

EXPLORING THE MATHEMATICAL IDENTITIES OF SUCCESSFUL LATINO HIGH  
SCHOOL STUDENTS

Stephanie Wright

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in  
partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of  
Education (Culture, Curriculum, and Change).

Chapel Hill  
2016

Approved by:

George Noblit

Catherine Scott

Juan Carrillo

Brian Hogan

Cassandra Davis

## ABSTRACT

Stephanie Anne Wright: Exploring the Mathematical Identities  
of Successful Latino High School Students  
(Under the direction of George Noblit)

Using Martin's (2000) framework, this study examined the mathematical identity and socialization of successful Latino students in a small community in the rural South. Positioned in the *New Latino Diaspora* (Murillo, 2002; Villenas, 2002), I provide a counternarrative to the gap-gazing dominant narrative of Latinos in mathematics education research, which historically has primarily focused on lack of academic success among Latino students in comparison to their White, middle class counterparts. These case studies explore not only how the ways in which students defined their own mathematical identity, but also how parents, teachers, and peers influence students' mathematical identities.

The four high school students presented as cases in this study all exhibit positive mathematical identities and show relatively high levels of interest in continuing their education in STEM fields. The students identified being successful in mathematics as innate ability, as opposed to an acquired or nurtured skill, and identified mathematics as closed system, only available to those with a pre-existing aptitude for mathematics. They expressed appreciation for mathematics as a static, finite school subject having little access to experiencing mathematics as a field of open inquiry or real life application. The students also saw the importance of mathematics as being more about fulfilling a prerequisite for higher education rather than a field of high interest or passion.

These students' self-identified their success in mathematics and defined this success primarily by comparing themselves to their less mathematically successful peers in school. These students also expressed concern over a perceived negative effect of limited opportunities for higher education on their peers as dictated by documentation status. There were exhibited mixed perceptions on the role of parents' perceptions of mathematics, and there was very limited emphasis given to the role of teachers in the creation of positive mathematical identities. For these students, academic and mathematical success was often associated with a negotiated relationships with their peers and/or family while teachers seemed to be, at best, benign transmitters of mostly algorithms and facts. Implications for mathematics teachers and mathematics education researchers are discussed, such as the possibilities offered by critical mathematics pedagogies.

This work is dedicated to Debbie and Carol, two women who dedicated their lives to mathematics education; to my husband, Will, for your endless love, support, and encouragement.

## **ACKNOWLEDGMENTS**

Thank you to the members of the University-Based Mentoring Program, and to the participants in this study. Thank you for sharing your stories with me.

I am very grateful to my committee for their contributions to this project. I would like to express my deepest and most heartfelt appreciation to my advisor and dissertation chair, Dr. George Noblit. Thank you for sharing your compassion, patience, and endless knowledge with me, and thank you for always encouraging me. I would like to thank Dr. Catherine Scott for always having faith in me, and for being such a wonderfully caring person. Thank you to Dr. Juan Carrillo for sharing your expertise and your constructive feedback. Thank you to Brian Hogan for giving so much to your students and being so supportive during this project. And, thank you to Dr. Cassandra Davis for reminding me to share my reflections about my work with others.

Thank you to all my professors at the University of North Carolina at Chapel Hill. I have been so fortunate to work with you and have enjoyed some wonderful experiences learning from you all. I would like to extend a special thanks to Dr. Lynda Stone for your guidance and support, especially in my initial transition to graduate school. I would also like to thank Dr. Marta Civil for inspiring me and giving me the tools to start this project.

And, finally, I would not have been able to complete this work without the love, support, and encouragement of my family and friends. I would like to extend a special thanks to my sister and best friend, Jackie, for your eternal confidence in me.

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## **CHAPTER 1**

### **INTRODUCTION**

This qualitative study investigated the mathematical identities of Latino students in a rural city in the southern United States, part of an area referred to as the New Latino Diaspora. This study builds on an existing multi-level, sociohistorical framework of mathematics socialization written for use with African American students. Through semi-structured interviews and case study analysis, this study presents a counternarrative to the deficit- model narrative of Latino students pervasive in mathematics education by examining successful Latino students.

The participants were high school students in a University-Based Mentoring Program (UBMP). This research project is also informed by interviews with the participant's college-age mentors and their parents, but only as a means to gain further insight into each student, not as a means to understand the mentors or parents. As UBMP members, these students were selected based not on academic need, but on academic success and potential. They are selected to the UBMP by a selection committee based on criteria, including but not limited to grades, which are further scrutinized as participant selection begins. In looking at successful students, I am actively positioning my research against models that focus on mathematical deficiencies of Latino students. These students are not necessarily all successful in mathematics specifically, but have demonstrated classical markers of academic success, such as average or above average grades.

In this dissertation, I used an existing framework designed to measure the position of African Americans to measure the position of Latino students. I am not implying that these groups are the same or have the same experiences within the American educational system. Instead, their experiences are quite complex and dynamic, and the sociocultural histories that inform their experiences in schools are vastly different. For the purposes of this project, I examined the potential for common experiences based on both groups being historically marginalized in American society, positioned as “less than” in comparison their White, middle and upper class peers in school achievement standards. In doing so, I explored the degree to which marginalization works across marginalized groups.

The research of this project is comprised of interviews with all participants. The results are presented as case studies in Chapter 4, themes are addressed in Chapter 5, and implications are addressed in Chapter 6.

### **Gap-Gazing and the Deficit Perspective**

According to the most recent NAEP national report card prior to the beginning of this study (2012), though overall students scored higher on the mathematics assessments at grades 4 and 8 than ever before, Latino students scored lower in mathematics in relation to their White and Asian counterparts. In fact, though this gap in achievement across disciplines has leveled off overall, the gap in mathematics for these students has continued to widen (Lee, 2004). Not only is this no longer surprising, it appears to be the dominant narrative told about Latino students in the American education system. There has also been an historic trend of fewer African American and Latino students taking advanced level mathematics courses (Secada, 1992; Lee, 2004; Walker 2007). Research indicates that, while the number of Latino students continues to increase, their matriculation into higher

education, particularly in Science, Technology, Engineering, and Mathematics (STEM) fields continue to be dismally low without intervention (Chapa & De La Rosa, 2006).

