To address this potential issue, triangulation through interviews, observations, and questionnaires was employed to increase the validity of the constructs the instrument was measuring. In addition, care was taken to pilot the instrument in a different district to identify any potential confusion with any of the questions.

Third, while the aim was to interview two students from each classroom and obtain data that would either support or challenge assertions made, the interviews proved

to be a challenge, as some students did not engage in conversation during the interviews. As a result, the data obtained from the student interviews is limited.

Fourth, because this study only reports on data after the implementation of the policy, I could only rely on teachers' reported previous practices. For example, in the case of Ms. Rivas, it would have been valuable to compare her teaching practice to before and after the implementation of the policy to determine the extent to which the policy impacted her instruction. Furthermore, the added layers of policy (mathematics facts and Otter Creek curriculum) implemented by three of the teachers created an additional layer of complexity. This raises questions about the complicity of the state, district, school, and teacher in implementing policies that conflict with current research for educating ELLs.

And last, the study is limited to my own critical subjectivity, including my personal biases, beliefs, expectations, and perceptions about policy, teachers of ELLs, and English language learning and teaching. Therefore, while my experiential knowledge is a rich source of knowledge, it can also be a source of potential bias, and as a result affect the inferences and statements made about the study. To address this issue, the second coder served to ensure the accuracy of my findings.

Implications for Future Research

The purpose of this study was to examine a case of the implementation and enactment of 4-hour block in elementary classrooms, and understand how language policy, coupled with teacher beliefs and practice, impacts equitable access and consequent mathematics achievement and success of ELL students. While recent studies (i.e., Lillie et al., 2010) have begun to unveil the damaging consequences of the state

mandated curriculum in the 4-hour block, little is known about the impact that this policy has on students' equitable access to mathematics. Although this is an exploratory study limited to one district, it can be used to open dialogue between educators, researchers, and policymakers about how to afford equitable learning opportunities in mathematics for ELLs. However, future research is needed to examine the complex relationship between policy, teacher beliefs and practice more in depth. A larger, perhaps longitudinal study is needed to critically examine the extent of the impact of language policy on ELL students' opportunities to learn and succeed in mathematics.

The results of this study suggest that testing for the various positions of policy mediation is complex. To better understand how policy is mediated through teachers' beliefs and practices, a more flexible framework is needed that allows for teachers' shift in ideological alignment. While there will be teachers that fall on opposite ends of the continuum, as was the case in this dissertation, this type of framework may be more effective in examining the impact of policy and teachers' beliefs and practice on student opportunities to learn mathematics.

By critically analyzing the opportunities that ELL students have to learn mathematics in the context of restrictive and segregative language policies, we can begin to understand the impact of policy, teacher beliefs and practice and suggest ways to provide equitable access for ELLs to learn mathematics. Further research is needed that specifically examines how the alignment of policy ideology, teacher ideology, and their mathematics practice intersect to create learning opportunities for ELL students. This research is particularly important to better understand how those teachers that partially align with policy, as was the case of Ms. Rivas and Ms. Cohen, are at risk of aligning

with policy that coerces inequitable opportunities to learn for ELLs. Furthermore, if educators, researchers, and policymakers are to fully understand the impact and consequences of this policy on students' access to mathematics, and promote positive and effective change, it is important to understand the broader ideological and political context surrounding the contentious bilingual debate in which this study is situated.

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APPENDIX A

INTERVIEW PROTOCOL FOR TEACHER INTERVIEW

Broad ELL Policy

Tell me what you know about the ELL legislation (4-hour ELD block) recently implemented.

Can you describe how the state policy of grouping classes by English language proficiency level affected your mathematics teaching, if at all? Can you give me an example?

What about the 4 hours of language instruction?

Describe how you view the expectation of students reaching English fluency in 1 year of school?

Administration

What's your perception of how the district and school administration has implemented the ELL policy?

Describe how the administration managed the transition to the new policy.

Instructional Change

Describe how your mathematics practices have changed because of the policy, if at all.

Has the ELL policy benefited your mathematics teaching in some way? Can you give me an example?

Has it limited your mathematics teaching in some way? Can you give me an example?

Student Ideology

Describe your student population. (this could be ethnicity, culture, race, SES, intelligence...)

What are the strengths and weaknesses of the students in your classroom? What about their strengths and weaknesses particular to mathematics?

Pick a student that represents an average mathematics ability for your classroom.

Can you give me a problem that you think [name of student] could solve, but that would be difficult for him/her?

Why do you think they could solve it?

What do you think will make the problem difficult for the student?

If they don't discuss issues of language, ask:

Describe if language has affected or not [name of student] ability to solve the problem. If so, to what extent?

APPENDIX B

INTERVIEW PROTOCOL FOR STUDENT INTERVIEW

Solving a Problem

Walk me through using the language you used as you thought of the problem.

Describe what you were thinking when your teacher was talking about the problem.

What language were you using to think about the problem when your teacher was talking about the problem?

Walk me through the problem as you understood it.

Did you have any difficulties understanding any part of the problem? If so, what part(s) and what made it/them difficult?

Did your teacher help you understand the problem? If so, can you describe what she/he did that helped you to better understand the problem. Can you give me an example?

