Views From A Community College On The U.S.-Mexico Border: Mexican/Mexican-American Postsecondary Students' Perceptions Of K-16 Mathematics Education

Carlos Ruben Paez Paez
University of Texas at El Paso, crpaez23@gmail.com

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VIEWS FROM A COMMUNITY COLLEGE ON THE U.S.-MEXICO BORDER: MEXICAN/MEXICAN-AMERICAN POSTSECONDARY STUDENTS’ PERCEPTIONS OF K-16 MATHEMATICS EDUCATION

CARLOS RUBÉN PÁEZ PÁEZ
Department of Teacher Education

APPROVED:

______________________________
Judith H. Munter, Ph.D., Chair

______________________________
Olga Kosheleva, Ph.D.

______________________________
Mourat Tchoshanov, Ph.D.

______________________________
Art Duval, Ph.D.

______________________________
Charles Ambler, Ph.D.
Dean of Graduate School
Abstract

The purpose of this study was to investigate Mexican/Mexican-American postsecondary students' perceptions and experiences of mathematics instruction in U.S. formal education (K-16). Framed by critical race theory and using a grounded theory approach, this inquiry was conceptualized within the framework of the literature on academic disparities in achievement in mathematics between Mexican American students and other student populations in U.S. schools, highlighting students' perceptions and student voice. Qualitative data were collected through interviews and surveys from five postsecondary students who voluntarily participated in the study. Data analysis used the constant comparative method, a key element of grounded theory methodology (Glaser, 1978). Participants described simultaneously experiencing multiple dimensions as elements of their lived experiences in mathematics education, including active student resistance to unsuccessful pedagogical practices, ongoing reflections about these experiences, and the development of recommendations for improvement. The three major findings of this qualitative research study: a) generate deeper understanding of how Mexican/Mexican-American students perceive and experience mathematics instruction in U.S. K-16 schools; b) explicate how these students' underachievement may stem from their active resistance to unsuccessful teaching practices; and c), show how mathematics instruction frequently lacks in variety and innovation, assuming a “one-size-fits-all” strategy for all learners. Implications for research and practice include the need to examine culture, language, and social contexts to better support these students at every level throughout their mathematics education.
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Chapter One

Introduction

In the U.S. public school system (K-16) today, student demographics have changed considerably (Martinez, 2006). The numbers and percentages of immigrant students, particularly Latino and English Language learners (ELLs) have increased dramatically. Definitions of majority and minority have been transformed. Latinos are 16.9% of the U.S. population. However, in Texas, Latinos represent 38.2% of the population (U.S. Census Bureau, 2010). The majority of Latino students are of Mexican origin (69%), followed by Puerto Rican (9%), Dominican (3%), Salvadoran (3%) and Cuban (2%) (See figure 1).

Figure 1. Latino students’ origins in the U.S. This figure illustrates the percentage of Mexican, Puerto Rican, Dominican, Salvadoran, Cuban, and other corresponding to Latinos in U.S. (U.S. Census Bureau, 2010).
In states like California and Texas, and in many of the largest school districts across the country, minority students (non-White students) are now over 50% of the student population (Flores, 2007). According to Fry & Gonzales (2008), the Latino school-age population will increase by 166% by 2050 (to 28 million from 11 million in 2006), while the non-Latino school-age population will grow by just 4% (to 45 million from 43 million) over this same period (Fry & Gonzales, 2008).

Mathematics in the 21st century

According to Adler, Ball, Krainer, Lin, & Novotna, (2005) we are currently witnessing what can be called the “massification” of mathematics as a school subject. In many countries today there is a broad move to make mathematics available for everyone. Mathematics is viewed as an essential competency for critical citizenship (Sriraman, & Steinthorsdottir, 2007). An understandable consequence of the increasing demand for mathematics proficiency for all is an increase in the need for quality teaching. This need is particularly evident at basic levels of schooling. Even though the need for quality teaching is high at the secondary and higher levels of schooling, where mathematics is a concentration subject, quality teaching is even more critical at levels where mathematics is a general requirement (i.e., elementary and pre-school levels). More educators and better mathematics teaching are needed if mathematical proficiency is indeed to become a widely held competence (Adler, Kariner, Lin & Novotna, 2005). Of course, quality instruction depends on teachers, and so their preparation and continuing professional development is crucial.

Mathematics Education

Bass (2005) argues that mathematics education is a domain of professional work that makes fundamental use of highly specialized kinds of mathematical knowledge, and in that sense
it can be usefully viewed as a kind of applied mathematics. Just as in other domains of “applied mathematics”, the first task of the mathematician who wishes to contribute in this area is to understand sensitively the domain of application, the nature of its mathematical problems, and the forms of mathematical knowledge that are useful and usable in this domain. According to Bartolini & Bazzini (2003) “mathematics education is defined as the complex and heterogeneous social system which includes theory, development, and practice concerning the teaching and learning of mathematics” (p. 203). In other words, mathematics education can be defined as the practice of teaching and learning mathematics as well as the research associated with it. Berry III, Ellis, & Hughes (2014) affirm that:

Examining the past century of mathematics education reforms in the US, most efforts have focused on addressing one or more of three basic concerns: content – what mathematics children should learn?; pedagogy – how students should be taught mathematics?; and quality – who is qualified to teach mathematics? (p. 541).

According to Matthews (2013) Shulman (1986) in his now classic article on Pedagogical Content Knowledge (PCK) outlined the history of standards for teachers in the United States, remarking that at that time subject matter knowledge was the most important knowledge in the preparation of teachers. However, in the following decades there was a substantial shift. Shulman noted that subject matter knowledge had faded almost completely in favor of knowledge of pedagogy, culture, and policies. Although he acknowledged that “mere content knowledge is likely to be as useless pedagogically as content-free skill” (p. 8), Shulman was critical of the diminished attention to content knowledge. He proposed three forms of knowledge: subject matter knowledge, pedagogical content knowledge, and curricular knowledge, all of which should lead to synthesized pedagogical content knowledge (Mathews, 2013). PCK closes a gap
Shulman (1986) noted—the knowledge of content that is particular to the teaching of the subject matter. Beyond knowing the content as an expert might, Shulman suggested that teachers must know multiple ways of representing the concepts in the content and the challenges and misconceptions their students may have, as well as the ways to help these struggling students. PCK, then, joins knowledge of subject matter with knowledge of teaching.

There is a much larger body of literature on PCK that focuses on the elementary grades; however, work conducted at the secondary and post-secondary levels has been added because these levels are currently a growing area of interest in mathematics education research.

In our globally competitive society, it is becoming more important that all students be confident in their ability to do mathematics. Furner, Yahya & Duffy (2005) argue that knowledge of mathematics is an important skill necessary to succeed in today’s world. The National Council of Teachers of Mathematics (2000) has noted that equity requires accommodating differences to help everyone learn mathematics. In U.S. there are students from different cultures that have different needs. Therefore, teaching practices should be responsive of the cultural identities of their students. However, Savage, Hindle, Meyer, Hynds, Penetito and Sleeter (2011) affirm that achieving equity on diverse schools is a global challenge, and educational disparity takes on different forms depending on context. According to Lynch & Star (2014) despite apparent professional consensus, debate continues about whether instruction with multiple strategies is beneficial to all students or only to high achieving students. These doubts come primarily from the practitioner community, but they also have some support from researchers. For instance, Silver, Ghouseini, Gosen, Charalambous, and Strawhun (2005) found that many had beliefs that exploring different strategies would be feasible only with high-ability students.
According to Borman & Overman (2004) & Matsumura, Slater, & Crosson (2008) schools environments do not always encourage the personal relationships between the teacher and student that are very important in pedagogy, even though studies have found that a caring and supportive environment is critical for students. Padron, Waxman, & Lee (2014) established that the lack of achievement of students from high risk and high poverty environment necessitates changes in today’s school environments to create a caring, supportive environment where all students can succeed. Chionh & Fraser (2009) argue that empirical probes of the educational productivity model revealed that classroom and school environment was found to be a strong predictor of both achievement and attitudes even when a comprehensive set of other factors was held constant. There is evidence that student perceptions are more important than objective measurements of the environment (e.g., Bennet & Ward, 1993; McDowell, 1995; Van Damme, Opdenakker, Van Landeghem, De Fraine, Pustjens, & Van de gaer, 2006).

Mathematics education has been concerned with pre-service and in-service teachers’ training (Sriraman & Törner, 2014). The origins of the field indicate that mathematicians spent a considerable amount of time in producing coherent textbooks for teachers that focused on the mathematical content (Sriraman & Törner, 2008). In the last three decades teacher training has been the focus of numerous initiatives not limited to the U.S. but in different parts of the world. A considerable amount of mathematics education research has reported on start-up projects with teachers, models of professional development, summer workshops, design based approaches to professional development (Lesh & Sriraman, 2010).

According to McMillan, Myran & Workman (2002) and Saliu (2005) assessment is a critical component of any general education and higher education. Airasian (1997) established that assessment is essential in improving the teaching process. Assessment includes observations,
ratings of performance, paper and pencil tests and examinations, evaluations of all sorts, scaled measurements, etc. (Miller, Linn & Gronlund, 2012). Zimba (2005) established that assessment is not merely concerned with testing or measurement. It is a process that enables schools to make judgments about the value of student achievement. It certifies and makes available information communicating that intended students have attained standards of achievement, skill and performance.

Since the mid-1980s there have been mathematics education researchers conducting studies in areas that highlight the ways in which race, racism, social context, play a central role in the learning and teaching of mathematics (Berry et al., 2014; Ellington & Frederick, 2010; Flores, 2007), challenging the assumptions that mathematics teaching, learning, curriculum, and assessment are the only factors that matter when understanding the mathematical experiences and achievement of children (Malloy and Jones 1998; Tate 1995). However, too often, race, racism, social justice, contexts, identities, conditions, and others are relegated as issues not appropriate for mathematics education when in fact these issues are central to the learning and teaching of mathematics for all children (Berry et al., 2014).

**Mexican Students in U.S. Schools**

Reports on K-12 school achievement (e.g., National Assessment of Educational Progress, 2006) indicate that the academic progress of Latino students, many of whom are Mexican, is slower than the progress of their peers in public school classrooms. A number of researchers (e.g., Castro-Salazar, & Bagley, 2010; Ingram & Gonzalez-Mathews, 2013) have also provided documentation indicating that students of Mexican origin are not succeeding academically in proportion to the rest of the U.S. population. Furthermore, studies show that Latinos in postsecondary education often struggle academically. When these students complete high school,
test scores indicate that many are not “college-ready” (Flores, 2007), and community colleges provide an excellent starting point for these students for several reasons. Approximately 50% of all Latino university students begin their postsecondary studies in a community college because of accessibility (i.e., the institutions’ location in the community), lower costs, and flexibility in scheduling course offerings. (Green, 2006; White House Initiative for Educational Excellence for Hispanic Americans, 2012). Thus, the community college student is located in a unique space – between the K-12 system and the university; Mexican/Mexican-American community college students on the U.S.-Mexico border who are in the process of transitioning from community college into the university were selected to be the target population for this study.

However, although community colleges enroll large numbers of Latino students, retention and completion are concerns, particularly for students who struggled academically in K-12. From more than 1 million of associate’s degree certificates conferred to U.S. citizens and nonresident aliens in 2011, Latino students were awarded 18.3% of the certificates (See figure 2) compared to 54.5% for Whites, 20.3% for African American and 4.3% for Asians (U.S. Department of Education, 2011). While this dissertation focuses attention on students who have transitioned to the university level, the disparities in achievement in mathematics between Mexican/Mexican-American students and White students in their peer group in community college are particularly striking, as shown in data from National Assessment of Educational Progress (National Center for Education Statistics, 2011).
Figure 2. Students with Associate’s degrees in the U.S. This figure shows the percentage of associate’s degrees conferred by each group (U.S. Department of Education, 2011).

**Achievement Gap vs Validity Gap vs. Opportunity Gap**

The concept of an achievement gap (Williams, 2011) is to point to the deficiencies in student proficiency, preparation, background, culture, etc. Critical theorists, however, highlight different perspectives on the systemic inequities and criteria for measuring academic achievement. Some assessment experts describe the disparities in achievement as a validity gap (Nichols & Berliner, 2008a). This concept refers to how some groups’ results are more ecologically valid than the results from other groups, due to the way standardized tests, used to define “achievement”, are constructed (Figueroa & Valdes, 1994; Krashen & Lee, 2005). Others have described an opportunity gap as a systemic inequity where low-income students, students of color, and English language learners often do not have the same access as others to highly
qualified teachers, high-quality curriculum, and well-resourced classrooms (Darling-Hammond, 2010).

In today’s U.S. classrooms, there are students from different countries, cultures, and ethnicities in the same classroom, with unequal experiences and practices. Furthermore, critical researchers point to studies (e.g., Berliner, 2010, Krashen & Lee, 2005) indicating that there is no one standardized test instrument for all that could cover these divergent experiences and practices of all students. These studies provide empirical evidence of the ways in which traditional testing and assessment practices frequently lead to life-changing outcomes with high-stakes consequences that are not fair for all students. Additionally, there is a growing literature suggesting that the unintended consequences of high-stakes tests can be damaging to the short- and long-term educational prospects of students from immigrant, non-mainstream backgrounds (e.g., Berliner, 2010).

Recent years have seen increased attention to students’ transition between high school and college. According to Porter and Polikoff (2012) there are increasing numbers of non-mainstream students enrolling in college as well as an increasing number of students taking remedial courses. For decades the most important components to determine college readiness have been reading, writing and mathematics. However, mathematics has been identified as the most challenging component for students in general as well as the major predictor of college readiness (Sriraman & Steinthorsdottir, 2007). Further research is needed to develop insights into the challenges and opportunities posed by the disparities in achievement in K-16 mathematics for practitioners and policymakers. In many respects, mathematics has become part of the language of power in the public policy arena; thus, underachievement in mathematics may result in de facto disenfranchisement (Cobb & Mc Clain, 2006).
Schooling has been seen as one example of the reproduction of the social structure. Bourdieu (cited by Mills, 2008) identified schools as places where social, economic and cultural inequalities are enacted. Some authors have specifically identified mathematics instruction and assessment as a school-based tool for reproducing society (Harding 1991; Hrabowski, 2003). For example, Spielhagen (2006) argues that eighth-grade algebra plays a pivotal role, acting as a gatekeeper for more advanced courses in both mathematics and science, and as one of the major components of standardized tests used to determine readiness for college. According to Sriraman and Steinthorsdottir (2007) the calculus sequence has been an expedient component in order to filter out students unable to fulfill program pre-requisites. However, the “sorting and filtering” of students (e.g., Oakes, 2008) can have devastating effects on individuals, their families and their communities. Critical educators (e.g., Harding, 1991) have described the ways in which science, technology, engineering and mathematics have been “frequently used not just for the benefit of the few but also for the direct oppression and exploitation of the many” (p. 35).

**Deficit Approach and the Status Quo**

The below average performance in mathematics of Mexican/Mexican-American students in U.S. public education institutions is a critical issue, and further research is needed on this topic. For decades deficit approaches in educational research (e.g., Smith, 2012; Valencia, 1997) have dominated the discourse on educational achievement, arguing a genetic pathology model to explain disparities among diverse student populations. This model finds its roots in the hereditarian notion of genetically determined intelligence. According to Smith (2012) the model of deficit thinking seeks to make the case for an innate basis that favors Whites over certain ethnic minority groups such as Blacks and Mexican Americans. However, numerous researchers (e.g. Brown-Jeffy, 2009; Comber and Nixon, 2009) have studied pervasive inequities both inside
and outside the school system to explain the differences in test score achievement among various populations.

Relatively few researchers (e.g., Flintoff & Webb, 2012; Molesworth, 2004) have attempted to venture into the students’ lived experience, to seek new understandings and alternative meanings that will emerge. This grounded theory study builds on this emerging body of research, describing the experiences and perceptions of a group of Mexican/Mexican-American postsecondary students in the U.S. public education system to develop new knowledge and insights about their lived experience in K-16 mathematics education in U.S. schools.

**Purpose of the Study**

The purpose of this study is to investigate Mexican/Mexican-American postsecondary students’ perceptions and experiences of mathematics instruction in U.S. formal education (K-16). Students who are in transition from community college to a four-year university (especially those who completed high school recently) served as critical informants, describing the challenges and providing new perspectives on mathematics achievement disparities from a distinct point of view. Framed by critical race theory (CRT) and using a grounded theory (GT) approach, this inquiry was conceptualized within the framework of the literature on academic disparities in achievement in mathematics between Mexican-American students and White-American students, students’ perceptions, and students’ experiences. This investigation considers how students’ perceptions and experiences as learners have affected their academic achievement in mathematics education in the United States. The students come from a different culture, with unique cultural and linguistic assets, and face different challenges when studying mathematics, for instance, the language as well as mathematics by itself. Using a grounded theory study approach, the study aimed to generate new understandings of these students’ perceptions and
experiences. Data collection strategies included participant informal interviews, participant questionnaires, and field notes. This study presents a view of K-16 schooling from the perspectives of Mexican/Mexican-American post-secondary students, in process of transferring to a 4-year university and it serves as an instrument to amplify their voices and add invaluable insight into Mexican/Mexican-American postsecondary students’ perceptions and experiences as learners of mathematics in U.S. K-16 schools.

**Rationale of the Study**

The information gathered through this inquiry attempts to provide new information and generate new understandings that will add to the literature in the field of mathematics education in multicultural contexts. This investigation explores the potential for new knowledge generated from the voices of Mexican/Mexican-American postsecondary students’ perceptions and experiences as learners of mathematics. The information from this study aims to provide meaningful insights and to generate new insights about the balances of the environment inside of the classroom (Adler & Davis, 2006) including the teacher-student relationship; the student-student relationship; and the student-content relationship, as well as outside of school.

This study is limited to Mexican/Mexican-American community college students who are currently and/or have transferred recently to a four-year U.S. university. Since I am a Mexican doctoral student who has faced different challenges in the U.S. higher education system from those faced by White-American students, my own lived experience in both the Mexican and the U.S. public education systems provides background on this issue of critical importance to educational researchers in both Mexico and the U.S. With large and growing numbers of immigrant students in the U.S. K-16 education system, practitioners and researchers alike need to have deeper knowledge about social practices related with culture, ethnicity, and language that
serve as advantages for certain groups of people as well as disadvantages for others. Even though numerous studies have been conducted on disparities in achievement in mathematics between Mexican-American students and White-American students (e.g., Lee, 2004; Simms, 2012), further research is needed about Mexican/Mexican-American postsecondary students’ reflections on their lived experience as participants in the U.S. public schooling system.

Research Question

This study is initially guided by one primary research question:

How do Mexican/Mexican-American postsecondary students describe their experience and perceptions in K-16 mathematics education, particularly in U.S. high school?