For example, in 2000 Latino individuals accounted for 12.5% of the total population and 17.5% of the college-age population; however, only 10.8% of the high school graduates were Latino, 9.9% of the associate degree recipients were Latino, and only 6.6% of all bachelor's degrees and 3.8% of all doctorates were Latino individuals. (Chapa & De La Rosa, 2006, p.204)

As educators and researchers, we are inundated with statistics describing the achievement gap as the problem of historically marginalized groups that include, but are not limited to, African American, Latino, and/or Native American students. Martin says that the race-comparative approach has a “deleterious effect of helping to position Black children at the bottom of a racial hierarchy of mathematics ability” (2012, p.48).

As Irizarry & Raible (2014) point out,

Achievement gap discourses that continually reference the disparities on test scores and academic outcomes between students of color and White students, for example, tend to normalize the performance of White students, holding it up as the gold standard. One a whole, students of color continue to be reminded that they do not measure up. Often absent in conversations around the so-called achievement gap is any analysis of the unequal distribution of educational opportunities across school settings. (p. 441)

Rochelle Gutiérrez also argues this focus on the achievement gap and the obsession of “gap-gazing,” reifies the dominance of the white, middle class students while marginalizing students of color (2008). These marginalized students, particularly African American and Latino students, are constructed as the problematic students who are responsible for their own low test scores and lack of achievement (Martin, 2012; Gutiérrez & Dixon-Román, 2011). This construction is not entirely unchallenged in the field of mathematics education. And yet, there is a strong need for the work of those committed to

equity and social justice agendas and specifically those who are focused on countering the deficit model of describing Latino students via their shortcomings rather than their successes.

Gap gazing also accepts a static notion of student identity, presuming that students can be reduced to a set of cultural markers, rather than recognizing they are constantly in flux, dependent upon the social structures and social relations in which they are engaged. By always relying upon a comparison group, the achievement gap discourse perpetuates the idea that subordinate populations cannot be studied for their own sake and/or that such populations have nothing to contribute to more general discussions or theories about education. Ignoring the largely overlapping achievement patterns of groups, the dividing practices (Foucault 1980) common in gap gazing research serve to dehumanize students. (Gutiérrez & Dixon-Román, 2011, p.23)

The achievement gap literature has created a problematic and slanted narrative for Latino students and their relationship with mathematics. Looking at test scores alone tells us little about the conditions in which students are working that may be responsible for such discrepancies (Martin, 2012). There is a need for more and better research approaches to answer the underlying questions about these gaps – ones that explore socio-cultural issues (Lim 2008) and not just test scores. While there is still much work to do in terms of equity and social justice as it relates to the mathematics education of these students, the creation of a narrative that positions them as underachievers in mathematics education needs to be challenged and rewritten. The best way to rewrite this narrative and provide a counternarrative, is to look at the experiential knowledge that successful Latinos students have about themselves (Solarzano & Yosso, 2002; Solarzano & Delgado Bernal, 2001). We must first, however, understand how Latino students are currently situated in educational research.

### **Latinos in Education Research**

According to the 2010 Census data, 16.3 percent of the population of the United States identifies as Hispanic or Latino, up from 12.5% in 2000 (Census, 2010). In North



Carolina, from 2000 to 2010 the Hispanic and/or Latino population more than doubled (Census, 2010). According to the North Carolina Department of Public Instruction in the year of this study, 14.3% of public school and 6.3% of charter school students enrolled in K-12 schools are classified as Hispanic (NC DPI, 2013).

**Subtractive Cycles and “Push Outs”.** Aside from a growing population associated with low test scores, research shows that there are large concerns for Latino students in U.S. schools from a sociocultural perspective. “Minoritized students encounter inequitable learning opportunities throughout their educational career. Low expectations based on historical deficit thinking often mediate schools’ treatment of minority students (García & Guerra, 2004; Valencia & Black, 2002)” (Quintos, 2011, p.36)

In a discussion of one particular group of Latinos, Mexican-American students, Valenzuela (1999) warns of the detrimental and subtractive cycle that the deficit model of schooling perpetuates. She also warns that this schooling system strips Mexican-American students of their culture while positioning them as less-than their white peers (1999). Valenzuela describes English language learning Latinos as having only horizontal mobility (p.31) and positions immigrant students on the bottom tier of educational outcomes. And students are not the only ones who suffer when described in relation to the U.S. school system. Parents are also described from a deficit perspective when it comes to education (Olivios, 2004). This deficit perspective includes the narratives of Latino parents not valuing nor caring about their children’s education nor having the necessary knowledge to help their students with their work (Olivios, 2004).

Over the last twenty years, certain areas of the United States such as North Carolina have become home to an increasing number of Latinos than even before. Due to this

phenomenon researchers have deemed these areas of the United States the New Latino Diaspora (Murillo, 2002; Villenas, 2002; Hamann, Wortham, & Murillo, 2002). With an influx of a new population often comes a surge in xenophobia, intolerance, and/or apathy both in the workforce and in the educational system. Here, teachers often see Latino students as mathematics achievement levels and statistics (Antrop-Gonzalez & De Jesús, 2006). These students are defined as low test scores, as students who cannot learn mathematics due to language deficiencies, as students who will not graduate or attain jobs that require mathematics. The rather than just drop outs, Latino students become “push outs” (Antrop-Gonzalez & De Jesús, 2006, p.420), or students who are not only not supported by the school but forced out by “culturally hostile public schools” (Antrop-Gonzalez & De Jesús, 2006, p.410). But while there are stories of disparaging situations for Latino students, there are also stories that highlight the possibility and potential of these students.

The research done using the Funds of Knowledge perspective (Moll 1992), show that Latino students and their families have plentiful educational resources to share with their teachers and schools, when given the opportunity (Civil, Planas, & Quintos, 2005). Latino parents, like all parents, have educational experiences which are influenced by culture and socio-historic factors (Martin, 2000; Quintos, 2008). And, therefore, it is important to examine culture and community beliefs about mathematics in an effort to uncover and challenge those beliefs that undermine a students’ appreciation of mathematics (Martin, 2000; Civil, Bratton, & Quintos, 2005).