Mathematics Time

Describe what math time looks like in your classroom? Be as specific as possible.

What does the teacher do during math time?

What do you do?

What do your classmates do?

Describe the language you use when you work with your classmates during math time.

Describe your favorite part of math time.

What makes it your favorite?

What are you doing during this time? What is the teacher doing during this time?

APPENDIX C
TEACHER BELIEFS SURVEY

	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
1. The most important factor in second language acquisition success is student motivation.				
2. Most of the mistakes that second language learners make in mathematics are due to interference from their first language.				
3. Children's home language can be a good resource for making sense of and solving mathematics problems.				
4. A child who can read and write in their first language will be able to learn mathematics faster and easier, as opposed to a child who cannot read and write in his/her first language.				
5. The inclusion of English language learners in mainstream classes benefits all students.				
6. If a student is not proficient in English, the child should be in a classroom learning mathematics in his/her first language.				
7. Students must learn English first before they can participate in mathematical problem solving, including providing arguments and explanations.				
8. If a student is not proficient in English, the student will do better in mathematics if he/she knows how to read and write in his/her first language.				
9. Allowing a student who is not yet proficient in English to use his/her first language to solve mathematics problems hinders his/her ability to learn English.				
10. If an English language learner is in an English- only class he/she will learn mathematics better.				
11. Students must learn English as quickly as possible, even if it means the loss of their native language.				
12. High levels of bilingualism lead to practical, career related advantages.				

13.	High levels of bilingualism result in higher development of knowledge or mental skills.				
14.	It is good for students to maintain their native culture, as well as American culture.				
15.	The development of the first language helps develop a sense of biculturalism.				
16.	When English language learners are allowed to interact freely (for example, in group or pair activities), they learn the mistakes of other students.				
17.	Mathematics requires little language and is therefore accessible in the same way to all children regardless of English language proficiency.				
18.	Differentiated instruction is necessary in the mathematics classroom for students not yet proficient in English.				
19.	Contextualizing vocabulary when teaching a new mathematical concept is not necessary because mathematics requires little language.				
20.	English language learners are best taught using whole-group direct instruction/lecture.				

APPENDIX D

OTTER CREEK PROBLEM SOLVING SAMPLE

Level 3 Day 80 OUT & IN PROBLEMS

***Teachers please note:

The problems include renaming with hundreds numbers (3 digit numbers) from Day 80 on.

1. A farmer had 87 chickens. Then he sold 23 chickens. Then 49 chickens got out and were lost. How many chickens did the farmer have left?

$$\boxed{} + \underline{ ? } = \overset{+87}{\boxed{}} - \underline{}$$

out + end = in

 chickens

Answer

2. The farmer had 88 sheep. He bought 77 sheep from another farmer. Then 32 lambs were born. The farmer sold 50 sheep. Then the farmer gave 25 sheep to his brother. How many sheep did the farmer have left?

$$\boxed{} + \underline{} = \overset{+}{\boxed{}} - \underline{}$$

out + end = in

Answer

3. The farmer had 62 cows. He bought 75 more cows. In the spring 45 cows were born. Then the farmer bought 33 cows from his uncle. How many cows did the farmer have? *[Be sure to draw the box.]*

$$\underline{} + \underline{} = \underline{}$$

$$\underline{} + \underline{} = \underline{} - \underline{}$$

Answer

1. Read the problem.
2. If the problem has both gaining and losing or more than one of either, write **out + end = in**.
3. Make boxes over "out" and "in," and a blank line over "end."
4. Re-read the problem and put each quantity in a column over the right box:
 - put the starting quantity **over** the "in" box
 - put all quantities that are gaining or adding **over** the "in" box.
 - put all quantities that are losing or going away **over** the "out" box,
5. Add the quantities in the columns and write the sums in the boxes.
6. If the final question asks for what is left at the end, write "?" over "end" and solve by subtracting the total "out" from the total "in."
7. What's the answer?
8. What's the label?

APPENDIX E

OTTER CREEK MATHEMATICS FACTS SAMPLE

Set A [1+2, 2+1, 1+3, 3+1] Practice on facts in Set A

3	1	1	3	2	1	3	1	1	2
<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+2</u>	<u>+1</u>

1	3	1	2	1	1	3	3	1	3
<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>

2	1	3	1	1	2	3	1	3
<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+2</u>	<u>+1</u>	<u>+1</u>	<u>+1</u>	<u>+1</u>

1	2	1	1	3	3	1	2	3
<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>

One Minute Timing on facts in Set A

1	3	1	1	1	2	2	1	3
<u>+2</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>

2	1	1	1	2	2	1	3	2
<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+1</u>

3	1	1	2	3	1	3	1	1	2
<u>+2</u>	<u>+2</u>	<u>+1</u>	<u>+1</u>	<u>+1</u>	<u>+3</u>	<u>+1</u>	<u>+2</u>	<u>+3</u>	<u>+1</u>

2	1	3	2	1	3	1	2	1	1
<u>+1</u>	<u>+3</u>	<u>+1</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+2</u>	<u>+1</u>	<u>+3</u>	<u>+2</u>

1 minute timing goal _____

Number of problems correct _____