I anticipated the development of a number of sub-questions during the data collection and analysis phases, as described by the general principles of grounded theory methods since this method requires continually analysis and new questions emerged from constant comparative method of analysis (Charmaz, 2012). The sub-questions that emerged from the data are the following:

- What kinds of mathematics instruction have Mexican/Mexican-American postsecondary students experienced on the U.S.-Mexico border?
- How do these students describe their perspectives about mathematics?
- What are the pedagogical practices in mathematics that have been institutionalized as components of the explicit or implicit (i.e., hidden) curriculum?
- How have these students resisted unsuccessful teaching strategies?
- What new knowledge can be gleaned from these students’ recommendations for transformative processes?
Researcher Role

In qualitative inquiry, the researcher is typically the main instrument in collecting data and analyzing the material that will be gathered (Merriam, 2002). In the case of this research project, my role as researcher was critical in the process. According to Martin and Siry (2009), positionality or researcher role refers to “how one is situated through the intersection of power and the politics of gender, race, class, sexuality, ethnicity, culture, language, and many other social registers that shape who we are” (p. 955). The researcher has the ability and the flexibility to modify any aspect of the investigation to fit the situation and explore circumstances and various components as they came into play. It is essential in a qualitative study that the researcher be immersed in each component as the study is carried out. During the process of the in-depth interviews the researcher decides the pace and the most appropriate questions according to the answers of the participants. Throughout the manuscript my voice is woven into the narrative, speaking in first person since this is a grounded theory study and this style of narration allows the researcher to reflect critically upon their personal and professional experiences. In this study, with informed consent from the participants, I also have included comments about participants’ thoughts, beliefs, experiences, perspectives, personal histories, and memories.

I am a Mexican male doctoral student, enrolled in a U.S. public institution of higher education. All of my schooling was in Mexico before study for a the Ph. D. in the U.S. My first language is Spanish, and I was born in Mexico. When I decided to enroll in a doctoral program in the United States, I faced many challenges such as the experience of two different school systems (Mexico and U.S) and two different languages (Spanish and English). While I was not a community college student in the U.S., nor a transfer student at the undergraduate level in a teacher preparation program of study (like the participants in this study), the experiences
described (above here) helped me connect with participants’ background, culture, and lived experiences.

**Definition of Terms**

For the purposes of this study, some of the terms have to be clearly defined because these terms are used with different meaning by some authors. Some of these terms can be ambiguous; therefore, it is important to understand that the following definitions of terms are used in the context of this project as defined here.

**College readiness**

College readiness is defined as a demonstration of students’ preparedness to participate in college-level coursework by obtaining a passing score in the American College Testing (ACT), Scholastic Assessment Test (SAT) reasoning test; in Texas, these college readiness scores are derived from results on statewide standardized assessments (e.g., Texas Higher Education Assessment (THEA), Texas Essential Knowledge and Skills (TEKS), or Texas Assessment of Knowledge and Skills (TAKS) (Porter & Polikoff, 2012).

**Latino**

This term refers to Americans with origins in the countries of Latin America such as Mexico, Cuba, Colombia, Puerto Rico and Salvador. (Martinez, 2006)

**Mexican-American students**

In this study, this term is used to signify students who (1) were born in the United States, (2) have Mexican origins (i.e., parents or grandparents), (3) self-identify as having Spanish as their first language, (4) have had some of their schooling in the United States, (5) are (or were) college students in the United States, and (6) live in the United States.

**Remedial courses**

15
Remedial courses consist of those courses and support services provided to individuals who face significant deficiencies in foundational subjects (Bahr, 2010).

Structural barriers

Structural barriers are defined as social constructs that serve as obstacles to students in their formal education through K-16 (Castro-Salazar & Bagley, 2010).

Organization of the Study

This study is presented in a five-chapter organization format. The first chapter provides a general overview of the dissertation, the foundation and statement of the problem, the purpose of the study, the rationale of the study, researcher role, assumptions and limitations, and the definitions of terms that will be used throughout the study. Chapter 2 reviews relevant literature and provides theoretical background for the study. The methodology is discussed in Chapter 3 with information about the research design, theoretical framework, context of the study, sampling design and criteria, recruitment of the participants, the data collection procedures, and the processes for analysis of the data. Chapter 4 presents the data collected (i.e., student stories) in an attempt to capture the experiences of each participant. In addition, this chapter includes data analysis procedures and findings (the codes, conceptual themes and categories that emerged from the study). Finally, a discussion of the findings is presented in Chapter 5. The final chapter also includes a discussion about the implications for research and practice and recommendations for further research.
Chapter Two

Literature Review

This chapter discusses key bodies of literature that shape and inform current knowledge and understanding about the disparities in mathematics achievement that have characterized Mexican/Mexican-American postsecondary student outcomes in the U.S. public school system, including definitions and discussions of diverse perspectives on these disparities, described variously as the achievement gap, the validity gap (Figueroa & Valdes, 1994) and the opportunity gap (Bol, & Berry III, 2005; Flores, 2007). The purpose of this study was to investigate Mexican/Mexican-American postsecondary students’ perceptions and experiences of mathematics instruction in U.S. formal education (K-16). Thus, this chapter includes a review of research on key factors that have been identified as causes or factors contributing to the continuing disparities in mathematics achievement, focusing on: a) structural barriers faced by diverse students in U.S. public schools (e.g., Apple, 2007); b) studies on student responses to power and privilege (e.g., Rubie-Davies, 2010), and c) findings on institutional responsiveness to this educational issue (e.g., Bahr, 2008). Additional sections of the literature review will provide an overview of critical race theory as a framework (e.g., Hylton, 2012) appropriate for further examination of the critical issues relevant to achievement disparities (e.g., Brown-Jeffy, 2009).

Studies of Achievement Disparities in Mathematics

Underrepresented students in U.S. schools: Achievement gap, opportunity gap or validity gap? Numerous scholars (e.g., Bae, Holloway, Jin, & Bempechat, 2008; Mathews, 2005) assert that even though Latino achievement has improved over the past several decades, Latino students continue to achieve at rates lower than White-American and African-American students in the U.S. public school system and are underrepresented in most areas of higher
education. This issue is better known as the achievement gap. Brown-Jeffy (2009) states that school racial composition is associated with the achievement gap.

**Deconstructing the achievement gap.** The achievement gap has been seen as an issue of concern to educators; however, it is critical to look at its contextual background, including the factors and specific circumstances under which these disparities in achievement outcomes appear. For example, in the United States there are students from diverse nations, with different customs, traditions, and educational practices. In order to teach these students according to the most current research on effective learning, schools must be cognizant of their prior knowledge, learning potential and needs; school programs, administrators and teachers must affirm and understand their background and their prior experiences (González, Moll, & Amanti, 2005; Kafai, 2006; Koedinger, & Corbett, 2006).

**Opportunity Gap.** Current research into this critical issue (e.g. Flores, 2007) explains the achievement gap as a manifestation of an underlying cause -- the opportunity gap. Darling-Hammond (2010) identifies an “opportunity gap” that has evolved as new kinds of learning have become necessary -- a gap where low-income students, students of color, and English language learners often do not have the same access as others to highly qualified teachers, high-quality curriculum, and well-resourced classrooms. Schools in diverse U.S. communities have access to critical resources such as teacher quality, high quality pedagogical materials, technological tools, scholarships, etc. (Darling-Hammond, 2010; Kozol, 1991, 2005). Critical theorists describe differential access to these resources as an opportunity gap (Bol & Berry III, 2005).

**Validity Gap.** The achievement gap has also been deconstructed by critical theorists (e.g., Figueroa & Valdes, 1994; Nichols & Berliner, 2008b) and redefined as a validity gap. The notion of a validity gap refers to how some groups’ test score results are more ecologically valid than
the results from other groups, because of the contested notion of an equal playing field in the
construction of achievement in tests (Biddle & Berliner, 2002).

Bol & Berry III (2005) affirm that “though various reform efforts for mathematics have
been implemented in our public schools, disparities in achievement still exist between White
students and African American, Hispanic, and Native American students with respect to higher
level mathematics coursework” (p. 32). Disparities in mathematics achievement are evident in
assessment scores as well as in course enrollment patterns. These issues have been redefined by
critical scholars (e.g., Biddle & Berliner, 2002; Flores, 2007) as a validity gap (Nichols &
Berliner, 2008a), and opportunity gap (Darling-Hammond, 2010), as well as other terms that go
beyond the current discussions of persistent achievement gaps that characterize non-White
children in U.S. schools.

The disparities in achievement become evident in school beginning as early as
kindergarten. In fact, the achievement differences grow as topics increase in complexity.
According to Simms (2012) the explanatory power of race and socioeconomic status (SES) are
perhaps the two most common variables considered in educational research related with the
achievement gap. Although there are studies examining the achievement gap, opportunity gap,
and the validity gap (e.g., Lee, 2004; Mathews, 2005), there is little research discussing how
these disparities are shaped by the insiders’ perspective; in this study the focus is on
Mexican/Mexican-American college students transferred from community college. While some
scholars (Green, 2006; Rousseau, & Tate, 2003; Spielhagen, 2006) have pointed out that
underlying causes seem to stem from inequities of opportunities such as less access to well
qualified and experienced teachers, less access to high teacher expectations, and less funding per
student in schools, it is crucial to hear Mexican/Mexican-American community college students’
perspectives on the K-16 mathematics disparities in achievement to develop a deeper understanding of the complex factors underlying this critical issue.

The sections that follow here provide an overview of key factors that have been identified by previous scholars (Apple, 2007; Bahr, 2010; Rubie-Davies, 2010) as causes for the disparities in achievement in mathematics in U.S. public schools. These factors are: structural barriers, student responses to power and privilege, and institutional responsiveness.

**Structural barriers.** A number of studies (e.g., Campa, 2010; Castro-Salazar, & Bagley, 2010) describe the navigation across and between historical, socioeconomic, political and cultural boundaries, barriers and contexts faced by Mexican/Mexican-American K-16 students in U.S. schools and how these students make use of some strategies to succeed academically. Some scholars (e.g., Apple, 2007; Brighouse, 2009) have also discussed the process of educational failure and how it can occur in the context of overt and more subtle forms of racism experienced throughout these students’ schooling and everyday lives.

**Tracking.** It is common to see a visible majority of ´ethnic minority students´ across K-16 education who too often find themselves, not coincidentally, beginning their postsecondary education experience in two-year college literacy and mathematics remediation courses. A critical reexamination of the assessment and placement mechanisms reveal systemic practices that are used to track students into remedial coursework throughout the K-12 years and into college that potentially work against nontraditional students´ access to and success in the opportunity structures of higher education (Salas, Portes, D´Amico, & Rios-Aguilar, 2011).

**Hidden curriculum.** Several critical scholars (e.g., Apple, 2004; Giroux, 2006) have described a hidden curriculum based on the concept of hegemony that shapes the school in many aspects. Margolis (2001) defines hegemony as intentionally produced forms of subordination and
discrimination that benefit some at the expense of others. Thus the school is reproducing society where children of different economic classes receive very different types of education. According to Anyon’s classic (1980) study there is a connection between the social class, ethnicity and race of the students, the types of education they receive in school, and the types of job opportunities that will be available to them.

**Student responses to power and privilege.** Unequal conditions in schools as well as teacher expectations, learning environment, self-concept, peers, and parental influences may result in changes in student attitudes towards learning. In addition, there are studies that concluded that attitudes decline in higher grades, even more in postsecondary education in response to structures of power and privilege (Haladyna & Thomas, 1979; Morrell & Lederman, 2010). Students’ attitudes can shape their performance in school, therefore it is important to pay attention to this relevant issue.

**Unequal social power influence.** For example, studies have identified that Mexican/Mexican-American students may have developed negative school attitudes resulting from a high-unequal social power influence (USPI) environment during the K-12 years (Vazquez, & Garcia-Vazquez, 1998). USPI refers to a system where there is a majority group with power and privilege, based on race, socioeconomic status, gender, etc. An equal social power influence, in the school example cited above here, would be a system with equal or higher percentage of Mexican-Americans in the environment as leaders (e.g., teachers, administrators, counselors) compared with the Whites. A number of studies have also examined the learning beliefs of high and low achieving, low-income Mexican-American students (Bae, Holloway, Jin, & Bempechat, 2008). Findings suggest that these students’ perceptions about what it means to be a good student differentiated the low-achievers from the high-achievers.
Teachers’ expectations. In addition, teacher expectations affect student attitudes towards school as well as performance. The research on teacher expectations (e.g., Rubie-Davies, 2010) demonstrates that the way teachers perceive their students and make instructional decisions and judgments about their future potential for achievement in the classroom have a significant effect on students’ school performance (Babad, & Taylor, 1992). This body of literature suggests a relation between teacher expectation and student attitudes and achievement.

Hrabowski (2003) affirms that educators can contribute to minority students' academic and personal success simply by communicating high expectations. Kelly (2002) also recommends include creating a mixed set of expectations for all students in order to significantly reduce the participation inequity together. Many times what students need is to be treated all as equals; in other words, people must have the same expectations for them.

Institutional responses. A number of educational institutions across the U.S. have created and sustained programs and policies in response to achievement disparities. The short- and long-term effects of these programs have been extensively studied (e.g., Bahr, 2008, 2010; Ramos-Sanchez, & Atkinson, 2009), yet policymakers and practitioners agree that further research is needed. Two of these institutional responses are remedial coursework and counseling.

Remedial coursework. Remedial coursework has been provided to individuals in the school system that face significant deficiencies in foundational subjects. In U.S. public education at every level (K-16), low achieving students are tracked into lower level classes in an attempt to enable students to move forward, ostensibly providing them with the same opportunities for advancement as their peers (Bahr, 2008). The stated goal is that historically disadvantaged students will benefit from these programs, and attain a level of proficiency in core subjects comparable with their peers. However, this is not happening in reality (Bahr, 2010). Parsad,
Lewis, & Greene (cited by Bahr, 2010) found that “rates of successful remediation in math -- the subject in which the greatest number of students require assistance -- differ substantially by race. Groups that tend to be disadvantaged in math achievement generally, namely Blacks and Hispanics, also experience low rates of successful remediation” (p. 210).

This institutional response sometimes described as “tracking” (e.g., Oakes, 2008) has been researched extensively (e.g., Ansalone & Biafora, 2004; Watanabe, 2007) and critiqued because low-track classes are composed primarily of low-income students, usually minorities, and upper-track classes are usually composed of students from socioeconomically successful groups. In addition, curricula of high-track courses are much more intensive and in-depth than those of low-track courses, as would be expected. Therefore, tracking rather than being a solution may be an educational barrier for achievement (Bahr, 2008).

**Counseling.** Throughout the entire K-16 education system, counseling is another important institutional response to issues faced by Mexican/Mexican-American students in schools. A number of studies (e.g., Ramos-Sanchez & Atkinson, 2009; Saracho & Martínez-Hancock, 2007) have examined the relationships between acculturation, cultural values, gender, and help-seeking intentions among Mexican-American students. Findings suggest that as Mexican-Americans lose their culture of origin and increase their generational status their attitudes toward seeking help become less favorable. Studies (e.g., Bodenhorn, Wolfe, & Airen, 2010) suggest school counselors with higher self-efficacy are more aware of validity gap data, and school counselors who indicate a program approach and high self-efficacy are more likely to report narrowing achievement disparities. Additionally, culturally responsive effective counseling programs are scarce, and further research is needed. Effective faculty and staff working with minority students think critically about the purposes of teaching and the values and
beliefs embedded in the profession and make thoughtful and theoretically sound choices about when it is appropriate to apply them, to modify them, or to throw them out (Rueda & Monzo, 2002).

Additional research examining the lived experience of community college transfer students, and careful qualitative research focused on the students' perspectives will allow us to more fully understand the complexities surrounding the disparities in achievement between Mexican-American and White-Americans (Bahr, 2008).

**Hispanic students and the mathematics classroom.** Historically engagement and performance success in mathematics have been challenging for students from all backgrounds (Harding, 1991). According to Hrabowski (2003) curriculum content, classroom strategies, didactic material, and teaching and learning theories, in spite of some changes over the years, have not been the most appropriate ones in order to, first, reach students’ engagement in mathematics and science, and second to ensure students’ achievement in these subjects. Additionally, but not less important, immigrant students have had to deal with language, culture and other factors that have directly impacted their academic performance in all disciplinary areas. The lack of attention to these factors has contributed to immigrant students’ discouragement while in school due to differences in culture and educational backgrounds. When schools neither recognize the unique assets and strengths these children bring with them, nor provide adequate support for these children as they are acquiring English as a second language skills, these students may be characterized as low achievers and tracked into low college/career pathways. As Siler, Stolzberg, Glatz, and Strang (1999) declare, school personnel often do not perceive that the educational strengths and needs of immigrant students differ significantly from the needs of other educationally disadvantaged students in their schools. Thus, the “one-size-fits-
all” approach to instruction, support, and assessment often leads to inaccurate results for immigrant students as well as for many other students.

**Funds of knowledge.** For mathematics, as well as in other fields, students’ previous knowledge, cultural resources and experiential connections with the content (often described as funds of knowledge) are essential in order to provide foundations upon which learners can construct their own knowledge (González, Moll, & Amanti, 2005). Hispanic children are not an exception. Hispanic children bring with them multiple social and cultural practices that allow them to navigate the content in totally different contexts. According to Lumpink and Strong (1995), successful instructional strategies for the integration of mathematics and sciences must be conducted through deep understanding of students’ cultural perspectives in order to promote both interaction and participation.

**Language.** Immigrant students bring their culture with them, including ways of knowing based on their linguistic, social, and cultural resources. In the U.S. educational system, language has played a determinant role in Hispanic students’ achievement. As Lerman (2001) establishes, the reality or otherwise of the world or the certainty of our knowledge of it are not the issues: the issue is that we receive all knowledge of the world through language and other forms of communication.

Recent studies demonstrate that the Hispanic student population in the United States comprises over 80 percent of the U.S. English Language Learner Population (Capraro, Capraro, Yetkiler, Rangel –Chavez, & Lewis, 2010). According to the Texas Education Agency Report (2010), Hispanic students’ performance in mathematics and science vary significantly not only from White students, but also from those who are classified as limited English proficient students (who took Spanish version on tests). In their study, Rivera, Stansfield, Scialdone, and Sharkey
(2000) state how mobility and limited English proficiency not only influence the level of participation in statewide assessments among immigrant students, but also the performance of those immigrant students who do take these tests. According to the Texas Education Agency Report (2010), statistics demonstrate the influence of language on students’ test score achievement in mathematics and science.

**Critical Race Theory**

Critical race theory (CRT) guided the grounded theory study because CRT is characterized by its ability to avoid the passive reproduction of established practices, knowledge and resources that make up the way types of research have been traditionally carried out. The one size fits all myth is demystified at the same time as contributions to new and emergent forms of knowing become valuable outcomes of developing CRT methodologies. A CRT approach has the potential to facilitate a challenge to mainstream epistemologies and, consequently, their agendas. According to Delgado Bernal (2002)

Today, bilingualism often continues to be seen as un-American and considered a deficit and an obstacle to learning. A Eurocentric epistemology that is based on White superiority, capitalism, and scientific theories of intelligence has provided the cornerstone of de jure and de facto segregated schooling for Mexicans and the historic and current devaluation of the Spanish Language. (p.112)

This epistemological orientation for generations has viewed Mexican/Mexican-Americans as culturally deficient and characterized them as ignorant, backward, unclean, unambitious, and abnormal.