**The New Latino Diaspora.** Ten years ago, both Villenas and Murrillo described the situation of Latino immigrants working at poultry plants and living in an area in the New Latino Diaspora called Hope City as the new form of American slavery (Villenas, 2002;

Murrillo, 2002 as “Sunder Crossings”). Villenas’s description of the cultural violence inflicted on these Latino immigrants in the workplace and in the greater community brings to mind the pre- and mid-Civil Rights era of symbolic and actionable forms of racism present in daily life. Not surprisingly, this racism was also present in the school system and affected the way teachers, both caring and apathetic, viewed their Latino students. Reportedly, the worst cases were at the high school level, causing many students to drop out. Villenas says,

As a county advocate lawyer for Hope City Latinos/as explained, the most disastrous effects were at the high school level, where racism in the form of peer discrimination, institutional tracking, and inferior education for English language learners were rampant. Indeed the majority of Latino students were situated in the lowest level tracks, and the unusually high dropout rate was under legal investigation (2002, p. 20-21).

Villenas (2002) found even the health, social, and educational service providers for this area often characterized the Latino community as a whole from a deficit perspective, one that was not in line with the way parents described their roles in raising their children.

With symbolic racial violence surrounding them at work, at school, and in the community as a whole, the members of this New Latino Diaspora are “creators and forgers of new Latino communities” (Villenas, 2002, p. 30). This research causes us to wonder, how has changed or remained the same in the last two decades? What impact has the past within the New Latino Diaspora had on this area and the Latino students within it? And, where is mathematics positioned within this community and the Latino community inside it? This last question is quite important because mathematics holds a special role in education as the great divider, a tool of mobility or lack thereof.

### **Mathematics as a Tool of Educational Mobility and Gatekeeping**

Our relationship with mathematics can not only determine how we view ourselves as individuals, it can also determine aspects of our educational mobility (Martin, 2000; Kaasila,

2007a; Esmonde, Blair, Goldman, Martin, Jimenez, & Pea, 2011). While a positive relationship with mathematics can open doors to further education and career possibilities, a negative mathematics identity can swing those doors shut. Instead of telling the story of Latino students existing on the negative side of mathematical identity and educational mobility as defined by test scores, we need a lens with which to see the possibility, the positive, and the mobile.

Mathematics is a tool of educational mobility because it is considered a requirement for access to higher education and training in many fields. In this position, mathematics becomes a link, or a barrier, to better jobs and increased salaries. Therefore, mathematical knowledge is a form of capital (Bourdieu, 1977) that can transition into access to monetary capital. In their connections to peers and role models within their families and/or schools, Latino students may have forms of social and cultural capital that are or are not valued by the mathematics of schools. Cultural mismatch can contribute to mathematical anxiety and feelings of self-inadequacy (Ryan & Ryan, 2005 as cited by Lim 2008). When these forms of capital are valued, mathematics becomes a tool of educational mobility, but when these forms of capital are not valued, mathematics becomes a gate-keeper to students.

While mathematics can be empowering (Brodie, 2011) it also plays a role in perpetuating inequalities among historically marginalized groups (Quintos, 2008). To historically marginalized groups, mathematics is subject of abstraction with no real context and a gated community reserved only for students of privilege (Quintos, 2008; Apple, 1992; Gutstein, 2003; Stinson, 2004; Martin, 2012). Martin, Ghoulson, & Leonard (2011) explain that school mathematics “has been used to stratify students, affording privilege to some and limiting opportunities for others” (p. 14).

Even with the structural inequities that exist within society and the context of schooling, teachers themselves play a role in mathematics gate keeping, even by not acknowledging that mathematics is gated. “Mathematics teachers are positioned as gatekeepers, and yet many are reluctant to recognize the political impact of their teaching” (de Freitas, 2008). This gated nature of mathematics is not without critique. Scholars who focus on “Critical Mathematics” (Frankenstein, 1989; Gutstein, 2008) offer students and teachers a chance to use mathematics to examine social inequalities and injustices that exist in society (Brodie, 2011). Simply, these are the scholars that ask us to move past the current definitions of mathematics and the current narrative of Latino students in mathematics education. These scholars ask us to move beyond gap-gazing which can be done by looking at mathematical success.

### **Defining Mathematical Success: Standardized and Problematic**

Mathematics is a highly tested school subject. Mathematics scores represent a third of the two most frequently used college preparedness exams in the United States, the SAT and ACT. These scores are often used as criteria when evaluating applications to institutions of higher education and are also used to place students into requisite mathematics courses at community colleges and universities. Therefore, mathematical ability is associated with eligibility for higher learning and advanced training for higher paying jobs.

For the purposes of this project, I specifically focus on Latino high school students who are now or have been successful in school mathematics. This means they consider themselves to be successful, are in honors or AP mathematics classes, score well on mathematics standardized tests, and may even be considering majoring in a Science, Technology, Engineering, or Mathematics (STEM) field. With each aspect of this definition

comes a problematic association. First, whether or not a student considers themselves to be successful in mathematics is highly subjective, although the effect of beliefs about mathematics ability is widely studied. Second, research shows a trend of less Latino and African American students enrolling in advanced mathematics courses and majoring in STEM fields, and so some students might have limited access to or experience in these classes. And third, standardized test scores such as the SAT, ACT, and End-of-Course grades are on average lower for Hispanic and Latino students but test scores alone do not describe the full nature of students' relationships with mathematics.

### **Beyond Gap-Gazing**

An important potential first step in the effort to move past gap-gazing is to stop constantly positioning Latino students in relationship to their white peers. In order to more fully understand Latino students in the mathematics classroom, we must examine these students as individuals and groups of students who by their socialization and culture may have some commonalities and differences. We must see the human elements of our students and realize that their ever-changing stories are not fully written by our current methods of measurement. One thing is certain, this information cannot be found in test scores alone. We need to look at the influences on students, their peers, parents, and communities and how they make sense and meaning of the mathematics they encounter.

My work with mathematical identities of successful Latino students provides an opportunity to hear the voices of these students. In this research, I present an opportunity for them to explain and examine their own mathematical identities and the role their relationship with mathematics will play with regard to their educational and career mobility. I am purposely only looking at successful Latino students to challenge the reification of the Latino

mathematics education problem and the negative stigma left by the achievement gap literature, admittedly to the exclusion of other participants. While my focus is on high school students, implications for students and educators will be addressed.

While this chapter outlines the existence of the problem while Chapter 2 outlines the framework in which I base my research. The participants, location, and methods of research are described in Chapter 3.

### **Definitions**

**Latinos.** In my discussion of Latinos I am referencing males who identify as Hispanic or Latino and those whose country of origin is Spanish-speaking. It is important to note that though Latinos may have a common “historical legacy of Spanish” and a common history of structural discrimination in the United States there exist vast differences in birthplace, location, social class, and individual histories (Quintos, 2011, p. 31). In the United States school system, Latino students are bound together in the face of an educational system that frequently discredits elements of their shared culture in favor of the white, middle class paradigm. This research project is not meant to lump together all of these individuals as though they live a common experience but instead is an attempt to understand the experiences of a few, in hopes of touching on themes that may help us broaden the narrative of Latinos so carefully and negatively constructed by the achievement gap literature. Also, I use the term Latino in this study because the four cases described herein are males. My use of the term Latino is not to purposely overlook women and LGTQ members of the Latin@ and Latinx communities but, in the context of this study, Latino is a more appropriate term.

**Achievement Gap.** The purpose of this study is to actively speak against the narrative construction the achievement gap literature has presented for Latino students. The achievement gap in this paper refers to the reported difference in mathematics standardized test scores which allegedly show historically marginalized groups (e.g. African American, Latino, and Native American students) score at achievement levels below White students.

**Mathematics.** For the purpose of this paper, mathematics will primarily refer to the K-16 school subject of mathematics taught to students by teachers which is different in many ways from the field of mathematics as studied by mathematicians. The students at the center of this study are in high school and as such have had limited access to studying mathematics in the nature of mathematicians, an inquiry-based field.

**Mathematical identity.** Mathematical identity is defined in this paper to be the way in which an individual or group perceives their own relationship to the school subject of mathematics and mathematical problem-solving (Martin, 2000; Leatham & Hill, 2011).



## CHAPTER 2

### REVIEW OF THE LITERATURE

This chapter outlines the relevant research literature and theory that relate to the design and methods of analysis in this study. The literature is organized into three sections within this chapter: (a) the theoretical framework, (b) the literature review, and (c) the proposed tools of analysis. Theoretical framework focuses on Martin's (2000) multilevel model of *mathematical identity and socialization*. The literature review section outlines previous research on mathematical identities as it relates to students, teachers, parents, and community perspectives. And, the proposed method of analysis section outlines the use of case study as a tool of analysis in this research project.

#### Theoretical Framework

##### Martin's Mathematical Identity and Socialization

The basis for this project comes from Martin's model of mathematics identity and socialization. Although Martin's model is built around the experiences of African American students, the model offers insight into the sociohistorical construction of mathematical identities of individuals, families, and communities of people. The African American experience is inherently different than the Latino experience in the United States, although both are historically marginalized groups and as such both have a history of being described from a deficit perspective, especially at it relates to mathematics education (Martin, 2000; Gutiérrez, 2008). While this project explores Martin's work, the purpose is only to set up the

theory and method behind this research project, not to equate the experiences and identities of Latino students with those of African American students.

**Dynamic Mathematical Identity.** Scholars have explored aspects of students' mathematical identities of historically marginalized students (Martin, 2000, 2012; Spencer, 2009; Nasir, 2000). Martin (2000) defined mathematical identity and socialization as

The participants' beliefs about a) their ability to perform in mathematical contexts, b) the instrumental importance of mathematical knowledge, c) constraints and opportunities in mathematical contexts, and d) the resulting motivations and strategies used to obtain mathematics knowledge. (2000, p. 19)

Additionally, there are outside influences that affect mathematical identity, and one's relationship with mathematics can change over time (Kaasila, 2007a). Martin explains that while experiences with mathematics shape mathematical identities for students, "the individual is not passive in their mathematics socialization. Rather, he or she is both reactive and proactive – resisting, conforming, making decisions, forming beliefs and dispositions, and constructing mathematical knowledge and identities" (p. 34).

Martin (2000) suggests that looking at mathematical socialization and identity building is a missing element in understanding "the mechanisms responsible for producing problematic achievement and persistence outcomes as well as in accounting for mathematics success among African-Americans" (p.34). Martin (2000) refers to differential treatments such as the historical trend of African-American students being tracked into lower-level classes in schools with lower-qualified teachers and less money for facilities and instructional materials. This process creates a systematic reproduction of inequity and inequality for African American students, which can recreate negative mathematical identities. However, in order to fully understand a student's mathematical identity, it is important to be able to fully analyze their experiences at many levels (Martin, 2012; Berry, 2008).

Martin has three claims about mathematical identity as it relates to African American students which focus on the broader contexts, the experiences of individuals, and the active nature of participants in the construction of their own mathematical identity.

Mathematics learning, achievement, and persistence among African-Americans must be examined within their broader contexts... The experiences that characterize mathematics socialization and affect mathematical identity among African-Americans provide an important interpretive framework with which to understand outcomes in mathematics achievement and persistence. [And] African-American parents and adolescents are not passive in their mathematics socializations but exhibit a wide range of agency-related behaviors that affect their success or failure. (2000, p. 170)

Thus, the relationship between mathematical experiences and identities is not predictable or necessarily easily understood. Martin (2000) says that negative experiences can cause negative mathematical identities, but agency of the individual can overcome these negative experiences. He gives, as examples, students who became successful in mathematics as a response to negative stereotypes and pessimistic expectations. Additionally, influences on mathematical identity come from many places. For instance, understanding the beliefs and experiences of parents and community members as they relate to mathematics can help us understand the students' position towards mathematics.

**The socialization of mathematical identity.** Any research into mathematical identity must acknowledge and investigate the social influences present for all students. As a dynamic characteristic, mathematical identity is a product of various influences and socialization. Relationships matter in mathematical identity creation (Brodie, 2011; Boylan & Povey, 2009). The major players of this mathematical identity creation, or socialization, include teachers, parents, and peers. The term “mathematics socialization” (Martin 2000) describes the processes and experiences by which individual and collective mathematics identities are shaped in sociohistorical, community, school and interpersonal contexts

(Martin, 2000). Martin outlines the major themes from these various levels in his research, as summarized in Table 1.