Race, class, gender and their intersections have regularly been excluded from important social and political developments and landmarks in knowledge and dominant paradigms (Hylton,
As a result the use of voicing, storytelling and counter-storytelling have become popular tools in the expression of a CRT standpoint.

A critical race consciousness must invigorate key arenas of public policy (e.g., education, health, criminal justice) to disrupt the negative racial relations in our society. Education researchers can do this by recognizing that CRT is a pragmatic framework with great potential to transform perspectives. Numerous scholars (e.g., Solórzano & Delgado Bernal, 2001; Solórzano & Yosso, 2000) affirm that CRT in education can be defined as a framework that challenges the dominant discourse on race, gender, and class as they relate to education by examining how extant educational theory, policy, and practice have led to subordination of certain racial and ethnic groups.

CRT does not prescribe a predetermined set of methods or methodologies. However, there are clearly approaches that can facilitate CRT approaches such as grounded theory. CRT’s pragmatic politics ensure that no one methodology is privileged, dogma is challenged even amongst activist scholars. However, CRT by nature involves a measure of commitment to social justice and social change, and recognition that race and racism are central factors in the social order (Hylton, 2012).

With this in mind, the grounded theory research conducted in this study sought new understanding about the perceptions and experiences of Mexican/Mexican-American community college students as learners of mathematics. Critical Race Theory (CRT) was a guiding framework that provided an explanation of systemic issues and isolated race issues in a way that was highlighted by critical theories. The issues identified in this case were the disparities in achievement and several of the factors associated with it, specifically in relation to Mexican/Mexican-American postsecondary students. CRT’s major premise is that society is
fundamentally racially stratified and unequal, where power processes systematically
disenfranchise racially oppressed people (Hylton, 2012). CRT is not only a theory that
acknowledges social injustice and oppressive practices; it also helps to illustrate the relationship
between power and culture (Denson, Avery, & Schell, 2010). This critical perspective is an
instrument of critique and a framework for examining legal issues of political, economic, and
social inequality (Stovall, 2006).

CRT as an emerging field of inquiry has been used as a tool of critique and analysis in K-
20 education research. Those studies have changed the nature of education research and have
pointed out the urgent need for further research that critically interrogates race and racism in
education. Dixon & Rousseau (2005) proposed that CRT, a framework developed by legal
scholars, could be employed to examine the role of race and racism in education.

Several CRT scholars, (Hylton, 2012; Yosso, 2007) have established that traditional
approaches to critical policy studies were incomplete and required a more critical race focused
perspective related to equality in the public sector. Epistemologies are a result of social practices
where power is being exercised that can reinforce color-blind, race neutral, ahistorical, and
apolitical points of view.

Furthermore, class and gender theories contribute to CRT as they inform the nuances of
intersectionality. Intersectionality is one of the mechanisms used in CRT to emphasize that
though the starting point for CRT is race and racism, these theorists do not lose sight of the
complexities of the intersection of race with the constructed and identity related nature of other
forms of oppression such as sexism, classism, and other oppressions (Delgado-Bernal, 2002).
Intersectionality brings with it a challenge to CRT researchers in terms of how these complex
axes of oppression can be adequately conceptualized and incorporated into methodologies,
asking new questions that in many cases cannot be explored using conventional means (Hylton, 2012). These ideas reflect many of the realities of critical race theorists who aim to privilege voices ignored in research, to decolonize knowledge, and have found it necessary to engage in activist scholarship to transform these conditions.

I am personally and professionally committed to the study of Mexican/Mexican-American transfer community college students enrolled in a 4-year university college within a critical theory framework because critical race theory (CRT) provides a lens for viewing their lived experiences within the contexts of issues of power, privilege and social justice. Critical theorists examine ways that race, class, gender, the economy, education, religion, and sexual orientation interact to construct a social system (Barbatis, 2008). CRT has been commonly used as a framework for examining: racial inequities in education, pedagogy and practice, the schooling experiences of marginalized students of color, and the efficacy of race-conscious education policy. Studies of critical race scholars (e.g., Ladson-Billings, 2003; Sleeter & Delgado Bernal, 2002) have changed the nature of education research through the investigation of the theoretical and methodological significance of CRT and its role in as well as its links to education theory and practice specifically applied to studies of race and education. CRT also stresses the need for further research that critically interrogates race and racism in education (Lynn & Parker, 2006).

This study attempts to gain new insights about postsecondary students’ experiences and perceptions about U.S. mathematics education. Therefore, it is essential to have a better understanding of how issues related with power and justice are related to these experiences and perceptions.
Reflections on Reviewing Literature in Grounded Theory Research

Numerous scholars (Dey, 2007; Dick, 2007; Glaser & Strauss, 1967) have discussed diverse perspectives on the role and function of literature reviews in grounded theory research. Charmaz (2006) describes the objective of the literature review, to provide insight into ideas and research related to areas of exploration. Others, however, have stated that an extensive review of the literature is not necessary when conducting a grounded theory study because being immersed in the literature could bias the researcher during data analysis (Holton, 2007; Strauss & Corbin, 1990, 1998).

In this study, I attempted to seek middle ground between these divergent perspectives. Literature and research focused on underrepresented groups such as Mexican and Mexican-American postsecondary students as well as key factors identified as causes for disparities in mathematics achievement have informed my understanding of Mexican and Mexican-American postsecondary students’ positionalities in U.S. mathematics education. The knowledge I obtained from this review of the research influenced the development of interview questions, sampling decisions, and data analysis (Strauss & Corbin, 1990, 1998). Aware of the potential for bias as a result of this preliminary review of related literature, I re-visited the original research question, and expanded the pre-formulated topic with sub-questions that had emerged from the data (see Research question section in Chapter 1). Thus, in Chapter 4, I expand the literature review and present a discussion of some of the literature about Mexican/Mexican-American postsecondary students’ perspectives around mathematics education and the factors that affect postsecondary students’ performance in mathematics education in the United States that emerged from the data. I include this preliminary literature review as Chapter 2, section because the norms and traditions of higher education require that Ph.D. candidates demonstrate certain abilities including the
development of a literature review. Thus, although in this chapter the literature review is limited it will be expanded in further chapters. At later stages in the research process, concurrent with the data analysis phase, I reviewed additional literature that aided me in understanding some of the findings of this study and in generating new knowledge and insights about this phenomenon. Those themes/sub-themes will be introduced in Chapter 4.

Summary

This chapter has reviewed the most important literature that informs current knowledge and understanding about the disparities of achievement in mathematics, including definitions and debates of the achievement, the validity gap and the opportunity gap. A review of research on key factors that have been identified as causes or reasons for the continuing disparities in mathematics achievement was discussed, focusing on: a) structural barriers faced by diverse students in U.S. public schools; b) studies on student responses to power and privilege; and c) findings on institutional responsiveness to this educational issue. Furthermore, the chapter includes a discussion about Hispanic students in mathematics classroom. In the closing section, the chapter reviews critical race theory as a framework for alternative views on achievement disparities as well as critical race theory as a methodology.
Chapter Three

Methodology

This chapter describes the methodological design that was used to conduct this study. The purpose of this study was to investigate Mexican/Mexican-American postsecondary students’ perceptions and experiences of mathematics instruction in U.S. formal education (K-16), and the primary research question this study examined looked at how Mexican/Mexican-American postsecondary students describe their experience and perceptions in K-16 mathematics education, particularly in U.S. high school. In the first section of this chapter, the research design is explained and the rationale for selecting a qualitative methodology with a grounded theory approach is described in detail. The context of the study is explored in the next section, providing a description of the setting where the investigation was conducted. In addition, the characteristics of the participants are explicated in the next section. Data collection and data analysis are the next sections where the process of recruitment of participants and selection criteria are explained. In addition, sampling strategies, data collection techniques, and the data analysis process are outlined. The trustworthiness of this study and ethical considerations are also presented.

Research Design

There are several considerations to keep in mind in the process of deciding to select the qualitative methodological approach. According to Merriam (2002) qualitative studies are commonly used to understand any phenomenon more deeply. Qualitative research is an inquiry process in which the researcher explores a social or human phenomenon. Qualitative approaches are also used to gain new insights about issues already known or to gain new more in-depth knowledge that may be difficult to address with a quantitative approach. Qualitative studies typically require more time and attempt to go more in-depth than quantitative studies. This study
attempts to gain new perspectives about Mexican/Mexican-American postsecondary students’ disparities in achievement in test scores in mathematics in U.S. public schools, through careful qualitative research with postsecondary students transferring from community college to a four-year institution.

A qualitative research paradigm was chosen for this study because there is a need to deconstruct and redefine the achievement gap concept in mathematics education. The grounded theory approach is the research design that best fits to answer the queries of this research study. The term grounded theory derives from the fact that new theory arises from the data itself (Charmaz, 2006; Glaser, 1992). One of the main reasons grounded theory has been used frequently in qualitative research is the attention its exponents have given to addressing practicalities such as explaining the categories and their role in the analytic process, describing the meaning of grounded categories and their implications of its production, and presenting how grounding can be accomplished (Dey, 2007).

In this study, data were collected through an online-survey, field-notes, and in-depth interviews, each one of which played an important role in generating new insights implicit in the data. Since this study attempts to generate new knowledge about the perceptions of Mexican/Mexican American postsecondary students transferred from community college and grounded theory focuses on discovering new theory from data; the grounded theory approach was a good fit for this study.

**Theoretical Framework**

With critical race theory as framework, using grounded theory as approach, there is no one narrow methodological approach, nor a reductionist set of predetermined agendas embedded in the design of this study; that is, the methods and implementation of the study are just as
significant as its purpose. The discussion of critical race theory was foundational to the theoretical framework and provided further depth to the study; however it would be more accurate to describe it as praxis, given that CRT requires a lived activism. In this study, I was engaged as active participant, offering my help when the informants needed advice or wanted to confide in me about anything related with mathematics or technology -- even with any issue they felt comfortable to share with me. In addition, I was available for students through the semester in order to help them with any issue related to school. I offered myself as mentor and advisor for students. I mentored and advised them based on my own personal and professional lived experiences as a Mexican student enrolled in postsecondary education in the U.S.

Grounded theory provided a unique approach for capturing students’ perceptions and reflections about issues in mathematics education. Grounded theory is the tool that allowed me to gain new insights through theoretical sampling. Theoretical sampling is a deductive process of selectively sample new data doing constant comparisons (Charmaz, 2012). Thus, although this research had set out an initial research question, with pre-determined goals, such as developing a deeper understanding of Mexican/Mexican American postsecondary students experiences with and perceptions relating to about U.S. mathematics education, using grounded theory as strategy, I anticipated that new questions, new understandings and new theory could emerge from the data. Data analysis incorporated in-depth discussion of the intersections of race and equity issues associated with mathematics education.

Using a primarily qualitative approach and grounded theory methods, themes emerged from the data, rather than predetermining the categories and concepts. However, this process was time-intensive and labor-intensive. According to Kelle (2007) “Glaser and Strauss’s initial idea that categories would emerge from the data if researchers with sufficient theoretical
sensitivity would apply a technique of constant comparison was difficult to realize in practice” (p. 191).

Mexican/Mexican American transfer community college students who have been participants in the K-16 education system possess unique insights and knowledge that has rarely been heard. In order to gain a deeper understanding of the disparities in achievement the findings from this study potentially make a significant contribution to the literature on this topic, deepening our understanding of this phenomenon through investigation of the circumstances under which Mexican/Mexican American transfer community college students have progressed academically throughout the K-16 public education, from the student perspective (Green, 2006).

**Context of the Study**

This study involved in-depth qualitative inquiry with Mexican/Mexican-American transfer community college students who are currently enrolled in a southwestern university. These students had transferred to a research university from a community college that offers its students remedial courses to take, the number of students per classroom is typically smaller than in universities, teachers prioritize excellence in teaching, cost is lower than in other colleges, and has open enrollment. These Mexican/Mexican American transfer community college students are transitioning (or have recently transitioned) to a 4-year institution located in the same city, one of the largest binational communities in the world. An officially designated Hispanic Serving Institution (HSI), this southwestern university is home to a majority Hispanic student population, many of whom are among the first in their families to attend college. The southwestern university has a multicultural locale and long history of fostering diversity with more than 22,600 students enrolled. The university was founded in 1914, and has long been committed to providing access and excellence to those seeking a higher education. Today, this university
offers 75 bachelor degrees, 78 master degrees and 19 doctoral degrees. Furthermore, the university’s population reflects the demographics of the regional population. Currently, 54.9% of the southwestern university’s students are female and 45.1% are male. The race of the students is distributed as follows: 76.1% are Hispanic, 10.4% are White, 6.7% are Mexican National, 3% are Black, 1.9% are other international students, 1.3% are Asian-American students, 0.3% are unknown, and 0.2% are Native American (UTEP, 2012).

**Sampling Design**

This qualitative study uses a purposeful sampling design. The rationale for purposeful sampling rests on the notion that sample selection should be based on researcher’s knowledge and experience of the group to be sampled using clear criteria to guide the process (Gay, Mills, & Airasian, 2009). Purposeful sampling strategies are frequently used in qualitative studies to include information-rich cases that might be appropriate in terms of shedding light on a phenomenon of interest (Jones et al., 2006).

**Sampling Criteria**

The sampling criteria were developed to find participants who could provide a deeper understanding of Mexican/Mexican American postsecondary students’ experiences in U.S. mathematics education. The participants were selected according to the following criteria:

1. Participants must be born in the United States or Mexico,
2. Participants must have Mexican family origins (1st or 2nd generation),
3. Participants’ first language (the language they first spoke at home as children) must be Spanish,
4. Participants should have experience in classes in community college in the United States in order to be able to share their thoughts about college and university,
(7) Participants should preferably be recently graduated from high school (2010, 2011 or 2012)

(8) At the time of the study participants should preferably be the first in their families to attend college.

In the final step, based on the on-line survey, the researcher purposefully selected a subgroup of five students -- based on the criteria explained before -- to participate in in-depth interviews.

The target population for this study was Mexican/Mexican-American transfer community college students who are transitioning to a 4-year institution (southwestern university), and plan to follow a career in teaching. This study was conducted at a southwestern university. This university provided three orientation sessions in the fall semester, two in November, and one in December for transfer community college students, who plan to enter to the southwestern university in the spring semester. In these orientation transfer sessions the students were introduced to the programs, facilities and commodities that the university offers to them. Those students, who plan to enter a career in teaching, are directed to the College of Education for one hour during each one of the Orientation events.

**Participant Recruitment**

The method of recruitment and selection of the participants consisted of the following steps:

Step One: In the first step, 15 minutes were allotted to me during the College of Education’s one-hour block of time at each of those orientation sessions to talk about technology in the college classroom. At the end of his presentation I invited the transfer students who were interested in learning more about technology to participate in two one-hour free interactive
technology sessions, designed to be useful and informative for new students, scheduled for future dates (December 10, 2012 and January 14, 2013). Students were informed that I was a doctoral student, and that information about this research study would be made available at these technology information sessions for those who would like to participate. The students who were interested in attending the free interactive technology sessions were asked to leave their contact information with me so that they could receive email invitations to the next technology sessions. Students understood that they could attend technology sessions without being obligated or pressured to participate in the study.

Step Two: In addition, one student who had already transferred into the College of Education heard about the study and indicated her interest in being part of the study as well. This student heard about the research in progress through word of mouth and talked to the researcher and since she met all the requirements to be part of the study, this student was included.

Step Three: To recruit additional participants I requested permission from the instructor of a selected undergraduate course (BED 4310. Teaching Mathematics in Dual Language Classrooms) during the summer semester. This class was selected because I had access to this population and the students were willing to participate. The class was taught in the evening from 5:30pm to 10:00pm, three days per week. There were more than twenty students in that class. Most of the students in that classroom were bilingual and spoke both English and Spanish.

Informed Consent

After inviting all the students to participate in the research project, I provided information about the research project and an overview of human subject participation, including privacy, confidentiality, time commitments, and other topics covered in the informed consent form (see Appendix B). I also provided a brief overview of the purpose of the study. Those who agreed
to participate were asked to fill out and signed an informed consent form. Students who volunteered to participate in the research knew that they had the right to withdraw with no penalty at any time.

**Data Collection**

The research design for this study was a grounded theory study with the purpose of discovering and generating new theory and fresh insights. According to Creswell (2012) the participants in grounded theory research studies engage in a process of inquiry in response to a particular phenomenon.

Data collection methods included an online survey (see Appendix A), administered to all students in the selected classroom as well as the other two students interested in participating in the study. The survey explored the demographics of the students and there were also questions related to the topic of the study and it helped me to make informed decisions about selection of the purposeful sample. After I reviewed data from the surveys of those students who had signed the informed consent form, I was prepared to select the purposeful sample. The other surveys were deleted.

Based on the online survey results, I purposefully selected a smaller subgroup of 5 students to participate in in-depth interviews based on the criteria previously explained. The students participated on these interviews from August – December (with additional optional meeting dates for member check). Creswell (2012) established that interviews should play the major role in the data collection in a grounded theory study. He also argued that researchers have to rely on interviews to best capture the experiences of the individual in their own words. I selected just five students because this number of participants allowed me to go deeper with them. These selected students met the criteria previously stated early in this chapter on the
participant’s section. The in-depth interviews (see Appendix C) provided a more focused, in-depth set of data for study and analysis. These students had already provided informed consent, and were informed about the time and logistics that the in-depth study requires.

Qualitative data were gathered through interviews and surveys asking the participants about their experiences in K-16 mathematics.

These data helped to build an understanding of the phenomenon studied (Creswell, 2012). In this study each participant participated in three sessions of in-depth interviews taking no longer than 50 minutes each. The interviews were audio recorded. I transcribed each one of the interviews as quickly as possible following each interview session. Once the interviews were transcribed, this information was analyzed line-by-line and sorted according to themes. Initial codes were assigned to the data. Later focused codes were assigned to data according to patterns that emerged from data. The process of data analysis was developed in-depth later on the data collection and data analysis section.

In the following section the data analysis procedures will be described with all the steps involved.

**Data Analysis**

In grounded theory, when analyzing data, the researcher asks himself/herself what occurs in the specific setting and what the lives of the participants are like (Charmaz, 2006). The goal of grounded theory is to develop a theory that has been grounded in data. Theory development begins with the coding of data (Charmaz, 2003). In this study, I attempted to find new insights about U.S. mathematics education through personal engagement with Mexican/Mexican-American transfer community college students’ to a 4-year university, who shared their experiences and perceptions about this topic.
Data analysis uses the constant comparative method because it constitutes the core of grounded theory (Glaser, 1978). This method consists of comparing conceptualized data on different levels of abstraction, and these comparisons contain deductive steps. Initial codes are compared with conceptual themes and theoretical themes in order to generate new conceptual ideas based on inductive and deductive analysis. Each phase of coding is compared with the previous one.