Table 1  
*Martin's Multilevel Framework for Analyzing Mathematics Socialization and Identity among African-Americans: Key Themes*

<u>Level</u>	<u>Themes</u>
Sociohistorical	<ul style="list-style-type: none"> <li>● Differential treatment in mathematics-related contexts</li> </ul>
Community	<ul style="list-style-type: none"> <li>● Beliefs about African-American status and differential treatment in educational and socioeconomic contexts</li> <li>● Beliefs about mathematical abilities and motivation to learn mathematics</li> <li>● Beliefs about the instrumental importance of mathematics knowledge</li> <li>● Relationships with school officials and teachers</li> <li>● Math-dependent socioeconomic and educational goals</li> <li>● Expectations for children and educational strategies</li> </ul>
School	<ul style="list-style-type: none"> <li>● Institutional agency and school-based support systems</li> <li>● Teachers' curricular goals and content decisions</li> <li>● Teachers' beliefs about African-American parents and communities</li> <li>● Student culture and achievement norms</li> <li>● Classroom negotiation of mathematical and social norms</li> </ul>
Agency and Mathematics Success Among African-American Students	<ul style="list-style-type: none"> <li>● Personal identities and goals</li> <li>● Perceptions of school climate, peers, and teachers</li> <li>● Beliefs about mathematics abilities and motivation to learn</li> <li>● Beliefs about the instrumental importance of mathematics knowledge</li> <li>● Beliefs about differential treatment from peers</li> </ul>

Martin's multilevel framework of mathematics socialization and identity includes sociohistorical, community, school and personal agency factors affecting the creation of positive mathematical identities (Martin 2000). Martin is not the only researcher to address the social nature of mathematical identity. Walker (2006) also looked into the socialization of

mathematical identity. Her study describes a “web of influences” in mathematical identity building by looking at the effects of peers, teachers, parents, and community influences. She discusses how such influences fostered mathematical success among urban high school students (2006).

Although Martin later expands on this framework in “Learning Mathematics while Black” that looks at micro-, meso- and macro- levels of students’ identity building, he does so in such a way that specifically focuses on the African American experience. In doing so, he advances the framework beyond application to the Latino community at this point in the current research. Therefore, while Martin provides a basis for looking into mathematical identity, there is a point where his work diverges from being relevant to Latino students.

## **Literature Review**

**Latino Males and (STEM) Education.** While being careful not to gap-gaze, it is important to understand the present field of research on Latino males as it relates to academic success and STEM fields. As Sáenz and Ponjuan (2009) attest, there is a crisis in education as, “Latino males are effectively vanishing from the American higher education pipeline,” The students are more likely than their White or even Latina peers to leave secondary or post-secondary schools in order to join the workforce (Sáenz & Ponjuan, 2009).

In comparison to their White and Black peers among 18- to 24-year olds, Latino males had the lowest college and university enrollment rates and trail their peers (Ponjuan, Palomin, & Calise, 2015). Of the Latino students who do enroll in post-secondary education the majority do so in a 2-year college rather than a 4-year institution primarily because the cost is too great and they lack access to necessary information about attending a 4-year institution and/or receiving financial aid to do so (Ponjuan, Palomin, & Calise, 2015; Fry &

Taylor, 2013; Nuñez & Kim, 2012). Additionally, community colleges offer more flexible schedules, reduced cost, and greater accessibility for students, especially as some students are still balancing their plans for higher education with contributing financially to their families (Ponjuan, Palomin, & Calise, 2015; McDonough, McClafferty, & Fann, 20002; Pew Hispanic Center, 2009; Turcious-Cotto & Milan, 2013).

Ponjuan, Palomin, and Calise also found that “no Latino males ethnic subgroup (Mexican, Puerto-Rican, Cuban, Central American, South American, or other Hispanic) has a bachelor’s completion rate above 20%” at 4-year degree institutions and no more than 29% for 2-year institutions” (2015, p.62- 63). Researchers suggest after enrolling in 4-year institutions, some Latino males feel uneasy in their new surroundings (Ponjuan, Palomin, & Calise, 2015; Gloria, Castellanos, Scull, & Villegas, 2009). Carrillo (2016) suggests this may be due to being “perceived as ‘trespassing’ into a space that is generally considered outside of their cognitive/intelligence reach” (p.159). Students who are able to matriculate may feel additional pressure in being one of few Latino students on campus (Carrillo, 2016). Ponjuan, Palomin, and Calise, (2015) suggest Latino students would benefit from male- or ethnicity-focused organizations on campus.

***Latino vs. Latina.*** There is research to suggest that Latino males do not perform as well academically as their Latina counterparts in part due to low teacher expectations and negative teacher perceptions about Latino students (Sáenz & Ponjuan, 2011; Gardner, 2006; Sánchez, Colón, & Esparza, 2005; Valverde, 2004). Perceived discipline issues are also a huge barrier for Latino students, as students of color suffer from the negative academic effects of higher suspension rates (Arcia, 2007; Nichols, 2004).

Cruz (2014) suggests,

Latino boys face multiple social and educational factors that impede their academic success, such as: incarceration, lack of school support, tracking into lower level courses, and being viewed as trouble-makers where there are disproportionate numbers of Latino boys held in detention centers than whites. Moreover, more Latinos than whites are tried as adults and are targeted by police (Gardner, 2006), making educational attainment a lofty goal. (p. 5)

Similarly, Cammorota (2004), Lopez (2002) and Katz (1997) all argue that Latino males are often represented as gang members and/or deviants in society and, as such, are subjected to greater discipline and policing within schools. These students suffer the consequences of being out of school and loss of academic proficiency often as a result (Skiba et al, 2011). There is evidence to suggest the cause of these discipline issues is cultural mismatch between the student and teacher and/or classroom-level racial profiling (Gregory et al, 2010). Podsiadlo and Philliber (2003) also found higher graduation rate for Latino males in single sex, religious school with an emphasis on core subjects and development of bilingual literacy, but this hardly seems a sustainable or necessary model for more than a small minority of Latino males.

In addition to profiling, there are issues of curricular and cultural mismatch for Latino students. Herbert (2001) studied Latino students with high abilities in an urban high school finding a curricular mismatch of rote instruction of the teachers combined with the students' expressed need for hands-on learning styles in instruction. This mismatch created barriers to the Latino students' academic success (Herbert 2001). Also, Latino students without the guidance of a supportive mentor, even if academically gifted, are at risk for academically underachieving (Herbert & Olenchak, 2000). As a coping strategy, Latino students are prone to give themselves identities as non-academics (Sleeter, 2004; Ford, 1996), resisting higher education. Latino students are less likely to matriculate into or complete college, even if they

do complete high school (Wilkins & Kuperminc, 2009). Further, those that do venture into higher education do not seem to be going into STEM fields.

According to Flores (2011),

In 2006 Latinos numbered 44.3 million people, accounting for almost 15 percent of the total US population (NACME, 2008), but only a mere 2 percent of those 44 million Latinos living in the United States worked in STEM-related fields (McGee, 2008). By 2042, Latinos are expected to grow to 30 per cent of the US population (US Census, 2008).”

With Latinos representing such a large and increasing portion of the population in the United States, their absence in higher education and STEM fields cannot be ignored.

Wyner, Bridgeland, and Dilulio (2007) warn that Latino students are particularly vulnerable of losing their identity as high-achieving students early on, at the elementary level, especially if they are also low-income students. Research also suggests that students begin to self-identity as having a good or bad relationship with mathematics in early adolescence, around ages 11 and 13, respectively (Rodriguez Flecha, 2012). One purported cause is that Latino students often feel invisible in the classroom, citing lack of support structure with respect to peers and teachers in STEM-based classes (Strayhorn, 2009). The majority of school curriculum is focused on the needs and learning interests of middle class, white students (González et al, 2005) and Latino students are not often exposed to curriculum that would create an interest in working in a STEM field (Chapa & De La Rosa, 2006). Latino males also cited challenges connecting STEM topics to real life and their own interests (Strayhorn, 2009).

With higher dropout and suspension rates and lower representation of Latino males in post-secondary education, an important aspect in research is focusing on instances of success and the support structures in and out of schools that contribute to that success (Cruz, 2014;



Zimmermann, Johnson, Wambsgan, and Fuentes, 2011). There are, however, signs of hope. By looking at Latino males who successfully completed their PhD, Cardenas found that, despite sacrifices and injustices, self-motivation and support structures can lead greatly towards educational advancement of Latino males (2014). Similarly, in looking at first-year, college students, Lu discusses finding a supportive learning community was instrumental in having a successful transition to STEM-related academic course (2015).

Additional research suggests that relationships with parents and teachers are a possible but not determining factor in academic success leading to choosing STEM careers (Rodriguez Flecha, 2012). While other research suggests that, despite close connections with family and support structures, individualistic determination and self-efficacy are often purported reasons for academic success (Cammorota, 2004; Morales, 2010; Covarrubias and Stone, 2015).

Research about successful Latino male is still in its infancy relative to the field of mathematics education, but recent research has been explored in the field. Cruz (2014) researched students in gifted programs in urban high schools. Cruz identified the four types of students in her research, i) the conformist, ii) the self-assured, iii) the story-teller, and iv) the non-conformist. Both the conformist and the self-assured students were in gifted programs with high accountability, and the students felt supported by friends, family, and teachers. These two types of students were considered high-achieving while the latter two, the story-teller and the non-conformist, were considered low-achieving. The story-teller and non-conformist students were involved in low-oversight programs, where students are prone to slip through the cracks. Contrary to their high performing peers who spoke of narratives of independence, responsibility, and confidence, they have experienced a lack of motivation

and a loss of confidence while developing avoidance mechanisms towards academics in general (Cruz, 2014).

**Breaking the Narrative through Examining Experiences.** In this section, I discuss Critical Race Theory (CRT) and LatCrit method of using counter-storytelling, or counternarratives to challenge dominant paradigms in society and, in this particular situation, education. In doing so, I am positioning my work as a version of storytelling that is counter to the dominant narrative of Latinos in STEM education. The CRT and LatCrit theories are valid and should be addressed in this project, especially since the framework for this research project also originated in CRT. I am not, however, positioning myself as a Critical Race Theorist or LatCrit researcher. While I value and encourage the work of these scholars, as a White middle-class female, I do not view myself as one who can fully engage in this work without, even unconsciously, co-opting a movement lead by People of Color.

As a part of LatCrit, which uses a framework based on CRT, scholars have begun to challenge the marginalization of Latino students (Solarzano & Delgado Bernal, 2001). At the heart of this research is theme of the “centrality of experiential knowledge” (Solarzano & Delgado Bernal, 2001, p.314). Solarzano and say

A CRT and LatCrit framework recognizes that the experiential knowledge of Students of Color are legitimate, appropriate, and critical to understanding, analyzing, and teaching about racial subordination in the field of education. In fact, CRT and LatCrit educational studies view this knowledge as a strength and draw explicitly on the lived experiences of the students of color by including such methods as storytelling, family history, biographies, scenarios, parables, *testimonios*, *cuentos*, *consejos*, chronicles, and narratives (Bell, 1987; Carrasco, 1996; Olivas, 1990; Solarzano & Villalpando, 1998; Solarzano & Yosso, 2000; Villalpando & Delgado Bernal, in press; Villenas & Deyhle, 1999). (2001, p.314)

This experiential knowledge can be shared through oral histories and counter-storytelling (Solarzano & Yosso, 2002), thus leading to the exploration of counternarratives.

Solarzano and Yosso argue that counter-storytelling offer an ability to build community among those at the margins of society, challenge existing perceived wisdom, create new opportunities for the marginalized by exposing them to role models, and create a richer story than previously existed (2002).

There is a need for counternarratives to the existing research in mathematics education particularly as they relate to Latino males (Ríos Vega, 2015). As Ríos Vega points out, previous research either focuses on a Black-White binary or lumps all Latino/a students together (2015). In doing so, this research does not paying attention to the differences in gender and runs the risk of “perpetuating the norm of Latino boys as uninterested in their education,” when, in fact, they may be singled out and profiled as problem students (2015, p.18). But, these counternarratives need not represent all Latino students; they simply work to challenge the dominant narrative.

And so, there is some research beginning in examining Latino counternarratives as they relate to mathematical identity. Zavala (2012), in researching Latino/a high school students, reminds us that mathematical identity and racial identities intersect in very complex ways. Zavala (2012) says

The intersection of mathematics identity and racial identities may provide some explanatory power for how students resist dominant discourses of Latino/a underachievement by feeling motivated to succeed...The intersections of mathematics and linguistic identity provide fruitful area to understand the agency students may exhibit in findings resources for their own educations...The intersections of race, language, and mathematics identities are under-researched and undertheorized areas (p.125).

But, Zavala also warns that the experiences of Latino youth are varied and complex, they cannot be reduced down to simple, singular characterizations or a silver bullet fix to educational issues, like the need to overcome a language barrier. Therefore, these are not

simple issues to take on and there are many factors in play for each student, but the basis of this work may exist in the mathematical identity of students.