**Memo writing.** Grounded theory involves continually comparing one unit of data with another. The goal when implementing this theory is to derive meanings inductively from data based on comparative evidence. Glaser (1992) advocated that after each piece (in-depth interviews) of data collection the researcher take notes of the key themes. This is often referred to as “note-taking” (Charmaz, 2006, p. 75). Therefore, in this study three in-depth interviews were conducted with each participant. The interviews were a central component of the data collection strategies. I tape-recorded each in-depth interview, and during each interview, I took notes, seeking to uncover the key themes associated with the research topic. These field notes served as the first data to be coded. Moreover, I wrote early memos, keeping in mind that focusing on actions and processes regarding concepts in memos can assist in better understanding an emerging conceptual theme. Memos were written after each interview and during open and selective coding. I ensured that these memos were dated and written in an informal manner in order to record observations in the interviews and during transcription and data analysis. Each memo included a title as well as raw data as questions or comments in an effort to further define the codes being explored (Charmaz, 2006). Additionally, I wrote memos about constant comparisons made between data from the same participant at different points, codes with other codes, conceptual themes with other conceptual themes, and conceptual themes
with new data in order to further define the conceptual themes (Charmaz, 2006). Reading and sorting the memos informed the development of conceptual themes and the grounded theory (Strauss & Corbin, 1990, 1998).

**Open coding.** The memos also allowed me to analyze the data and codes early in the research process, conceptualizing all incidents in the data. During this stage, known as open coding, I was constantly comparing data, codes and modifying the growing theory, (Charmaz, 2006). Furthermore, I transcribed each interview as soon as possible. The transcriptions were coded line-by-line, word-by-word, and incident-by-incident. Coding for theoretical meaning contrasts grounded theory from mere sorting or sifting which is the usual purpose of qualitative coding (Charmaz, 2006; Gay, Mills, & Airasian, 2009). Coding in grounded theory aims at discovering what the theoretical meaning of data might be (Glaser, 1978). In this study, I was looking for codes associated with themes related to postsecondary students’ experiences and perceptions of U.S. mathematics education. For instance, they can be events that affect positively or negatively students’ perception of U.S. mathematics education.

**Focused coding.** In the next stage, I grouped collections of codes of similar content from notes and transcriptions; these groups were associated to concepts in order to generate categories. This process is also known as selective coding (Charmaz, 2006). At this stage, my efforts focused on trying to find a core variable or tentative core variable to explain students’ experiences and perceptions in relation to U.S. mathematics education. Subsequently, I wrote advanced memos describing how categories emerge from concepts. This process is better known as theoretical sampling. Theoretical sampling is the deductive part of grounded theory. It consists of obtaining data to explicate emerging categories (broad groups of similar concepts that are used
to generate a theory), advance the analysis of tentative categories and provide direction on where to go (Charmaz, 2006).

**Theoretical coding.** Finally, a collection of explanations or theoretical codes that helped to explain students’ perceptions and experiences in U.S. mathematics education emerged from categories. The theoretical codes should emerge from the process of constantly comparing data in early memos, advanced memos, field notes, transcriptions, codes, concepts, and categories. Theoretical coding consisted in relationships between categories.

**Axial coding.** In Grounded Theory this is the process of relating initial codes to categories or conceptual themes to each other using the constant comparative method and inductive and deductive thinking. The basic framework of generic relationships is understood, according to Strauss and Corbin (1990, 1998) who propose the use of a "coding paradigm", to include categories related to (1) the phenomenon under study, (2) the conditions related to that phenomenon (context conditions, intervening -structural- conditions or causal conditions), (3) the actions and interactional strategies directed at managing or handling the phenomenon and (4) the consequences of the actions/interactions related to the phenomenon.

**Identifying the core category.** The core category or constant comparative coding is the main point of a grounded theory, integrating all of that theory’s various aspects. This occurs during the process of selective coding through the exploration of the centrality of the story, the narrative rendering of the analysis, to the eventual development of the core or central category. In writing a story about the analysis, Strauss and Corbin (1998) advocated that researchers describe their “gut sense” about the subject matter of the research (p. 150). The story line is the final conceptualization of the core category, and as such, this “conceptual label” must fit the stories/data it represents (Strauss & Corbin, 1990, p. 121).
Ensuring trustworthiness and validity

According to Strauss & Corbin (1990) in grounded theory a greater emphasis must be placed on verbatim transcripts than other sources of data because they facilitate the development of a theory. Hence, once I finished with the manuscript, I sent a report by e-mail to each interviewee with a report for his or her review and approval to corroborate the content of the report. All changes recommended by the participants were made in the interview reports. Lincoln and Guba (1985) affirm this form of member checking is critical to establish the credibility of the research findings. Once member checking is finished, at the end of the study a letter will be sent by e-mail to each of the participants thanking them for the time each participant committed to this study.

Summary

This chapter provides a description of the methodological design that was used to conduct this study. At the beginning of the chapter, the research design was explained as well as the rationale for selecting a qualitative approach (grounded theory). The context of the study was explored in following section. Moreover, the characteristics of the participants were provided in the next section. In the next section, the process of recruitment of participants and criteria were described. At the end of the chapter an explanation of the data analysis process was provided in detail.
Chapter Four

Results

This chapter describes the analytical procedures that were used to report the findings of this study. The purpose of this study was to investigate Mexican/Mexican-American postsecondary students’ perceptions and experiences of mathematics instruction in U.S. formal education (K-16), and the primary research question this study examined looked at how Mexican/Mexican-American postsecondary students describe their experience and perceptions in K-16 mathematics education.

In the first section of this chapter, the processes used for gaining access and entry, and developing rapport with the participants is described. A brief profile of each one of the study participants is provided in the next section, providing a informants’ educational and family backgrounds. In addition, the characteristics of the participants are explicated in the next section. I also present a narrative of how I established rapport with the participants. Then, there is a description of the participant profiles. In addition, I provide the conceptual themes that emerged from this study. The conceptual themes are explained using thick description, which includes direct quotes from the participants. The conceptual themes emerged, and formed the foundation for a grounded theory of Mexican/Mexican-American postsecondary students’ experience and perceptions in U.S. K-16 mathematics education, particularly in college and university. Finally a visual model is presented, summarizing the new knowledge and insights that emerged from this grounded theory study.

Gaining Access and Entry: Developing Rapport

In a grounded theory qualitative study is important to develop good relationships with participants (Denzin & Lincoln, 2003). Veronica was the first participant to agree to participate
in the study. She was one of the students that attended one of the orientation sessions that UTEP offers to community college students where I gave a presentation about technology issues in the college classrooms. Veronica voiced her interest in attending the free interactive technology session that I offered, she made time in her schedule to participate in the data collection sessions, but she didn’t attend the technology sessions. Martha was a student working and studying in the college of education at the time of the study. She had heard about the research in progress, and sought me out to request an opportunity to participate in the study.

The other three participants were approached for the first time in one of their classes in the summer of 2013. I had invited an entire classroom (approximately 25 students) to participate in this study and since all students in that classroom agreed to participate, they all filled out the survey. Alejandra displayed an enthusiastic attitude towards the study raising her hand and saying that she really wanted to participate.

All the participants had no experience as informants in a research study. Therefore, most of them appeared to be nervous and told me that they did not know what to expect for those interviews. However, they also told me that they were excited because they felt important.

The Participants

All the participants were enrolled as full-time students at the southwestern university. None of them had children at that time. Table 1 provides a brief description of each participant. Pseudonyms were selected by the students and the researcher. Each participant was given the opportunity to check and provide feedback on her profile in order to ensure that the description was accurate and to obtain agreement on the content. The profile includes self-reported information collected in the surveys as well as data gathered during the interviews from memos and the interview itself. The language spoken in participants’ home is Spanish. Martha was the
only participant with both parents with college degrees. Veronica, Adriana, Elena, and Diana are first generation college students in their families.

Table 2. Participants’ demographic information.

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Ethnicity/Race</th>
<th>Language Spoken in home</th>
<th>Current residence</th>
<th>Mother’s level of education</th>
<th>Father’s level of education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veronica</td>
<td>20</td>
<td>Mexican-American/Latina</td>
<td>Spanish</td>
<td>U.S.</td>
<td>Some college</td>
<td>Associate’s degree</td>
</tr>
<tr>
<td>Martha</td>
<td>28</td>
<td>Mexican/Latina</td>
<td>Spanish</td>
<td>Mexico</td>
<td>Bachelor’s degree</td>
<td>Bachelor’s degree</td>
</tr>
<tr>
<td>Elena</td>
<td>22</td>
<td>Mexican-American/Latina</td>
<td>Spanish</td>
<td>Mexico</td>
<td>Elementary</td>
<td>Elementary</td>
</tr>
<tr>
<td>Delia</td>
<td>31</td>
<td>Mexican-American/Latina</td>
<td>Spanish</td>
<td>U.S.</td>
<td>High school</td>
<td>Don’t know</td>
</tr>
<tr>
<td>Adriana</td>
<td>32</td>
<td>Mexican-American/Hispanic</td>
<td>Spanish</td>
<td>U.S.</td>
<td>Some college</td>
<td>Bachelor’s degree</td>
</tr>
</tbody>
</table>

**Veronica.** Veronica was 20 years old, and was the youngest participant in this study. She was also a very confident student in the subject area of mathematics. Veronica was born in the U.S., then, she came back to Mexico and there she studied elementary school. Later, she came back to the United States when she was in 7th grade. She and one of her parents had been born in the United States; however, one of her parents was not born in the United States. The primary language spoken in her home was Spanish.

She came to the United States in the seventh grade to start her school education in Border City (a city in Texas in the border with Mexico). She attended high school in the United States and her grade point average (GPA) was 3.7. Veronica graduated from high school before 2010. During the data collection processes, I collected field notes, and I had the opportunity to observe her one time in one of her mathematics classes and I could identify her as one of the most
participative students. She showed a great level of knowledge of mathematics. I asked the college professor about her grades and he commented to me she was one of his most outstanding students at that time in his classes. Veronica’s grade point average provided evidence of her knowledge as well as her discipline. She identified herself as Mexican-American Latina and at the time of the study she was currently working as a math tutor. That information provided even further evidence of her sense of self-confidence about mathematics. Veronica also mentioned that she was very involved in church and that she loved helping people. Her dream was to be a missionary one day and help children to get their education.

When I asked Veronica about her parents’ level of education completed she shared with me that her mother had some college education and her father had an Associate’s degree. Veronica was enrolled as a full time student and she worked off campus 20 hours per week as a mathematics tutor. At the time of the study she was single and without children. She felt that Mexican/Mexican-American students in the U.S. do not have the same opportunities to succeed in schools. She had faced many challenges in her school experience as an English Second Language Learner, but her experience motivated her to select teaching as a career and she was enrolled in an education major. At the time of the study, she was about to graduate in Bilingual Education EC-6.

Martha. Martha was born in Ciudad Central (Ciudad Central is a city located in the South of Mexico), Mexico. She lived there for her first three years and she moved Ciudad Norte (Ciudad Norte is a city located in the Northeast of Mexico), Mexico for another three years. Then, Martha moved with her family to Ciudad Frontera (a city located in the North of Mexico) in Mexico. When she came to Ciudad Norte in Mexico she was about six years old. Martha started elementary in a public school; then, her parents changed her to a private school. The
private school offered English classes but they were about one hour a week. One of the stories that Martha shared with me was:

I remember being still in fourth grade and they would sing the ABC song and I would be like “oh, what’s the ending, I don’t know”. Since both of my parents… they do not speak English so it was a little annoying for me.

Martha studied high school in Mexico in her parents’ house. Both of her parents had Bachelors’ degrees, and they had decided to homeschool Martha since her completion of middle school. She completed all requirements and graduated from high school before 2010. She was classified in the U.S. education system as foreign born and she had obtained a student visa that permitted her to study in the U.S. Martha identified herself as Mexican Latina, and although she crossed the border daily to attend classes at the southwestern university, she did not live in the United States. She was 28 years old when the study was conducted and Martha was enrolled at the university to get her Bachelors in EC-6 in education at that time. She was enrolled as a full time student and was working on campus 40 hours per week. At the time of this study, Martha was also working in Ciudad Frontera at a Christian Mexican school located on the border with the United States.

Martha was the participant with whom I developed the closest rapport and most authentic relationship. In the first interview that we scheduled, she invited me to go to the Christian school where she was working at that time. I went to this Mexican school with her and after the interview she told me that her mother also worked there. Martha introduced me to her mother and after that she also introduced me to her brother who also worked there. Her mother worked as an elementary teacher and her brother as a music professor. Martha was single with no children at the time of the study. Martha told me that the primary language spoken in her home
was Spanish. Martha and I shared many commonalities that allowed us to have a close rapport and authentic relationship. We live in Mexico and cross the international bridge daily to study in the United States and we were enrolled in programs of study in education fields.

Elena. Elena was born in the United States; however, she lived in Ciudad Frontera in Mexico since birth. According to Elena she was born in a place called Maternidad. She mentioned that this place was not a hospital where you are born with the help of nurses. Actually, Elena said there were no doctors there, just nurses. Later I found out this place no longer existed.

She was 22 years old when the study was conducted. She was one of the two who seemed to be least comfortable in the interview. I told each participant to feel free to answer the questions in the language they feel most comfortable, English or Spanish before the interview started. She answered the questions with very short statements. I felt that Elena was very nervous. I also had the opportunity to observe her in one of her mathematics classes and I noted that her classroom behavior was also typical of a very shy person.

Elena graduated from a U.S. high school in 2010. She identified herself as Mexican-American Latina. In the university where she was studying, she was enrolled in an Association and that could potentially help her to get a job. Furthermore, she said that her enrollment in this association helped her to have something interesting in her resume.

She was born in the United States but her parents were not. Both of her parents, mother and father had completed up to the elementary level of education. She was enrolled as full time student. She was married at the time of the study, however she had no children. The primary language spoken in her home was Spanish. She stated that her experience in high school
mathematics was not great at all. She felt that all students in U.S. schools have the same opportunities to succeed in schools.

**Delia.** Delia was born and raised in the United States. She went to school in the United States. She told me that when she started college in 2000 she was planning to be a business major. However, she stopped out of college for ten years and then she decided to come back to study education. She felt at that moment that business was not her passion because she did not feel like she was going to be counting numbers. In addition, she had always liked teaching because she had had very good experiences with teachers in the past. Delia said,

> When I was little, I always had very good teachers. Miss Melendez… very good mentors. Like I had very good teachers and I always said I wanted to be a teacher, but you know? Your parents always push you up “Oh, ok, ok let’s open it for business” “Oh, be a business major” “Oh, ok. I want to be with my mom’s plans” And yeah, I worked and I figured “You know? I need to go back to school, but I didn’t want to” that wasn’t my passion, business.

So she came back to college and started all over again but this time, with a major in bilingual education.

She was 31 years old when the study was conducted. She attended high school in the United States and she graduated from high school before 2010. She identified herself as a Mexican-American Latina who lived in the United States. When I asked her about her parents’ highest level of schooling she told me that her mother had completed a high school level of education. Delia said she did not know the level of education of her father. At the time the study was conducted, she was enrolled as a full time student and she was working-off campus 34 hours per week. She was single at that time with no children. She was born in the United States but her
parents were not. The primary language spoken in her home was Spanish. She also affirmed that her experience in high school mathematics was not great.

**Adriana.** This student was born in Mexico, and later became a United States resident and moved to Border City, Texas. Adriana studied elementary school in Mexico. After she finished elementary school, she went on to study middle school in the United States and then she went back to Mexico to do her high school. Adriana also completed her first bachelor’s degree in Mexico and she finished it when she was 24 years old. After she finished her first bachelor’s degree in education she worked for six years in a school in Mexico as kindergarten teacher. At the time of the study she was studying her second bachelors degree in the United States. Having studied at the community college, she had already been awarded an Associate’s degree in Early Childhood. She was enrolled in the fast track program offered by the university. That means Adriana was taking her undergraduate classes with her graduate courses, and upon completion she will be awarded both the Bachelor’s and Master’s degrees together.

She was the oldest participant in this study, at 32 years of age, and was a highly confident student in the subject area of mathematics. She graduated from high school before 2010, and her educational background was typical of many transnational students on the border (i.e., elementary school in Mexico, middle school in the U.S., high school in Mexico, first Bachelors in Mexico and second Bachelors in the U.S.). She identified herself as Mexican-American Hispanic who lived in the United States. Her mother had some college level of education and her father had a bachelor’s degree. She was enrolled as a full time student while also working off campus 40 hours per week. Single and without children., Adriana had been born in Mexico and became a U.S. resident at the age of nine. The primary language spoken in her home was
Spanish. She stated that students in U.S. schools did not have the same opportunities to succeed in schools.

**Postsecondary Students’ Perceptions of K-16 Mathematics Education**

Of the forty-seven categories that emerged from the 215 initial codes, thirty-three addressed the research question of this grounded theory study. The categories were grouped in three core categories: *Our Voices*, *Our Resistance*, and *Transformative Processes: Changing the Equation*. The categories consisted of eight major themes and twenty-five subthemes (see Table 2), addressing the research question about postsecondary students’ perceptions of K-16 mathematics education in the U.S.-Mexico border.

Table 2. Categories and subcategories that emerged

<table>
<thead>
<tr>
<th>Our voices</th>
<th>Experiencing mathematics teaching instruction in the U.S.-Mexico border</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics education in the U.S.</td>
<td></td>
</tr>
<tr>
<td>Mathematics education in Mexico</td>
<td></td>
</tr>
<tr>
<td>Border crossers in the 21st century</td>
<td></td>
</tr>
<tr>
<td>Teacher preparation</td>
<td></td>
</tr>
<tr>
<td>Teaching is not only a job</td>
<td></td>
</tr>
<tr>
<td>Hindering a talent</td>
<td></td>
</tr>
<tr>
<td>Students’ perspectives about mathematics</td>
<td></td>
</tr>
<tr>
<td>I am good at mathematics</td>
<td></td>
</tr>
<tr>
<td>Learning geometry is hard</td>
<td></td>
</tr>
<tr>
<td>Working and studying make it even harder</td>
<td></td>
</tr>
<tr>
<td>Our resistance</td>
<td>Pedagogical practice in mathematics and the status quo</td>
</tr>
<tr>
<td>Learning by rote/memorizing</td>
<td></td>
</tr>
<tr>
<td>Teaching is teachers’ job</td>
<td></td>
</tr>
<tr>
<td>Mistakes are not allowed</td>
<td></td>
</tr>
<tr>
<td>Rushing the teaching process</td>
<td></td>
</tr>
<tr>
<td>Grading is not equal to understanding level</td>
<td></td>
</tr>
<tr>
<td>Resistance to unsuccessful teaching strategies</td>
<td></td>
</tr>
<tr>
<td>Behavioral problems</td>
<td></td>
</tr>
<tr>
<td>Singling out students</td>
<td></td>
</tr>
<tr>
<td>Big classrooms</td>
<td></td>
</tr>
<tr>
<td>Homeschooling</td>
<td></td>
</tr>
<tr>
<td>Succeeding in mathematics class</td>
<td></td>
</tr>
<tr>
<td>Relying in my previous knowledge</td>
<td></td>
</tr>
</tbody>
</table>
Support groups: My family, my peers and my cohort
Language and culture as assets
Transformative processes: changing the equation
Improving mathematics teaching
  Teaching interdisciplinary classes
  Changing individual to group teaching style
Mathematics as a second language
  Connecting mathematics with real life and previous knowledge
Demanding education quality
  Highlighting the importance of mathematics in life

Our voices.

*Experiencing Mathematics Instruction on the U.S.-Mexico Border.* The five participants in this grounded theory study went to school either in Mexico or in the United States, or both. Indeed, four out of five participants went to school in both Mexico and United States, moving back and forth across the systems. They shared different insights about their experiences in schools with me, especially in mathematics classrooms. In this section of the study, I attempt to relate the students’ voices in their own words, about the different education levels from elementary to middle school to high school to college to university. Some of the participants also provided narratives about their perceptions of education programs today, including comments on home schooling as an option.

*Mathematics education in the U.S.* The five participants attended school at one or more points in the K-16 continuum in the U.S. They are currently enrolled at the southwestern university located on the U.S.-Mexico border. Adriana affirmed that she did not like the methods used at the university level to teach mathematics classes. Her feeling was that the students did not do anything in classes. She commented that in university courses, students just memorize the book and they are tested every week. Adriana said:

The only one [class] I had, I remember the number, it was one before this. And we did a lot of mathematic but he didn’t give us like strategies. Like… he just [taught] math. He
didn’t [teach] like... I don’t know how to explain. We didn’t do anything. We just took the book. He gave us [a] test every week and that’s it.

Her disappointment as a student and as a future teacher was evident when she described the teaching practices in postsecondary classes. Adriana was expecting a different teaching method with more engaging activities and in a more fun way. She also commented:

It is strange here. I [do] not like agree with the method they use because they give you like the whole book. They separate in chapters. You have to present the chapter through the year and that´s your class. But you don’t have like real mathematics.

Adriana felt that mathematics was not easy for other people in that class because, according to her, the teacher did not teach anything. It seemed to her that the teacher assumed the students already knew. She asserted: “So he [the teacher] just gave us a bunch of homework and assignments and everything to do and… I knew how to do them but not the rest of the class”.

Delia’s narrative pointed out some similarities to what Adriana had said about teachers’ teaching styles. However, Delia’s comment was not about a specific teacher. Rather, she narrated a story about her brother – a freshman student – Delia stated:

It’s just like my little brother told me, he said. I know this is out of subject, but he told me that he had a science teacher in [his] freshman [year]. He didn’t understand [anything]. I don’t know how he passed the exam. He said “I passed. I did[n’t] get [anything]”. I was like “How boring!” And it was science [that] they were supposed to do, you know? Science is supposed to do experiments....

Adriana also explained that mathematics was easy for her because of her high school foundations in mathematics. She said that because she had studied high school in Mexico, she
already knew those concepts. However, she affirmed that other students struggled and she actually had to teach them.

One of her thoughts was that she would like to show U.S. teachers a different approach to teaching mathematics in schools with other strategies such as hands-on activities, rather than presenting in front of the class. Even though she thought there may be some value to teacher-centered presentations, she did not like that instructional approach and stated that it did not work for her.

*Mathematics education in Mexico.* In their narratives, the informants also shared some of their feelings and experiences related with their K-16 education experiences in Mexico. Some of them told me that mathematics education in Mexico was more advanced than in the United States. Furthermore, they said they had learned some things differently in Mexico. The participants commented that even the teaching strategies are different. Adriana shared with me an incredible story about her mathematics college experience. When she came to the U.S. to study the Associate’s degree at the community college, she was in a mathematics class but she realized that everything the teacher was teaching she already knew. Later, she just took a placement test and passed with a high score. That test helped her to bypass several mathematics classes that she did not need to take. Adriana affirmed:

I didn´t do math because at that time I [had] the opportunity to do like an exam. I paid five dollars and do the exam. And I was coming from [Ciudad Frontera] and of course I knew everything that was there. So I just took the exam and like… they [gave] me credit for that. For those classes that I had to take back then.

Veronica also had had a similar experience when she came to the United States as a youngster to study middle school. She told me that she was so advanced in mathematics classes
when she came to Border City, that she finished all the assignments more quickly than her classmates, causing her to misbehave and break school rules. Veronica stated:

I came to the U.S. in 7th grade and… I was telling my friend a couple of days ago this. I was so advanced in mathematics and everything that they taught me in Mexico, that when I came to the U.S. I started having… classes were so easy to me, like I would finish my work on time and I started having behavioral problems at my school.

Fortunately for her, some teachers identified her abilities and suggested that she join the mathematics club. This club allowed her to compete in mathematics at a local level. Veronica stated that:

Well, during middle school in seven[th] grade my teachers notice[d] my… that I was a little ahead because of everything that I learned in Mexico, so they made me join the math club and it was my first year there. I went to each competition and also in another city in Texas. And it kept going all through high school. So that was my experience outside of the classroom with math.

Veronica’s family eventually moved to River City and even there she continued participating in mathematics competitions.

Martha’s story had some additional insights to share related with K-16 education. She commented that her teacher [knew how to] identify her skill level because of her method of working on some operations. Martha pointed out that:

All my teachers were really nice to me particularly, um, but the only thing would be one of the teachers, she knew I was from Mexico and she just noticed I did things differently when it came to… I think it was division or something like that to be honest I don’t remember exactly.
**Border crossers in the 21st century.** One of the subcategories that emerged from the data analysis was relevance of acknowledging the growing presence of border crossers in the K-16 student population in the 21st century. The students that lived on the border in this study had unique opportunities. Sometimes, people who live in Mexico come to hospitals in the United States to give birth to their children in order to have children with U.S. and Mexican citizenship. This is based on the idea that children with dual nationality will have better opportunities in the future. When these children grow up and start their schooling either in Mexico or the U.S., they may go back and forth between Mexican and U.S. schools. Thus, for example, some border students may study elementary school in Mexico, then they can move to U.S. to study middle school or high school or even college.

Having these unique opportunities creates challenges and opportunities, and the participants shared their concern about how parents and teachers are preparing today’s multicultural, multiracial, multilingual current students for life. Adriana felt education has changed much through time. She was describing her ability with mathematics, however she felt there was a majority of students struggling with this subject area when she was in college. Adriana pointed out that:

Children [today] don’t know how to do things. They are very complicated; everything is hard for them for no reason. Because I think they didn’t let them think since early years. Don’t you think? Like they (teachers and parents) do everything for them. Therefore they don’t have reasoning [skills]. They don’t have to think so at the time they are going to school to do thinking, to practice their thinking skills they struggle with that. Because they don’t have to think. They don’t… parents don’t teach them how to think or how to resolve their problems. Daily problems.
She described herself as a very proactive person. She told me that in her house she has to do everything and she felt that is the way it should be.

*Teacher preparation.* These student informants, preparing for future careers as teachers, described a lack of teacher preparation in the schools they had attended. They felt that teachers were either not well trained or they were ill prepared for the different situations that arise in multicultural classrooms. The participants commented that teachers in U.S. K-16 classrooms have to learn more teaching strategies and methods of teaching. Elena stated, for example:

> I think it is very important to know strategies to help our students to learn math because it is not a very easy concept. I think in my own experience I had a lot of difficulties when I was in elementary school and… It is hard and when the teacher does not know how to explain [concepts to] you in the right way or he doesn’t know any strategies to use depending on what ways do you learn better.

*Teaching is not only a job.* One of the participants shared her concern about teachers who select this career because of the money. They would like to have teachers who see teaching as a commitment, not only a job. Informants want teachers who are willing to help students to learn. Veronica affirmed:

> I think a lot of teachers-especially middle school- just get… It’s so sad, they just get the license because that’s the high paying job right now. And it’s the high paying job and it’s needed in both fields, math and science in middle school. And I can see that in middle school. I can see a lot of teachers that didn’t even know math.

*Hindering a talent.* It was interesting to hear one of the participants sharing different perspectives about teachers’ responsibilities. Delia was concerned because teachers have great
responsibilities. Teachers, in her view, may be responsible for either promoting or impeding student potential and talent. Delia articulated:

What if the way I’m teaching, I’m hindering a talent? What if this student is, you know, [prevented from becoming] an engineer because I’m hindering his possibility and I’m not teaching the way he’s going to learn or she; he or she is going to learn. What if I’m hindering their possibilities of becoming, you know? What if I’m like…? I don’t know, I just… Teachers have so much responsibilities like if you think about it, we’re like. It’s a very important aspect. I think you have to be, we have to be, we have to be open. I think you just have to be open. They may fail, your lesson plan may fail, you have to have plan B, plan A. you can’t just. And what may work one year doesn’t mean that will work ten years after that because it’s not, you know? Everything changes. You just have to be open to change and with technology.

Students’ perspectives about mathematics. There were different feelings about mathematics instruction in the interviews that I conducted with the five participants. For instance, Elena described how her self-esteem was directly related with what she understood in class. She shared her story with excitement, describing her best experience in high school. Even though in the interview most of the time she described herself as lacking confidence about mathematics, in this section of the interview she seemed animated as she recounted this event. Elena affirmed:

I feel… I know as a student I think I was progressing but I still have thoughts about if I am really good at math. I am just like “I am not that good at math”. My best experience in high school was in my last year that I had to take that class and I felt pretty good because like… My self-esteem was getting higher. When in my 4 years in high school
was very low in math. So I really didn’t trust in my self in math and when I got in high
school in my basics, and all my math that I have to do I still had thoughts and I was
scared because I thought that I wasn’t good in math.

On the other hand, Adriana felt very comfortable and confident about mathematics,
however, she denoted disappointment when describing how she learned it. She commented:

I like math because I am good at. But not the way I learned it. I think there is more like
fun and… I don’t know, more strategies, hands-on activities that you can do with the
children. They are fun and they will learn it better. Not like the multiplications tables, oh
my god.

She also remembered when the teachers selected students to be in front in the classroom
and then the teachers asked them questions as the multiplication tables. Adriana stated: “I
remember I was embarrassed. But I am good at math so I never had any problems. But I know
most of the people do”.

In addition, Adriana said mathematics has been taught as a boring subject matter by many
teachers. On the other hand, Adriana commented that she felt some teachers liked mathematics,
and that’s their motivation for teaching it. However, these teachers sometimes assumed students
also liked mathematics and they did not make it fun because they felt it is already enjoyable just
because it is mathematics. According to Adriana the strategies to teach mathematics were not
appropriate. She pointed out: “I would like mathematics to be dynamic. Mathematics is boring. It
heats your brain. Teachers commonly like mathematics. And they guess everyone likes it. I am
good at it but I do not like it”.

Delia’s feelings about mathematics were very different. She said that she has always felt
nervous and lacking in confidence about mathematics. Delia stated that:
Mathematics has always made me nervous. I have had that fear because if you don’t get it you have like that fear. It is not phobia, I would say like a negative attitude. However, after the years it has been changed. The teacher has a lot influence in how they teach it. It depends in how a teacher teaches you. If a teacher is not precise in how he or she teaches it then the student will not learn. I think all of that is related with how the teacher learned it and how he or she teaches it to the students. Because we [students] are those who process the information.

Martha was also nervous the first time she got into a college math classroom. However, her fearful feeling was because she had been home-schooled, studying in her house since seventh grade. She was scared because it had been a long time since she was in a classroom studying with classmates. Martha commented: “the first year, I felt scared. Like the first math class I had, I was scared”.

Veronica described her feeling for mathematics as a great experience because she had good learning experiences with teachers. However, she recognized the importance of good experiences as learners. She felt that if a student had a bad experience then he or she might give up. Veronica stated:

I think the reason why I love teaching mathematics is because I had a great teacher in elementary school. And I think that mathematics teachers are essential in today’s society. Students are giving up on math because of bad experiences with their teachers. I personally, since I worked as a math tutor, I have to deal with a lot of older students that I have to… they are already in high school and I am also teaching them the multiplication tables and I always go to the root and it’s always because of a bad experience they had about the teacher in the past.
Furthermore, Veronica was shared one of her secrets in the interview. She was very confident about math and she did not hesitate to tell me that:

Since I love mathematics so much and I am going to be honest with you. I try to slack on my mathematics courses here in college just because everything is so easy for me and it comes so natural and I think that a lot of the things they are teaching me in the university I learned by trial and error at my job.

It seemed like her mathematics knowledge came from outside of school.

**I am good at mathematics.** Adriana felt her independent personality helped her to excel in school, especially in mathematics. She articulated:

I don’t know if I am outstanding because there were more intelligent students. However, my personality allowed me to excel. They were very intelligent but they didn’t go beyond that. I was always discussing in classes and I have always been in associations. I think that’s the combination. You don’t need to be very intelligent. Because if you are intelligent but you did not go beyond…

Talking about mathematics Adriana said:

What happens is that mathematics is… you can teach me something and it can be hard but I am very obstinate, I will be there until I get it. And I will get it. It does not matter if it is easy or hard.

Delia’s statements were somewhat similar. She said:

But you decide where, how you're going to…. Well, the teacher helps to solve the problem here “Blah, blah, blah. C square equals” But you, if you want to and I’ve found myself reading a book, a math book to find out more. Why this is half, you know? Why do we have to solve it this way? and “Why not the other way? Like, you know? And
sometimes I think that’s why every… we all have the inquisitive thinking… why things work. Some of us… we have to feel through it. We have, but I… for me, I like to know why this works. Especially when I got it wrong because everybody is like Why did I get it wrong? You know? That’s how you find out, but me… I’m very like… I always like to, I… I’m coming just curious! I have the curious… Why? Why this is work this way? Why not the other way and Why I can only? I mean I guess because I grew up with my mom. I grew up in a household whenever the TV didn’t work, we opened it up and fixed it.

Finally, Veronica also felt fortunate because of her personality. She stated:

I was a competitor and I was like yes I want to win and she was the one who started like… she would do like these flashcards that would be operations that you were doing in your head. You were doing in your head. At first everybody was really bad at it but at the end it was like… and I think that like motivated something in my brain for me to think everything. Like do number sense because before then I don’t remember myself being good in mathematics. After there that’s when I remember, that’s the moment that I remember that I love mathematics.

**Learning geometry is hard.** One thing that got my attention was the struggles that some of the participants had experienced with geometry. Different students mentioned this topic as their worst experience in mathematics. Elena stated:

And my worst experience was in geometry. I don’t know how I passed that class. I didn’t get anything and the teacher… she was not really worried about how I was doing. I don’t think she ever liked me and she never helped…. Like for example if I wasn’t understanding something she would tell me well, look at the book. You can see instructions in there and I was like ok, thank you. And she had these preferences to some
students and to students that were really understanding her class; she thought that we were saying that because we didn’t like her like we wanted to make her like (...) as a teacher. But in reality we didn’t understand anything and they were a few. And I didn’t know how did I pass that class.

Delia also commented about her experience with geometry. Delia, shared with me that her lowest grade in a mathematics class was in geometry. However, Delia felt it was because it had been a long time since she took geometry. Delia noted:

That was one of the lowest grades that I ever had; the geometry class. That one had to take for to get the teaching in our core. It was the geometry and concepts or something. It was part of our core or teaching core and she looked at me like “Hello?” It’s been a while since I’ve taken geometry in math.

Finally, Veronica was also struggling with geometry. Nonetheless, she said at the beginning it was a bad experience but later it became the best experience in mathematics.

Veronica stated:

I don’t know if it was the worst and then it became the best. Ah does that count? It was a very bad experience. It was a geometry class and the teacher was very strict and I am very outgoing, a very talkative person. And she… since I do everything in my head and I am always thinking in my head, she would always be like show your steps, show your steps. And the first six weeks that I was with her, actually I was close to failing in my geometry class.

Veronica commented that later in this class she learned to show her steps and that helped her to identify her mistakes. It became easy for her to solve problems in class.
Working and studying make it even harder. One of the participants pointed out the importance of colleges and universities to keep in mind the need for many students to work while they are studying. Many students today are also working, either part-time or full-time workers. Adriana shared her thoughts about this concern. She said:

He [the instructor] already knew we were exhausted. That class it was not about thinking but be seating there. The people who came from work were exhausted. Those are the bad experiences from university. The university thinks about the class but not about students’ needs. As a student you come to university to pass that class in order to graduate.

However, they must know it because they already passed through it.

Martha also commented about this issue. She argued that sometimes there is no time to follow all the steps without using a calculator because it takes more time. Martha stated:

I still don’t have the time to practice because I work full time or I do this. You’re asking me something that is impossible. Well, I’m like… You start getting familiar instead of like cheating with your phone and just like trying to do it over here.

Our resistance.

Pedagogical practice in mathematics and the status quo. One of the categories that emerged from data analysis was students’ resistance to pedagogical practices in mathematics, especially when these practices replicate the status quo. The informants pointed out specific elements of these traditional practices and beliefs about teaching. In this section I identified five subthemes: first, learning by rote/memorizing. Students shared their experience with teachers that used a strategy of learning by memorization. Second, teaching is a teachers’ job. Students argued that teaching is just teacher responsibility. Third, mistakes are not allowed in mathematics. There is a tendency to punish students because they made a mistake. Fourth,
rushing the teaching process. There is a need to go fast because teachers are preparing students for standardized tests. The last is grading is not equal to understanding level. There is a belief that students’ grades can measure what student learn or understand. However, grades are not necessarily telling that.

*Learning by rote/memorizing.* One traditional pedagogical practice that does not seem to be successful with the students was memorizing/repeating using rote methods. Adriana commented that she perceived memorizing as boring. She stated:

The way I learned mathematics was boring because I have to learn it by memory everything and… and now I think you can do it like more enjoyable. Like the multiplication tables, I had to write them thousand times each for homework. That’s for real.

Delia made a connection between standardized test and memorizing. She affirmed

You are actually building something or doing something with that formula and not just for me. I mean you supposed to learn from a chart and you have to memorize it because it is on the test, in the standardized test.

Martha had the same feeling about tests and memorization. However, she commented that she did, in fact, use this technique (memorization) in order to pass the tests. Martha stated:

I think I was studying and I was being taught for the test. My teacher said, this is going to be in the exam and I will write it down and I will put it in my notes. I would memorize that. It was just a short-term memorization. Like I already know I am going to have the test in two months or something and I need to memorize all that. I go home and then, I would try to put it like understand the concept like this is how you do it, this is step one… because math is more like that right? Like you do this and then that, and then that.
would put notes to myself. The day before the exam I would like not sleep and I would just go through my notes and get myself little… the same thing but with different numbers to know if I know the concept and all that. And then, when the test comes I am able to do it but it just because I am memorizing it not… may be not because I am understanding it.

*Teaching is the teacher’s job.* Adriana told her story about how her father refused to help her to do a mathematics assignment. Her father said it was her teacher’s obligation not his. Adriana also seemed convinced that teaching is just teachers’ responsibility. Adriana affirmed:

Because they (teachers) think you will learn or you will study for it. But that’s their job to teach you and not to… make you study. If you don’t learn it they have to re-teach. I remember one time, it wasn’t in math. But I remember one time… I don’t know which class was. I went to my dad and told him. I don’t know. I don’t know this. He told me, this is not my job. “That’s your teacher job”. But my teacher told me to ask you for help. That’s not my job. I know how to do it but that’s not my job.