*Mathematical Identities of Students.* In his case studies of successful African American students, Martin (2000) examines themes within these case studies, such as personal identity and goals or belief about mathematical ability and the motivation to learn. Martin chose this group particularly because he argues that successful African American mathematics students are understudied (2000). In doing so, Martin shows the ability of African American students to succeed in mathematics, despite structural inequities and the presence of racism in schools. Based on positive self-identities, motivation, respect for caring teachers, support from parents, and a general belief about the importance of mathematics to their lives students are able to have mathematical success. Martin's choice to look at students who are successful in mathematics results in positive, yet critical stories of students who are aware of the ways in which they have been treated differently. These students identify both as African American students and those who are successful in mathematics, or "nerds" as they sometimes refer to themselves (Martin, 2000).

Black, Williams, Hernandez-Martinez, Davis, Pampaka, & Wake (2010) also discuss mathematical identities by explaining the different leading identities that students evoke in their participation in mathematics. Exploring two case studies, Black et al (2007) locate the way students value mathematics with respect to its "use value" (p. 55), such as vocational uses, and its "exchange value" (p. 55), in which mathematics is a means to an end of access to higher education. This distinction indicates that an individual's mathematical identity is formed in relation to the purpose with which they perceive mathematics to have in their lives. Similarly, a study comparing English and Norwegian middle and high school students

(Pepin, 2011) was able to identify seven key themes from student questionnaires focused on students' perceptions of mathematics. One theme found was the idea of mathematics as necessary for delayed gratification of later life goals such as a good job. Additionally, the students identified the importance of working with peers and having the support of teachers and family members. While these themes are important to understanding students dynamic mathematics identity, the findings may be different when set in the context of the New Latino Diaspora in the United States rather than in European schools.

Walker (2006) examines the experiences and mathematical identities of successful African American and Latino students in the United States. Walker specifically looks at the role of peers and family members and finds that peer and family support is not only not missing from the stories of these students, but are central to their success. Walker's work refutes the lack of parental support myth for historically marginalized students, finding that parents had very high expectations for mathematical performance of their children (2006). Walker also discussed that in the minds of these successful yet marginalized students, collaboration and competition were not at odds but were both strategies employed by these students to succeed and further motivate themselves to learn mathematics. Peers, however can also play a role in limiting a student's motivation to succeed and can even effect teachers' beliefs about students (Lim, 2008). If a student is surrounded by peers who do not value mathematics education, then they begin to take on this view. Likewise, when teachers see students in social groups who feel this way, they may begin to have decreased expectations for these students' performance.

Research on mathematical identity is not limited to younger, K-12, students. Wilson, Winbourne, & Tomlin (2008) look closely at one adult woman's story by highlighting her

struggles with mathematics as a dyslexic from youth to adulthood. Despite having very negative experiences early on with mathematics, for example quite literally being labeled with a dunce cap, the woman is able to continue to try to understand mathematics, and change her mathematical identity. Work like this can be useful in helping teachers identify their roles in creating mathematical identities of students. While the use of dunce cap today may not be in the literal sense, students are often labeled in ways that represent the figurative dunce cap. And, their work suggests that we should look further into why for some negative mathematics experiences results in a negative mathematical identity and trajectory while for others a positive trajectory still exists (Wilson, Winbourne, & Tomlin, 2008). In this trajectory, race, class, gender, and other factors may play parts. It is not enough to look at the mathematical identities of students. Teachers play a crucial role in nurturing mathematical identity of students and we must analyze their mathematical identities as well.

***Mathematical Identities of Teachers.*** Teachers are “agents of mathematics socialization” (Martin, 2000, p. 91). Like their students, teachers have dynamic mathematical identities which changes over time (Kaasila 2007b; Kaasila, Hannula, & Laine 2011; Owens 2007/2008). Owens presents evidence that teacher’s mathematical identity shifts in response to supportive social influences. By working in supportive, teacher communities, teachers can develop and change their mathematical identities, especially when exposed to new curriculum and pedagogy (Owens 2007/2008). And, their mathematical identities can be purposefully challenged and changed. To this end, teachers can be rehabilitated from negative to positive mathematical identities (Lutovac & Kaasila, 2011).

Using mathematical biography and narrative analysis, Kaasila (2007b) was able to analyze key rhetoric to understand a preservice elementary teacher’s mathematical identity.

Kaasila describes Sirpa as a student whose positive experiences and role models in mathematics helped create a positive mathematical identity. This positive mathematical identity was strong in foundations to the point that setbacks in mathematics were not seen as deterrents and mistakes made were seen as necessary tools of learning. With a positive mathematical identity, Sirpa was able to transition from a student of teacher-led mathematics classes to a teacher of student-led mathematics classes. In this transition, Sirpa began distancing herself from her what she perceived to be her former mathematical identity, using educational research and her own reflections as fuel to continue her transformation.

Kaasila (2007a) uses narrative to transform preservice teachers' feelings about mathematics. For Kaasila, "a narrative approach opens up the forms of telling about experience, not simply the content to which the language of the narrative refers: we can ask why the story was told in the way it was" (2007a, p. 205). He emphasizes a focus on both the form and content of preservice mathematics teacher narratives, primarily using the example of Leila.

Leila is a preservice elementary school teacher whose mathematical biography reveals that she has had some traumatic experiences with mathematics in the past. Leila's difficulty in understanding mathematics at an early age led her to self-deprecation and a lack of self-confidence in the formation of her mathematical identity and her understanding of mathematics teaching and learning. She describes her mathematical identity in a metaphor of insiders and outsiders, with no way to change the dichotomy. Her negative experiences made the prospect of teaching mathematics very worrisome for her; however, these negative experiences also had a positive impact on her teaching. Leila considered understanding and having a positive attitude towards struggling students as paramount to teaching. As such, she

was very reflective about her lesson creating a liminal space in which, as she developed as a better mathematics teacher with respect to her major concerns about teaching, she also developed a positive mathematics teacher identity and was, as a result, able to change her mathematics story to having a positive ending. Thus, Kaasila's main focus of the article is that narrative rehabilitation, the practice where pre-service teachers share their stories and, through proper facilitation, amend their previous interpretations. A teacher's interpretation of their mathematical experiences can change for the better allowing them to become better mathematics teachers for their students.

Teachers have roles in creating a positive mathematics identity amongst students by using critical caring defined by high expectations and "hard caring" in which teachers push students to strive harder while offering support instead of making excuses for them or allowing them to perform under expectations (Antrop-Gonzalez & De Jesús, 2006, p. 424-425). And there is evidence to support that, despite differing in pedagogical practices, teachers can affect positive changes in students' mathematical identities. In a study comparing two elementary school classes, Hodge (2008) stressed the importance of acknowledging mathematical competence among students, despite differences in pedagogies of the teachers.