In this scenario Adriana’s dad did not help her. However, in the next scenario, Martha’s father usually helps her. He actually gets excited when Martha asks him for help. However, Martha felt teaching is also responsibility of the teacher. Martha commented: “So if I don’t understand something, it’s his job to explain it to me, right?”

*Mistakes are not allowed.* Another pedagogical practice that was part of the status quo in this study was that mistakes are not allowed in mathematics. Elena was scared because she could be wrong. Some students think they can’t make mistakes in mathematics because they will be punished or simply singled out. When I asked Elena if she felt welcome in a mathematics classroom she established:
I do feel welcome but… I get blocked when it comes to… for example, in my class with Dr. S, when he asks questions to answer I don’t answer and when someone else answers, I was like eh, I got that answer. But I don’t say it because I am scared to be wrong and to be judged. Or if I am wrong I am going to be embarrassed in front of them.

Delia had a similar experience. First, she talked about mistakes from a student’s perspective. Delia stated: “Some of the professors are like “You don’t get it?” Like they make you look-feel like [you are] dumb, you know?” And later as a teacher Delia affirmed:

Sometimes as teachers in the school we view mistakes “You’re like… There is something wrong with you if you make mistakes” It’s ok to make mistakes in order to be. Everybody makes mistakes. It doesn’t make you any less of a person. It’s ok and sometimes that’s. I’ve seen that happened a lot of in schools that if you make a mistake “Wow, wrong” It’s like, it’s viewed like and I think that’s. I think that’s what happens to some of the kids. They get such a bad like it has to do with…

Martha narrated something similar. However, she did not care either what the teacher or the classmates thought. Martha articulated:

During classes I’ve seen people asking questions and teachers would be kind of upset because then they get the test and then they still having low grades, so they’re like “What’s the point of you asking so many questions? So the teacher is all get to know me because I’m the one asking questions and I am like “If you think I’m stupid, well I’m sorry”

Rushing the teaching process. Sometimes there seems to be no time for questions or different activities, because participants feel teachers are just preparing students for tests and there is a lot of content to cover. In her own experience, Martha as teacher noted that “And
sometimes I think we just go like really fast to everything”. Delia also agreed with that. She affirmed: “The teacher should be focused in her students. They have a curriculum that must be taught and it takes time.

*Grading is not equal to understanding level.* The participants in this grounded theory study agreed with the statement ‘grades do no reflect deep understanding’. Actually, the informants had a different opinion about the purposes of grading. Elena affirmed:

I have teachers that in their exams their purpose is not to help you with whatever information you have learned, it is to confuse you. So I think it depends. You can compare how you’ve done in class and not give all the credits to the exam because sometimes you can get nervous or… The teacher might not have a good perspective of how to do an exam. And instead of helping you it affects you.

Elena shared her concern about how a test can make you nervous and sometimes the teachers seem to want to confuse you.

There were other interesting stories narrated by the other informants. For instance, Martha said that sometimes she did not know how she passed the test because she did not feel she had learned the concepts. Martha reiterated this point: I was not understanding, but I passed.

So that’s how I know I passed my math classes. Just like memorizing facts and then putting it in the paper. This is the funny thing; people would look for me to teach them. Ok you got 10 in the first exam and then they want to know how you did it. And like I would be able to explain them the procedure like you do this and you do that and you do that and that would be helpful for me because I am now would just be like reinforcing what I’ve learned. But like I am saying it’s like… probably I was able to teach it two weeks after that, maybe a semester after that. Once the semester was over all that it’s
gone. Like I do not remember anything. Since it was like fresh in my brain, I was able to help others but now, like I am not sure if I can do it. I need to study again.

In addition, she had been witness to other students who were passing exams but they did not know the concepts. Martha commented:

Sometimes and I see that in my country, kids go to the next grade and the next grade and the next grade and they are passing the exam but it doesn’t mean that they know, and I am just the perfect example of that, like I’m passing the exams and with good grades, but it doesn’t mean the things that I was learning they are in my hard drive and are going to stay there.

Delia described a similar case. She said her brother told her he did not learn anything and he passed the exam. Delia argued: “It’s just like my little brother, he didn’t understand [anything]. I don’t know how he passed the exam. He said I passed, but I did get [anything]”.

Veronica had a different perspective because as a tutor she saw the improvement in her students. However, it is not reflected in their tests and grades. Veronica affirmed:

I’ve worked there as a freshmen in college and uhm… So I see a lot… and seeing my students at the tutoring place where I work at, a lot of the grades do not reflect the bigger advance they’re having. Like I see as we’re teaching them. So I think grades do not reflect understanding. Sometimes they can and they help the teacher as a type of assessment but I think it’s a… it’s more informal assessment to see were kids stand.

**Resistance to unsuccessful teaching strategies.** All the participants shared descriptions of bad teaching experiences with me. The informants perceived mathematics as a hard subject area, however, each student highlighted their experiences in K-16 classrooms where bad teaching was memorable. They felt that the teachers in those classrooms were more concerned with
singling out students than improving or changing teaching strategies when they were not working.

*Behavioral problems.* Some participants commented on students’ behavioral problems. They said there are some students who are advanced and are bored in mathematics classes because they finish first or they already know the lessons. Therefore, these students often exhibit disturbing behaviors in class.

Veronica was the only student who identified herself as a student with behavioral problems. She affirmed:

> I was so advanced in mathematics and everything that they taught me in Mexico, that when I came to the U.S. I started having… classes were so easy to me, like I would finish my work on time and I started having behavioral problems at my school. Just because they weren’t… since I was an ESL student, I was considered [an] ESL student, I couldn’t do like gifted and talented courses, and I couldn’t do like extra work. Like I had to do what my classroom was doing. So it was like I wasn’t challenged and that’s why one of math pick me up for the math club. Even though I do not understand a bit of English. This issue was relevant for me because even though she did not understand English at that time, she was an outstanding student in mathematics.

Martha also shared her experience with me. It was about a student who already knew the topics that they were seeing in the mathematics classroom. Martha pointed out:

> There are just some people that are gifted. They have that great mind for math that they don’t need to have that class to pass it. And then what they’re doing is just like… Making a mess in the classroom.
Singling out students. Another strategy used by teachers in mathematics classrooms, according to the participants of this study was singling out individual students in front of the class. When I asked Elena if she felt welcome in a mathematics classroom she said:

I do feel welcome but… I get blocked when it comes to… for example, in my class with Dr. S, when he asks questions to answer I don’t answer and when someone else answer[s] I was like eh, I got that answer. But I don’t say it because I am scared to be wrong and to be judged.

The students shared their feelings of fear of being singled out in public. In addition, when I asked Adriana about her worst experience in mathematics, she articulated:

Like when teachers like expose you in front of the class when you didn’t know things. Or when you don’t know things. Because many of… I don’t know if here but in [Ciudad Frontera] they used to do that. They actually do that. They like expose you if you don’t know.

Likewise, Martha described how students are afraid to be singled out in the classroom. They actually preferred not to ask questions and not get the concept rather than be singled out in front of the classroom. Martha stated:

No, I think you are just like blank and since they’re moving to the next thing. You kind of act like oh yeah I got it but you are like I have no clue of what they are saying. But since everybody got it and you don’t want to feel stupid, like oh, I don’t understand the concept, then you are like oh, yeah.

Big classrooms. The capacity of the classroom was other concern for one of the students. She told me that she felt the classrooms should have fewer students. When I asked her how many students were in her classroom, she said:
There were like 50 or 40. She (the teacher) had this arrangement in the class that the students that got A’s were seated in the front. Like we were divided in two parts and like these areas were… so it was like half and half.

_Homeschooling_. One of the unanticipated categories that emerged from data analysis was homeschooling. There was one student who did not go to either public or private school from 7\textsuperscript{th} grade until 12\textsuperscript{th} grade. Martha was homeschooled for almost five years. However, at first she did not seem to be different in any way from the other students who participated in this study. When I asked her when she started homeschooling she said:

Seventh? I was homeschooled from seventh to twelve, so… I pretty much did not have teacher; just had a book, so the book was my teacher. And then if I had any questions about what I was learning, I would go directly with my father since he’s an engineer and he would be coaching me.

The process that she used was to study the books in her home and her parents helped her in case she needed it. Then she went to a school for testing. Martha stated:

They pretty much were paying my tuition in a school. But I was not going to that school. I was just going to take the exams. I was just going to school to test for my junior high and for high school. Just my parent’s perspective about education is something that should be done at home. And people would judge us, telling my parent a lot. I remember saying why “Oh, you’re going to put them in a bubble all the time?”

_Succeeding in mathematics class_. The students also shared with me stories of success. They provided different stories about how they succeeded in mathematics classes, and three categories emerged from the major theme: My personality, where participants talked about how their personality helped them in mathematics. Then, tutoring support, in this category the
students described their experience with tutoring. Most of them were good experiences. Finally, the role of language/English proficiency, in this category the informants discussed the importance of English in the U.S.

*Relying on my previous knowledge.* Some of the participants were keenly aware of how their upbringing, their personality, and their home life affects directly their performance as students in school. Adriana was convinced that her home education was the key determinant in her willingness to learn as student. She affirmed:

I have to do everything by myself. But that’s the way… I think that’s the way it should be. I am very independent. I know how to do everything, for real. I know. Ask me to change a tire. I know how to do everything. I don’t do it because I am a girl but I know how to do it.

Adriana was very confident that she could do anything because she has a very independent personality. She continued her story saying:

I have two brothers and two sisters. I am the oldest. I am 32, and I have a brother that is 29, and then I have a 21, and then I have two step sisters that are 15 and 14. And the more girly could be… is my one of my brothers, the one of 29 years. He is like a nena. He is so picky. But my parents didn’t let him do things. They almost gave him to eat in his mouth. I don’t know why? Probably he was so cute when he was little. Because he was, not right now but he was. Until now he call me. He just bought a house and he called me because… Do you like this house? Me, yes. But he doesn’t know how to make decisions. And that… everything is through math. You make decision in math, everything but…

Adriana drew attention to the difference between herself and her siblings. As she pointed out, her brother was not able to make decisions because he learned at home to leave his decisions to
others. In addition, Adriana was also saying that her brother did not use mathematics and she associated his lack of decision-making skills with the non-use of mathematics.

Delia was the other participant that emphasized this relation between learning at home, personality traits, and student achievement. Delia described herself as an inquisitive student. If she did not understand something or if she wanted to know more about anything she would go and search for a book and read it. Then, she narrated her story about when she was a child. Delia stated:

I’m very like curious! Why? Why this is working this way? Why not the other way and Why can only? I guess because I grew up with my mom. I grew up in a household where whenever the TV did not worked, we opened it up and fixed it. My mom has always been like that. We don’t call the repair guy and everybody at home, everybody tried to fix them for their own, and I guess that’s where it comes from. So I’m like I figured. That’s why. And my mom is not like engineer and I think just opens it up and says ok, this doesn’t work and we’ll pull this or we’ll… It’s just; I guess that’s where it comes from because it’s that how things work. It comes from… I think that’s what makes learning fun. Not so much; Ok, how boring would it be when Ok, it works like that. Why does…? How does that computer run? or How does…? You know? How do we move? How do we blink? Everything is connected. You just have to like I said it, it takes time planning, but I think that’s how… that’s how any human being learns; by absorbing.

Both Delia and Adriana described their personalities, speaking about how independent they are with passion and with pride. They seemed very confident when they were telling me their respective stories.
Support groups: My family, my peers, and my cohort. Martha was the participant who described herself as an active participant in tutoring on a regular basis. Her father was her primary coach. In addition, she had good experiences with it. Martha affirmed:

They (teachers) are like “If you didn’t get what I was teaching, I have office hours, so come to look for me” And that was really helpful. If I’m not able to get it with the additional information that I have at home, I need to look for my dad who was my math tutor.

Veronica also had good experiences with tutoring. She had had some struggles with the second language, however in extracurricular mathematics the peers, tutors and teachers helped her to learn English. She commented:

I think math club taught me more than the classroom did. Just because they challenged me and they… I had a teacher who spoke… both of my math coaches spoke both English and Spanish and they were so patient with me to teach me like how to do the word problems, to teach me the transition words, what the sum of meant that I had to add and all of that.

Language and culture as assets. Elena told me that she suffered because when she came to the United States she was not proficient in English. So she did not understand what her teachers were saying in her classes. Elena articulated:

I think what affected me the most was that I wasn’t understanding English.

Yes, and at the same time I was trying to learn math, even history. I even cried sometime in history because my teacher did not speak in Spanish so I wasn’t… In class there were a lot of discussions and I didn’t even understand the question, and I didn’t answer I don’t
know what to do. So it was very hard and even at my senior year I eventually learned English.

I think when I went into my high school right here. Instead of going to middle school I was in intensive English classes, ESL. I wish did not have a lot. I don’t think that’s a… In my own experience that doesn’t help. I will go more into… now that I know into a bilingual program but in those years in was more ESL to learn English.

Martha found it frustrating that neither of her parents were proficient in English. She stated:

I started in a public school in second grade here in Mexico. Then my parents changed me to a private school. It was not a bilingual school. It was just a private Mexican school and we did have English classes but it was like one hour a week. So I remember being still in fourth grade and they would sing the ABC song and I would be like oh, what’s the ending, I don’t know. Since both of my parents they do not speak English so it was a little annoying for me. The fact that I had so many questions about the language and I didn’t have someone to answer those questions for me.

**Transformative processes: Changing the equation.**

*Improving mathematics teaching.* The informants reflected about how they experienced and perceived mathematics as well as their resistance to every challenge they faced in mathematics education. These reflections led them to suggest ideas in order to improve mathematics education.

*Teaching interdisciplinary classes.* One of the students told me that because of her experience with interdisciplinary classes she felt students could be approached better through different disciplines connected with mathematics. In addition, some of the participants said that
using hands-on and other mathematics representations could help students who are visual
learners or other type of learners.

Adriana commented:

You could have a mathematics classroom with different learning centers. You could have
a drama center, a market, I don’t know. There you could do many things such as ratios,
patterns, sequences, addition, subtractions, and divisions. You could do many different
things in a market. Another example could be a music-learning center.

When I asked Elena what would be the kind of activities that she would like to implement
to teach mathematics she affirmed: “A lot of hands-on activities that make the environment of
the class more relaxed and at the same time they are learning a lot and that’s it”.

*Changing from individual to group teaching style.* I asked the participants about their
recommendations for a better mathematics environment. Martha stated: “it needs to be table
style. Not a little individual desk because if I’m not getting something, maybe the person next to
me is not and I can help them or vice versa”.

Elena also supported this idea of changing the individual table style. Elena established:

I will like to… I like how in here [this classroom] and college you can have round tables
because you are not by yourself. I guess in individual tables like you can talk to the
person that is next to you. And round tables give you the opportunity to get your ideas out
and to communicate with your classmates to discuss things and I think a lot of good
discussions will help a lot because you feel more comfortable talking in a small group
that talking to the whole class. And I know I am kind of old but if I know that for me it
would help a lot to have a lot of… for the teacher to communicate with the students. Like
very often like having not only the teacher talking but having these kinds of interactions between student and teacher. And with that it would help also for my future students. First of all, because you get to know the students that are around you. You get to talk to them more often that you would in an individual table. And from there when you know your classmates you feel more welcome to share your ideas even though you think you are wrong. Because oh I think this might be the answer but I don’t know, what do you think? And then, from there they are oh, I think this would be more accurate or I think you are wrong but I have the right answer, I can help you. Like sharing more ideas because you know them. And when you are separate in your table you feel like you cannot talk to the one… to the person that is right next to you. And you don’t know them; you don’t get to know them so you feel more unwelcome on that class.

Mathematics as a second language. Adriana was one of the participants that was working in bilingual classes as a teacher. She pointed out a good idea about an analogy of learning English and learning mathematics. She argued that teaching mathematics should be thought of in the same way that teachers think about teaching a second language. Adriana affirmed:

Mathematics is the same. As I told them, it is the same here and in China. Mathematics are symbols, like in China, well, they are not the same, they just have different name. I teach mathematics beginning with the signs, the numbers. When they learned the names, I started to teach mathematics. I could teach mathematics in English and the students could associate it because they saw it in their brains, and they processed it because it was the same brain language.
Connecting mathematics with real life and previous knowledge. Martha emphasized how mathematics concepts are linked one to each other. She said mathematics teaching should be based on previous knowledge. Martha pointed out:

It’s like they don’t continue on the next. Like teaching the next thing till they know everybody got the first concept. Because they understand that math is a building block or the thing, so then I’m going to build the next block till they know that everybody in the class it’s getting the first part. We don’t use like equations or proportions every day, so we need to get all that refreshed.

She actually made an interesting analogy or metaphor related with how mathematics should be taught or how knowledge should be constructed. Martha expanded this point further:

I don’t know like you are not going to be able to put the windows in a car if you don’t have doors, so kind of this, like something like that so you cannot teach… you cannot expect your students to be learning fractions if they are not understanding the concept of um, 10 hundreds those values because they are all connected.

On the other hand Delia highlighted what should be a memorable learning moment. That would be with examples with real life contexts. Delia affirmed:

And experimenting with, with the things around us, with nature, environment, and that’s how. I think that’s how you make learning more memorable because you “Ok, well” Yeah, you can learn a step, a concept, and most of the concepts that’s how you learn, but there’s no connection in your mind that you did something with that.

Delia also accentuated the importance of teaching based on prior knowledge.

You have to be prepared for any kind of [learner] because everybody learns differently; everybody has different knowledge, a prior knowledge of how things work. And some
people have it, like…you have to be prepared for what’s… Maybe a student might come in and say “Oh, I used to do it this way” and now you’re telling it to do it “This way” and “Why is it wrong?”

Delia discussed about how everything is a connected. You should know to add in order to learn to multiply. Delia commented there is a process and you should connect it with what the student already know.

**Demanding education quality.** Martha pointed out the importance of demanding quality in education because education is expensive, and it is a basic human right. From her perspective, students can and should demand good quality in education. Martha affirmed:

I need to be there asking questions. Probably people would say “Oh, she’s the one asking the questions that maybe I had. My education cost a lot. I’m paying a lot and I’m giving up a lot right now to get the education I’m having. So for me sitting at that desk, it’s not just time; it’s money that I’m earning and I’m thinking “I’m here to learn from my professor because I’m paying him”. So if I don’t understand something, it’s his job to explain it to me, right? So if I don’t get a concept, I’d be like “I’m sorry, I did not get this step”

**Highlighting the importance of mathematics in life.** Some participants highlighted the importance of mathematics in life. Adriana articulated:

“Well, it has to be important because you use mathematics for everything so they have to learn. They (teachers and students) have to know mathematics”.

For Delia, everything deals with mathematics. She noted: “Any field, you have to be curious about how things work because mathematics is… Ay, well… The way I learned it. Well, for me it’s learning how things work. Everything deals with mathematics”.

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Changing the Equation: The Model

The section that follows here presents a visual depiction of the primary findings that emerged from this grounded theory study. Figure 3 shows the interactions among: (A) student stories (“Our Voice: How do students experience and perceive mathematics?”); (B) student resistance (“Pedagogical practice and the status quo”), leading to a set of strategies that (C) “Change the Equation”. Participants were able to identify status quo’s pedagogical practice, but to resist the unsuccessful teaching strategies they suffered, and finally to implement strategies to succeed (Our resistance). Participants were able to identify status quo’s pedagogical practice, suffered unsuccessful teaching strategies but resist to them and finally implement strategies to succeed (Our resistance). Finally, students’ reflections on experience and perceptions about mathematics and their resistance to every challenge lead them to suggest ideas for transformative processes in mathematics education.
Figure 3. Changing the Equation: The model. This figure illustrates the connection between the core categories (circles) and their major themes (rectangles).

Summary

In this chapter I described how I gain access and entry into the world of the participants. I gave a narrative of the characteristics of each participant. The sections that follow provide an explanation of how each core category emerged and the categories and subcategories related to them. At the end, I provide a model that explains the interaction between the core categories and categories associated with each one.
Chapter five

Discussion, Implications, and Conclusion

A grounded theory study of Mexican/Mexican-American postsecondary students’ perspectives in mathematics education is presented in this dissertation. The key findings are grounded in the data collected from the participants and provide a framework that can be used to develop a deeper understanding of Hispanic postsecondary students’ views about mathematics education.

In this chapter, I build on the preceding chapters’ presentation of key findings, seeking to explicate the meanings behind those findings through discussion of the themes and categories that have emerged in relation to the topic under study: Mexican/Mexican-American postsecondary students’ descriptions about their experience and perceptions in K-16 mathematics education, particularly their views in U.S. high school. The data gathered in this study answered the primary, initial research question, and further enhanced understanding about critical dimensions of this multifaceted topic. These insights are reported through the sub-questions that frame the discussion of the research findings.

The purpose of this grounded theory study was to explore the views of Mexican/Mexican-American postsecondary students on the U.S.-Mexico border in relation to their experience in K-16 mathematics education. The study was guided by one initial, primary research question: How do Mexican/Mexican-American postsecondary students describe their experience and perceptions in K-16 mathematics education, particularly in U.S. high school? Five sub-questions emerged from the data:

- What kinds of mathematics instruction have postsecondary students experienced on the U.S.-Mexico border?
• How do these students describe their perspectives about mathematics?
• What are the pedagogical practices in mathematics that have been institutionalized as components of the explicit or implicit (i.e., hidden) curriculum?
• How have these students resisted unsuccessful teaching strategies?
• What new knowledge can be gleaned from these students’ recommendations for transformative processes?

The closing section of this chapter presents a discussion of the implications for research, theory, and practice as well as the potential for the findings of this study to contribute to research and practice. The assumptions and limitations of the study are also presented in this chapter. Finally, a conclusion is presented.

**Discussion of Findings**

The lack of research focused on Hispanic students’ perspectives about mathematics education makes this grounded theory particularly helpful in understanding the intersection of the themes and categories that emerged from this study. Presentation of findings began with descriptions of the kinds of mathematics instruction that postsecondary students have experienced on the U.S.-Mexico border; the grounded theory analysis examines these issues in relationship to literature. Second, I elaborate on the grounded theory that emerged in relation to how these students describe their perspectives about mathematics. The following section presents the processes I used to deconstruct the pedagogical practices in mathematics that have been institutionalized as components of the explicit or implicit curriculum and their connections with literature review. Next, I articulate the ways in which these students have resisted unsuccessful teaching strategies. Finally, theoretical implications are discussed in relation to the findings on what new knowledge can be gleaned from these students’ recommendations for transformative
processes. Each one of these questions/sub-questions, with discussion of findings follows below here:

**What kinds of mathematics instruction have postsecondary students experienced on the U.S.-Mexico border?** Students’ discussion of the first sub-question of this study led to the first theme that emerged from this study. The students described their experiences in mathematics education on the border. One of the major issues for students in schools was the language. Some of the participants were not English proficient when they were studying in classes in the United States.

Veronica and Elena were two of the students that felt that their lack of English proficiency did not allow them to have better opportunities. Veronica said she was not in gifted or talented classes because she was considered to be an ESL student, characterized by deficits. Elena commented that she had been frustrated in math classes (as well as in other subject areas, like history) because she did not understand anything her teacher was saying. Darling-Hammond (2010) and Flores (2007) identified this issue as an “opportunity gap”, a missing systemic link for low-income students, students of color, and English language learners who often do not have the same access as others to highly qualified teachers, high-quality curriculum, gifted and talented classes, and well-resourced classrooms.

**How do these students describe their perspectives about mathematics?** The informants articulated their perspectives on mathematics in some detail. They described the ways in which their “funds of knowledge” (González, Moll, & Amanti, 2005) helped them to understand mathematics. Their home education was helpful in their mathematics class. According to Moll, Amanti, Neff, & Gonzalez (1992) & Velez-Ibañez & Greenberg (1992) knowledge, cultural resources and experiential connections with the content are essential in order
to provide foundations upon which learners can construct their own knowledge. Adriana and Delia described the ways in which their experiences in their homes helped them to remain fully engaged in mathematics topics even when the teachers were not helpful. On one hand, Adriana shared her home experience where her parents taught her to be very independent without the help of anyone. On the other hand, Delia described how she developed critical thinking skills in her home. If something like a television broke down she felt that she had to fix it or at least try to do so. They did not call technical support or anyone. They just solved the problem. Therefore, her parents taught her to find a way to solve a problem. That is why when she did not understand a concept in her mathematics class she would go to a book or Internet and read and learn it by herself.

**What are the pedagogical practices in mathematics that have been institutionalized as components of the explicit or implicit curriculum?** The students provided detailed information about different teaching practices that they perceived to be unsuccessful with students. One of these practices is the assessment method. The students felt that their grades in mathematics classes did not reflect what they had learned in their classes. For example, Martha affirmed that even though she had good grades she did not feel that she was good at mathematics. Martha commented that she did not remember the concepts and what she did was study for the test and then she forgot everything. This issue can be related to what Nichols & Berliner (2008a) stated about the validity gap. In their studies they defined validity gap as a concept that refers to how some groups’ results are more ecologically valid than the results from other groups, due to the way standardized tests are constructed (Figueroa & Valdes, 1994; Krashen & Lee, 2005).
How have these students resisted unsuccessful teaching strategies? One of the categories that emerged from this study was the central role of support groups: family, peers and cohorts. In this category the students’ notion of family as strength or strategy to succeed in mathematics class is connected with Yosso’s notion of familial capital in her study about forms of capital in communities of color. Family member and home education played an important role in the experiences described as “aspirational capital” (Yosso, 2005), and was similar to the determination that Mexican/Mexican-American female students showed and recognized as strength. The determination demonstrated by the participants was evident as the students navigated college experiences as the first in their family to attend an institution of higher education in the United States. The conception of social capital (Villalpando & Solorzano, 2005; Yosso, 2005) was similar to the support groups described by the participants. The support groups of the participants primarily included family members and peers, but some of the informants also mentioned receiving support from teachers and tutors.

Another category related to students’ resistance to unsuccessful teaching strategies was “language and culture as assets”. Elena shared her experience with mathematics and also with history. Elena faced the challenge of learning how to speak and become fully literate in a second language while also learning content knowledge in a subject matter. According to Walqui (2006) adolescent students learning academic subject matter in a new language face a number of challenges different from those who are not language learners. Researchers (e.g., Razfar, Licon, & Chval, 2011; Sfard & Prusak, 2005) have been studying this issue using data from students’ standardized tests in mathematics. There are studies (e.g., Donato, 2000; Gutierrez & Rogoff, 2003; Lantolf & Thorne, 2007) that claim that sociocultural approaches to second language...
learning help to emphasize the interactive social nature of learning and the contingent, collaborative nature of support and development (Anton, & DiCamilla, 2009).

**What new knowledge can be gleaned from these students’ recommendations about transformative processes?** The students gave suggestions on how to improve mathematics teaching, why students should demand education quality and the importance of mathematics in real life.

The participants in this study emphasized the need to connect mathematics with real life and previous knowledge. Martha affirmed teachers should explain to students that mathematics is connected with real life activities such as cooking, shopping, gardening, and more. Critical race theory challenges deficit views of Communities as being disadvantaged, “and instead focuses on and learns from the array of cultural knowledge, skills, abilities, and contacts possessed by socially marginalized groups that often go unrecognized and unacknowledged” (Yosso, 2005, p. 69).

Following here is a table showing the connection between the codes that emerged from this study with the research questions that addressed the major components of mathematics education. In addition, each instrument was helpful to gather data that contributes to the findings and results of the study.

Table 3. Codes linked to research questions

<table>
<thead>
<tr>
<th>Mathematics Education</th>
<th>Research Questions</th>
<th>Instrument</th>
<th>Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>What kinds of mathematics instruction have Mexican/Mexican-American postsecondary students experienced on the U.S.-Mexico</td>
<td>Interview Survey</td>
<td>Mathematics education in the US.</td>
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<tr>
<td></td>
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<td>Participant Observation</td>
<td>Mathematics education in Mexico</td>
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<td></td>
<td></td>
<td></td>
<td>Learning geometry is hard</td>
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<td></td>
<td></td>
<td></td>
<td>Connecting mathematics with real life and previous knowledge</td>
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<td></td>
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<td></td>
<td>Teaching interdisciplinary classes</td>
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<td>Relying on my previous knowledge</td>
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<td></td>
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<td>Language and culture as assets</td>
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</table>
### Pedagogy

<table>
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<tr>
<th>Question</th>
<th>Method(s)</th>
<th>Strategies/Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do these students describe their perspectives about mathematics?</td>
<td>Interview, Survey</td>
<td>Learning by rote/memorizing</td>
</tr>
<tr>
<td>What are the pedagogical practices in mathematics that have been</td>
<td>Participant</td>
<td>Working and studying make it even harder</td>
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<tr>
<td>institutionalized as components of the explicit or implicit (i.e., hidden)</td>
<td>Observation</td>
<td>Teaching is teachers’ job</td>
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<td>curriculum?</td>
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<td>Mistakes are not allowed</td>
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<td>Homeschooling</td>
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<td>Singling out students</td>
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<td>Changing individual to group teaching style</td>
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<td>Mathematics as a second language</td>
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### Quality

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<th>Question</th>
<th>Method(s)</th>
<th>Strategies/Issues</th>
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<tbody>
<tr>
<td>How have these students resisted unsuccessful teaching strategies?</td>
<td>Interview, Survey</td>
<td>Teacher preparation</td>
</tr>
<tr>
<td>What new knowledge can be gleaned from these students’ recommendations</td>
<td>Participant</td>
<td>Teaching is not vocational</td>
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<tr>
<td>for transformative processes?</td>
<td>Observation</td>
<td>Hindering a talent</td>
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<td>Rushing the teaching process</td>
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<td>Grading is not equal to understanding level</td>
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<td>Big classrooms</td>
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<td>Support groups: My family, my peers and my cohort</td>
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### Implications

In this section I discuss implications for theory, research, and practice based on the findings from data analysis. Researchers and administrators need to examine different factors in order to better support these students through their mathematics education. This grounded theory study arrived at different outcomes that are connected to previous theory and studies (Darling-Hammond, 2010; Delgado-Bernal, 2002; González, Moll, & Amanti, 2005; Ladson-Billings, G. 2003; Lynn, & Parker, 2006). However, the findings of this study help us to have a better understanding of previous studies because the data was gathered from students’ narratives. Nonetheless, further research should explore critical issues in greater depth such as the student...
demand for greater education quality, the causes of student discourse around geometry as “hard”, etcetera.

**Implications for research.** Findings emerging from this study can support researchers and administrators to deepen current understanding of Hispanic postsecondary students’ experiences and development in K-16 mathematics classrooms. This study complements and can help to build on theory can help to understand complicated processes such as: the challenges that postsecondary students face in K-16 mathematics classroom, their feelings about mathematics education and how to improve students’ experiences in mathematics education.

The findings suggested that these Mexican/Mexican-American students performed and felt better working in groups and they can share ideas collectively that otherwise in individual tables would not be possible. We should pay closer attention to research about group teaching style in mathematics classes.

Household education is other topic that merits in-depth investigation. The students who described themselves as independent learners were also confident about performing well in mathematics. Even though they perceived their teachers as unhelpful, they felt that with their abilities and previous knowledge in households they could solve any situation. However, these students were also the oldest informants in this study (i.e., over 30 years of age). Additional research is needed on the roles of families, household, and home culture in student learning.

**Implications for practice.** One of the major challenges is to prepare teachers well trained in to both pedagogy and content (Mathews, 2013) have different strategies and techniques in order to respond to diverse students’ needs. Informants were concerned because they felt teachers are working just to meet minimum job requirements, but according to students,
quality teaching goes beyond that. Teachers need to authentically show that they care for the students and help them accomplish their goals.

In addition, students had recommendations about how to improve their experiences in mathematics education. The recommendations were the following: teaching interdisciplinary classes, changing individual to group teaching style, teach mathematics as a second language, and connecting mathematics with real life and previous knowledge. Learning from students’ voices in this study helps to affirm what experienced practitioners know and numerous research studies have shown (Dagenais, Day, & Toohey, 2006; Denson, Avery, & Schell, 2010). They suggested that implementing these recommendations could help students to perform in a better environment that could also improve their understanding and learning.

Assumptions

I assumed as a Mexican male doctoral student, enrolled in a U.S. public institution of higher education that I would gain the trust of Mexican/Mexican-Americans who were currently and/or had recently transferred from a community college to a four-year public university in the U.S. because of my background. My first language is Spanish. I was born in Mexico. I have Mexican parents and I came to study to the United States as a foreign student at the age of 26. I studied elementary, high school, bachelor degree and master degree in Mexico. When I came to the United States in order to enroll in a doctoral program, I faced the challenges of being in a different country and for the first time I was in a place where I had to develop my skills in a second language and culture. I found a lot of challenges in the process of enrolling in and adapting to the doctoral program such as adaptation to a different educational system, different assessments, communication with peers, and communication with instructors.
Based on my personal and academic background, I was expecting to establish a comfortable interaction and bond with the research participants. I assumed that the informants would be cooperative, open and honest and they would be willing to provide enough information to me in order to gain new understanding about numerous personal aspects. Fortunately, the participants were very open and informative. The informants described feeling pleased to know that someone cared about their stories. They also felt the researcher could narrate their stories in a way and in a place where these stories matter.

I was expecting that this information would describe experiences and perceptions in the mathematics education of Mexican/Mexican-American students. However, I did not expect to have so many insights about K-16 mathematics education in the United States. Furthermore, this study is based on a number of broad assumptions about the construct of academic achievement - and the way it is operationalized through standardized test scores.

In relation to the structure of this dissertation, I began this study attempting to bring few (or no) preconceived notions about the challenges Mexican/Mexican-American postsecondary students face in mathematics education in K-16 public schools. However, the norms and traditions of proposal writing in doctoral programs of study required me to present at least a preliminary literature review. As anticipated in grounded theory research, during and after the data collection and data analysis there were several unexpected findings. For instance, one of the unexpected situations was the value of attending to students’ voices. For example, my first approach to Adriana was eye-opening. She was really excited and became fully engaged as an informant in the study even before she was selected according to the criteria.
**Limitations**

The limitations in this study include the delimitation to a specific population of Mexican/Mexican-American students in the U.S. higher education system, (transfer students who are transitioning to the southwestern university after one or two semesters attending community college). The participants of this study were students who were enrolled at one community college with a culturally diverse student body, located on the U.S. Mexico border and immersed in two cultures (Mexican and American). This study was restricted to students in college of Education, and all the participants were female. The majority of these students practiced their second language (English) skills in schools and first language (Spanish) skills at home. They were located in an urban metropolitan area of the southwestern United States.

The data that were collected and used for this study included student interviews, field-notes and student questionnaires. I also collected data through a demographic survey, participant observation, interviews and member checking that provided information for triangulation of data. The participants in this study were Mexican and Mexican-American community college students who agreed to participate in the study on a voluntary basis. The study was also delimited by the focus of the interviews. Topics explored with participants were confined to their experiences and perceptions in mathematics education; and as with all qualitative research studies, overall generalization of study findings cannot be made to other populations. However, the opportunity to conduct member checking increased trustworthiness and credibility to the study as students confirmed the accurate interpretation and placement of their responses. With this in mind, the timing of each stage in the process of the study was critical.
Future Research

In this study the participants were Mexican/Mexican-American students in the U.S. higher education system, (transfer students who are transitioning to the southwestern university after one or two semesters attending community college) and they were pre-service and in-service teachers. Future research should explore the perspectives of students who are not studying education in order to be teachers in the future. Having perspectives of students from different fields could help to have a more broad understanding of the challenges faced by students with different backgrounds. In addition, the study in this dissertation was conducted in a place located in the border between two countries; future research might look at places with similar characteristics in order to expand our knowledge about how students experienced mathematics education in the U.S. and how can we – researchers, teachers, administrators, etc- can help these students and the new generations to have better opportunities to succeed in the future.

Even though there is extensive literature about Hispanic students’ struggles with second language learning, there should be more research focused on challenges faced by Latino students in mathematics education.

Conclusion

In this chapter, the findings were discussed in relation to literature. I explained the limitations associated with the study as well as the assumptions I made before and during the study. At the end, I described the implications for research and practice. The grounded theory gives researchers, teachers and administrators with a framework that can be used in their work with Mexican/Mexican-American students in K-16 mathematics education on the U.S.-Mexico border.
The Mexican/Mexican-American postsecondary students in this grounded theory study lived at the intersection of multiple words; some of them were the first to attend an institution of higher education and are engaged in both Mexican culture and in “American” culture. Participants simultaneously experienced multiple dimensions (see figure 3) such as students living experiences in mathematics education (our voices), students acting to resist unsuccessful pedagogical practices (our resistance) and reflecting about these experiences and giving recommendations (transformative processes: changing the equation).

Two of the major findings of this grounded study were: First, students highlighted that mathematics teaching should have different strategies that include: visuals, hands-on, interactions with other students and with different manipulatives in order to cover all the needs from different students. Second, this study also showed how parents could be also agents of change. One of the informants was schooled in her house with her brother. So far Martha has succeeded in postsecondary school with great experiences. Therefore, homeschooling is a practice that needs further study in order to understand better its functionality and its success/failure in students.

**Researcher's Final Reflection**

I decided to begin this journey of inquiry, and selected this topic of study for a number of personal and professional reasons. First, I have lived a number of similar experiences as a doctoral student in the U.S., and saw my own academic life as having parallels in many ways to these undergraduate Mexican/Mexican-American students' experiences. Additionally, I wanted to seek ways to articulate the challenges that Mexican/Mexican-American students face in U.S. K-16 education; gathering this information from students' voices provided unique opportunities for attending to their voices. Third, I had seen many students struggling with mathematics
especially on the U.S.-Mexico border; therefore, I wanted to research this teaching-learning issue and have a better understanding of it.

In many ways, I compare the experience of conducting a grounded theory study on this topic to a journey that was both challenging and rewarding. I have lived through many different feelings during the process, however, in retrospect, I have had more gratifications than disappointments because I learned from students' experiences, I broke some paradigms (beliefs) I had, and now I have the opportunity to narrate their stories.

Looking back, this journey was a great experience. I have the opportunity to work closely with five informants, attempted to provide accurate and trustworthy interpretations of their stories, and I look forward to disseminating these new perspectives and insights with a larger audience. Grounded theory is a unique methodology and it has allowed me to go in-depth on a topic of critical interest and relevance.
References


University of Texas at El Paso facts brochure. (2012). Retrieved from 
   http://universitycommunications.utep.edu/facts/index.html


Appendix A

Demographic survey

Demographic Survey
Age: _____ Community College GPA: ______

Year of high school graduation: Before 2010 2010 2011 2012

Did you attend high school in the U.S.? Yes No

If yes, what was your high school GPA? _____________

If no, write the name of your high school and location___________________

Please indicate your race (e.g., American Indian, Asian Pacific Islander, Black, Latino/a, White, etc.): __________________________

Please indicate your ethnicity (e.g., Cuban, Dominican, Mexican-American, Puerto Rican, Salvadoran, etc.): ____________________

Where do you live now? Mexico U.S. Other

Please indicate the highest level of education completed by your parent/s or guardian/s. Check one level for each column.

<table>
<thead>
<tr>
<th></th>
<th>Mother or female guardian</th>
<th>Father or Male guardian</th>
</tr>
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<tbody>
<tr>
<td>Don’t know</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>High school or less</td>
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<td>_____</td>
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<td>_____</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>_____</td>
<td>_____</td>
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<tr>
<td>Bachelor’s degree</td>
<td>_____</td>
<td>_____</td>
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<tr>
<td>Master’s degree</td>
<td>_____</td>
<td>_____</td>
</tr>
<tr>
<td>Doctorate or professional degree</td>
<td>_____</td>
<td>_____</td>
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</tbody>
</table>

Are you enrolled as a full time student? Yes No

Do you anticipate being available to complete a total of three in-depth interviews during the months of February and April?

If you currently work, where do you work?
A. Currently don’t work B. Work on campus C. Work off campus D. Both on and off campus

If you currently work, how many hours a week do you work? ___________________

What is your marital status?
A. Single B. Married C. Partnered D. Divorced E. Other: ______

Do you have children?
A. No       B. Yes       If yes, how many__________

Indicate your citizenship and/or generational status. (Circle one)

a. My grandparents, parents and I were born in the U.S.
b. My parents and I were born in the U.S., but one or more of my grandparents was not
c. I was born in the U.S., but my parents were not
d. One of my parents and I were born in the U.S., but one of my parents was not
e. I am a foreign born, naturalized citizen
f. I am a foreign born, resident alien/permanent resident
g. I am on a student visa
h. None of these apply to me
i. Other: ______________________

If you were not born in the U.S., at what age did you move to the U.S. ____________

What is the primary language spoken in your home? _______________________________

Please read each statement and select one option

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mathematics is very important in life</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2.</td>
<td>My grades in mathematics reflect how much I learned</td>
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<tr>
<td>3.</td>
<td>I am a good mathematics student</td>
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<tr>
<td>4.</td>
<td>I feel comfortable in mathematics classrooms</td>
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<tr>
<td>5.</td>
<td>Mathematics classroom environment can be improved</td>
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<td></td>
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<tr>
<td>6.</td>
<td>Teachers’ attitudes in classroom make me do my best</td>
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<td></td>
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<tr>
<td>7.</td>
<td>I use mathematics outside the classroom</td>
<td></td>
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<tr>
<td>8.</td>
<td>My peers support me in mathematics classes</td>
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<tr>
<td>9.</td>
<td>My parents support me in mathematics classes</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>10.</td>
<td>My teachers support me in mathematics classes</td>
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<td></td>
<td></td>
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<tr>
<td>11.</td>
<td>I feel comfortable taking a mathematics test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>My experience in high school mathematics was great</td>
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<td></td>
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<tr>
<td>13.</td>
<td>I am treated different because of my race</td>
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<tr>
<td>14.</td>
<td>All U.S. students have the same opportunities to succeed in schools</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
Appendix B

Informed Consent Form
1. Introduction

You are being asked to take part voluntarily in the research project described below. Please take your time making a decision and feel free to discuss it with your friends and family. Before agreeing to take part in this research study, it is important that you read the consent form that describes the study. Please ask the study researcher or the study staff to explain any words or information that you do not clearly understand.

2. Why is this study being done?

You have been asked to take part in a research study of Mexican/Mexican-American community college students’ perceptions and experiences through mathematics K-16 formal education in order to understand better their perspectives on the challenges and factors they faced and their description of how this affects their current and future experiences in mathematics.

Approximately, fifty to seventy five students will be enrolling in this study at UTEP.

You are being asked to be in the study because you are over the age of 18, and you are a community college student who is currently transferring (and/or has already transferred) to UTEP.

If you decide to enroll in this study, your involvement will last about six months (December 2012 to May 2013).
3. What is involved in the study?

If you agree to take part in this study, the researcher will administer an on-line survey. The survey will explore the demographics of the students and there will be also questions related to the topic of the study. You may also be invited to join a smaller subgroup (approximately 4 students) to participate in three in-depth interviews no longer than 90 minutes from January 31 – March 31, with the possibility of an additional meeting for discussion in May 2012. The in-depth interviews will provide a more focused, in-depth set of data for study and analysis.

4. What are the risks and discomforts of the study?

There are no known risks associated with this research.

5. What will happen if I am injured in this study?

The University of Texas at El Paso and its affiliates do not offer to pay for or cover the cost of medical treatment for research related illness or injury. No funds have been set aside to pay or reimburse you in the event of such injury or illness. You will not give up any of your legal rights by signing this consent form. You should report any such injury to Carlos Ruben Paez Paez at (915-747-0153) or crpaezpaez@miners.utep.edu and to the UTEP Institutional Review Board (IRB) at (915-747-8841) or irb.orsp@utep.edu.

6. Are there benefits to taking part in this study?

Participants in this study will receive free interactive instruction on technology applications, at no cost to them. Additionally, participants will be aware of the potential for this research to help us to better understand Mexican/Mexican-American postsecondary students’ perceptions and experiences about K-16 U.S. mathematics education.
7. What other options are there?

You have the option not to take part in this study. There will be no penalties involved if you choose not to take part in this study.

8. Who is paying for this study?

This study is part of unfunded research for a doctoral dissertation; nobody is paying this study.

9. What are my costs?

There are no direct costs. You will be responsible for travel to and from the research site and any other incidental expenses.

10. Will I be paid to participate in this study?

You will not be paid for taking part in this research study.
11. What if I want to withdraw, or am asked to withdraw from this study?

Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you do not take part in the study, there will be no penalty.

If you choose to take part, you have the right to stop at any time. However, we encourage you to talk to a member of the research group so that they know why you are leaving the study. If there are any new findings during the study that may affect whether you want to continue to take part, you will be told about them.

The researcher may decide to stop your participation without your permission, if he or she thinks that being in the study may cause you harm.

12. Who do I call if I have questions or problems?

You may ask any questions you have now. If you have questions later, you may call Carlos Ruben Paez Paez at (915-747-0153) or crpaezpaez@miners.utep.edu.

If you have questions or concerns about your participation as a research subject, please contact the UTEP Institutional Review Board (IRB) at (915-747-8841) or irb.orsp@utep.edu.

13. What about confidentiality?

1. All the recordings will be stored in a locker under lock and key. Electronic versions will be stored on the researcher’s laptop and will be password protected. The researcher will be the only with access to it. The researcher will use this information to do data analysis and he will retain it for five years after the study concludes. At that time, all data will be destroyed. Only the researcher and supervising professor will have access to it. The recordings will not be related by the name of the participants, they will be associated with pseudonyms.
2. Every effort will be made to keep your information confidential. Your personal information may be disclosed if required by law. Organizations that may inspect and/or copy your research records for quality assurance and data analysis include, but are not necessarily limited to the UTEP Institutional Review Board

Because of the need to release information to these parties, absolute confidentiality cannot be guaranteed. The results of this research study may be presented at meetings or in publications; however, your identity will not be disclosed in those presentations.

3. The privacy and confidentiality of the participants will be strictly enforced. Names and identities of participants will not be revealed, with each participant assigned a code number. In addition, all data, including the audio recordings of the interviews will be coded and stored in a password protected computer, housed in the Education Building, Room 201 and the researcher will be the only one that will have access to that information. No real names will be used on publications.

14. Mandatory reporting

If information is revealed about child abuse or neglect, or potentially dangerous future behavior to others, the law requires that this information be reported to the proper authorities.
15. Authorization Statement

I have read each page of this paper about the study (or it was read to me). I know that being in this study is voluntary and I choose to be in this study. I know I can stop being in this study without penalty. I will get a copy of this consent form now and can get information on results of the study later if I wish.

Participant Name: ___________________________ Date: ________________

Participant Signature: ___________________________ Time: ________________

We may wish to present some of the recorded video and audio from this study at educational conferences or in other educational settings. Please sign below if you are willing to allow us to do so with recordings of yourself obtained during the study, and agree to the statement -- "I hereby give permission for video and audio recordings made of myself during this research study to be also used for educational purposes, including being presented at educational conferences and shown in other educational settings."

Participant Signature: ___________________________________________

Consent form explained/witnessed by --

Printed name: ___________________________ Date: ________________

Signature: ___________________________________________
Appendix C

In-depth Interview
In-depth interviews

Interview #1

Before I begin the interview:

I want to remind you that this interview will be digitally recorded and all the information will be kept confidential. Information may be used for research purposes, but not specific information will be used. I will ask you about a pseudonym you would like to associate with the interview data and when reporting the findings. What pseudonym would you like to use? If you are unsure at this point, I can ask you again at the end of the interview. Do you have any questions? Let’s begin with the interview. Please feel free at any moment to take break for any reason just let me know.

- Tell me a little bit about yourself (e.g., name, hometown, future plans).
- Since you have decided to be a teacher, please describe what teaching and learning mathematics means for you.
- Do you think your grades in your community college mathematics classes showed how much you really learned? Why or why not?
- What about the grades in high school?
- In middle school?
- Describe your best and worst experience in a mathematics classroom in community college.
- Describe your best and worst experience in a mathematics classroom in high school.
- Describe your best and worst experience in a mathematics classroom in before high school (could be middle school, elementary, kindergartner).
- How do you feel about yourself as a math student? Why?
- How do you feel in a mathematics classroom?
- Describe the ideal mathematics classroom environment.

At the end of the first interview:

1. Thank each individual for participating.
2. Ask again about the pseudonym that they would like to use throughout the study.
3. Remind participants that their comments will remain anonymous.
4. If possible, schedule a tentative time for the second interview. The interview can be schedule via email if the students or I are unprepared to schedule the next interview.
5. Ask participants if they have any questions or additional thoughts that they would like to share.
Interview #2

Prior to second interview:

I want to remind you that this interview will be digitally recorded and all the information will be kept confidential. Information may be used for research purposes, but not specific information will be used. Do you have any comments regarding the previous interview? Do you have any questions? Let’s begin with the interview. Please feel free at any moment to take break for any reason just let me know.

- Describe in-depth your community college mathematics teachers’ attitudes towards students? (e.g., they had positive/negative attitudes)
- Describe in-depth your high school mathematics teachers’ attitudes towards students?
- Describe in-depth your middle school mathematics teachers’ attitudes towards students?
- Explain the activities you participated in in mathematics classroom and out of the classroom in your house or other places.
- Did you feel supported by your mathematics teachers? (e.g., they helped you personally to understand some concepts; the teachers make you feel comfortable to ask questions in classroom)
- Did you feel supported by your peers in the mathematics classroom? (e.g., they help you with the homework; they share comments with you about the teacher and the class)
- Did you feel supported by your parents in your mathematics classes? (e.g., your parents help you do your homework, when you have any doubt they help you find the answer) Explain.

At the end of the second interview:

1. Thank each individual for participating.
2. Remind participants that their comments will remain anonymous.
3. If possible, schedule a tentative time for the third interview. The interview can be schedule via email if the students or I are unprepared to schedule the next interview.
4. Ask participants if they have any questions or additional thoughts that they would like to share.
Interview #3

Prior to third interview:

I want to remind you that this interview will be digitally recorded and all the information will be kept confidential. Information may be used for research purposes, but not specific information will be used. Do you have any comments regarding the previous interview? Do you have any questions? Let’s begin with the interview. Please feel free at any moment to take break for any reason just let me know.

• How do you feel when you are taking a mathematics test? (e.g., do you feel nervous? Do you feel comfortable? Do you feel confident?)
• Describe your experiences in the U.S. high school where you were enrolled. (e.g., do you feel comfortable? Do you feel alienated?)
• Did you feel like you were treated differently as a Mexican/Mexican-American? (e.g., the teacher preferred not ask you because of your fluency in English, workgroups were integrated in order to benefit some groups)
• What would be your recommendations to improve mathematics education in US schools? (e.g., the quantity of students per classroom, increase/decrease the hours by week, use of technology)
• In your own perspective, tell me if all students have the same opportunities to succeed in U.S. high schools? (e.g., White Americans, Mexican-Americans, African-Americans)

At the end of the third interview:

1. Thank each individual for participating.
2. Remind participants that their comments will remain anonymous.
3. If possible, schedule a tentative time for the third interview. The interview can be schedule via email if the students or I are unprepared to schedule the next interview.
4. Ask participants if they have any questions or additional thoughts that they would like to share.
Vita

Carlos Paez earned his Bachelor of Engineering degree in Electrical Engineering from Instituto Tecnologico de Ciudad Juarez (ITCJ). He received his Master of Science degree in Mathematics Education in from the Universidad Autonoma de Ciudad Juarez (UACJ). In 2010, he joined the doctoral program in Teaching, Learning, and Culture at the University of Texas at El Paso (UTEP).

While pursuing his degree, Dr. Paez worked as a research associate and assistant instructor for the department of Teacher Education. He had developed a deep understanding of mathematics teaching strategies in order to help students in their learning process. He had also learned to develop qualitative and quantitative research as well as analyze data using software such as SPSS and NVIVO.

Dr. Paez has presented his research at international and national conference meetings including the Proceedings of the North American Chapter of the International Group for the Psychology of Mathematics Education (PMENA), American Educational Research Association (AERA) and Society for Information Technology and Teacher Education (SITE).

Dr. Paez’s dissertation, Views From a Community College on the U.S.-Mexico Border: Mexican/Mexican-American Postsecondary Students’ Perceptions of K-16 Mathematics Education, was supervised by Dr. Judith H. Munter.

Carlos Ruben Paez Paez, Ph.D.
Address: Paseo de la Huerta #237-D Ciudad Juarez, Chih, Mexico 32448
Home Phone: 656-625-1512 / Mobile Phone: 656-270-5197
Email: crpaez23@gmail.com
EDUCATION


Dissertation Title: “Views from a Community College on the U.S.-Mexico Border: Postsecondary Students’ Perspectives about Mathematics Education”

2009 M.S. in Mathematics Education, Universidad Autonoma de Ciudad Juarez, Mexico.

Thesis Title: “The Meaning Displayed when Solving Linear Equations”

2006 B.S. in Electrical Engineering, Instituto Tecnologico de Ciudad Juarez, Mexico.

PROFESSIONAL EXPERIENCE

Graduate Research Assistant. Responsibilities included teaching classes, research activities such revision of current literature, collecting data, English and Spanish transcriptions, NVIVO data analysis, assisting graduate advisor. (September 1, 2009 – August 31, 2014). College of Education, The University of Texas at El Paso, USA.


Lab Assistant and Office Manager, Educational Technology Research Laboratory (September 1, 2012 – August 31, 2014; supervised by Dr. Daniel Tillman). College of Education, The University of Texas at El Paso, USA.

Graduate Research Assistant. Responsibilities included research activities such as revision of current literature, development of lesson plans. (June 1, 2010 – August 31, 2010). El Paso Community College, TX, USA.


Industrial Engineer. Responsibilities included elaboration of visual aids of production standards, balancing of production lines, and implementation of engineering changes in the production lines. (August 1, 2007 – October 30, 2009). Conductores Tecnológicos de Ciudad Juárez, Mexico.


Mathematics Tutor. Responsibilities included tutoring students of different ages in mathematics topics they were struggling with learning. (September 1, 2002 – April 30, 2006). Instituto Tecnológico de Ciudad Juárez, Mexico.

TEACHING EXPERIENCE

Teaching Assistant for the following classes:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Year</th>
</tr>
</thead>
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<tr>
<td>RED 5350</td>
<td>Mentoring for Literacy Educators</td>
<td>2010</td>
</tr>
<tr>
<td>BED 5337</td>
<td>Mentoring for Literacy Educators</td>
<td>2010</td>
</tr>
<tr>
<td>RED 3342</td>
<td>Reading/Study in the Content Areas</td>
<td>2011</td>
</tr>
<tr>
<td>TED 5304</td>
<td>Scholarly Writing for Educators</td>
<td>2009–2011</td>
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</tbody>
</table>
TED 5313 Diversity in Educational Settings 2011
TED 6300 Critical Issues in Curriculum and Instruction 2011
BED 4311 Teaching Science in Dual Language Classrooms 2011–2013
SIED 5325 Inquiry Science Education in Bilingual Settings 2012–2013
ELED 4310 Teaching Mathematics in Elementary Schools 2014
BED 4310 Teaching Mathematics in Dual Language Classrooms 2014
EDT 3371 Educational Technology 2012–2014
TED 5300 Research for Classroom Teacher 2012–2014

PUBLICATIONS AND CONFERENCE PRESENTATIONS


INSTITUTIONAL SERVICE

Member of the Cross-Cultural Institute for Research, Collaboration and Learning in Education (CIRCLE) 2013 Conference planning committee. University of Texas at El Paso.

Member of the Cross-Cultural Institute for Research, Collaboration and Learning in Education (CIRCLE) 2011 Conference planning committee. University of Texas at El Paso.

Member of the Technology Committee in College of Education at University of Texas at El Paso in 2013.

PROFESSIONAL AFFILIATIONS

American Educational Research Association (AERA), Member (2013 – present)

Society for Information Technology and Teacher Education (SITE), Member (2013 – present)

North American Chapter of the International Group for the Psychology of Mathematics Education (PME-NA), Member (2013 – present)

RESEARCH INTERESTS

Multiculturalism in mathematics education:
  - Culturally-sensitive mathematics education in the U.S.A. and Latin America
  - Mathematics education in bilingual classrooms
  - Mathematics education for English Language Learners
  - Interdisciplinary pedagogy
  - Students’ achievement and attitudes towards STEM (science, technology, engineering, and mathematics)
  - STEM career preparation
  - Teachers’ mathematics self-efficacy

REVIEWING FOR JOURNALS


RELEVANT SKILLS
Bilingual: English and Spanish (fluent in both for speaking, reading, and writing)

Presentation software: Adobe Premiere Pro, Microsoft PowerPoint, Prezi, iMovie, MovieMaker

Quantitative data analysis software: SPSS, Excel

Qualitative data analysis software: NVIVO