Regardless of pedagogy or definitions of caring, teachers can benefit from understanding the wide range of dispositions that they and their students have about mathematic (Leatham & Hill, 2011). As mathematical role models, the example set by teachers inevitably affects the formation of identity amongst their students. Similarly and perhaps of more importance, social and familial influences also effect this outcome.



*Mathematical Identities of Stakeholders.* Martin reveals various stories of mathematical identity among the African American parents he interviewed. Many of the stories highlighted by case studies report early negative experiences with mathematics that accompany experiences with racism (2000). While some students were able to use individual agency or resistance motivation to turn their negative experiences into positive mathematical identity and/or ability, others were left with a persistent negative identity in mathematics.

Martin (2000) specifically notes that his work in mathematical identity is not meant to explain or only look at family socialization. But without taking on this agenda in his work, he warns,

The manner in which the mathematical beliefs, experiences, and identities of African-American adults affect the lives of their children can only be inferred. Nevertheless, it does seem reasonable to suspect that African-American parents and community members respond to their experiences in ways that send implicit and explicit messages – positive and negative – about the importance of mathematics learning and knowledge to their children... Very few of the African-American adults in this study could cite a history of having benefited from mathematics in ways that may have shaped a system of beliefs in which participation in mathematics was viewed as an ideal way of behaving. But because my analysis also includes cases where parents assumed a strong and supportive role in their children's education, my assumptions about the roles of families also takes advantage of the knowledge that parents are capable of invoking the kind of positive agency that is necessary for their children's success, despite their own experiences (Martin, 2000, p.38).

Martin (2000) says parents with negative mathematical identities express frustration over not being able to help their children in doing mathematics homework. The long-lasting effects of a negative mathematical identity, to some degree, informed the way they presented their perceptions of the importance of mathematics to the children or students within their community. And while mathematical identities are dynamic in nature, some remain static.

Wendy remarked that somewhere along the line she 'got lost' in mathematics and from that point on she never believed that she could succeed. These feelings about her ability did not change over the years even though she had recently experienced

short-term success in her mathematics course at a local community college (Martin, 2000, p. 174)

Martin's parent and community-member participants recalled experiences of racism and discrimination on the part of their White teachers in their explanations of early, negative mathematical experiences and identity formation. The cultural and racial mismatch of schools and students results in miscommunication and negative mathematical identity formation. Similarly, research has shown that while Latino parents also have high expectations for the children when it comes to mathematics education in school and in the home, but these expectations may not be the same that are valued by schools (Civil, Planas, & Quintos, 2005).

### **Summary**

While we seem to study teachers' and students' mathematical identities and even how they affect student learning, we still know relatively little about parents' mathematical identity and how they relate to the mathematical identities of students. Further work in this area could serve to inform pre-service and in-service mathematics teachers in working with parents and students. Whether used to inform teachers about the effects of positive and negative mathematical identities of parents on students, or to work towards rehabilitating negative mathematical identities of students and parents, there is a need for further understanding as it relates to this topic.

We can learn a great deal by investigating mathematical identities of students, parents, teachers, and even community members. The way in which we do this helps to rewrite and fill gaps left by purely quantitative measures. Martin's work purposefully focuses on successful African American students with regard to mathematical identity. He does so in a way that speaks against the typical discussions of the achievement gap, for

which African American students are positioned as lacking in comparison to their white counterparts (Martin 2012). But, Martin's work does limit the scope by excluding stories of other groups that could be beneficial to mathematics education research. This study would move this framework forward to focus on Latino students by also focusing on their successes. Mathematical identity particularly of successful students is at present understudied in Latino educational research. And so, the question becomes how do we best study Latino mathematical identities?

### **Research and Analysis**

**Case Study.** This research project is an exercise in case study methodology. Case studies are “intensive analyses and descriptions of a single unit or system bounded by time and space” (Hancock & Algozzine, 2011, p.10). Case study is narrative in its nature. The reporting of cases typically involves intricately illustrative descriptions while also allowing for thematic analysis (Hancock & Algozzine, 2011). Case study was selected for this research project for a number of reasons. First, the need to focus on the stories of individuals, to provide counternarratives, meant an in-depth look at certain, but maybe not all, participants in the research project. Case studies allow researchers to get as close as possible to the individuals. And, with interviews of mentors, mentees, and/or parents, there was a large amount of information collected, but was best used only to inform the stories of those individual high school students.

Experience is the stories people live. People live stories, and in the telling of these stories, reaffirm them, modify them, and create new ones. Stories lived and told educate the self and others, including the young and those such as researchers who are new to their communities. (Clandinin & Connelly, 2000, p. xxvi)

**Math stories.** The stories we tell ourselves and others provide clues to the lenses with which we see the world (Bruner, 1996; Black et al., 2010). Narratives help us make sense of

situated experiences. Clandinin and Connelly (2000) use Dewey's emphasis on experience as education (1938) to support researchers focusing on the experiences of individuals in research. They argue that, in doing so, we not only gain access to the experience of others but also take on their experiences as in some way our own. As opposed to test scores, which are concerned with human achievement, this research happens out of concern for the human experience (Clandinin & Connelly, 2000). In my research project, I solicited the stories people tell about mathematics out of the same concern for capturing human experiences and focusing less on standard measures of achievement.

We often define ourselves internally and to others by the stories we tell (McAdams 1993). The narratives that we choose, alter, and repeat give great insight into who we are and what we value as individuals or within a community. Our culture affects the telling of these stories (Oslund, 2012) and thus plays a significant role in our identity construction and representation. Examining autobiographical pieces has been used to understand both student and teacher mathematical identities through (Esmonde, Blair, Goldman, Martin, Jimenez, & Pea, 2011; Boylan & Povey, 2009; Kaasila, 2007a; Drake, Spillane & Huffer-Ackels, 2001) and even poetry (Oslund, 2012). The information gleaned from the mathematics stories people tell helps to fill in our gaps in knowledge and create a broader big picture of students, teachers and even families and the way they interact with mathematics.

Born out of identity work (Boylan & Povey, 2009) recent trend in mathematics education research has focused on individuals telling stories about mathematics. These stories elaborate on how students come to define themselves with relation to mathematics, as being good or bad at mathematics and how this determination affects their lives (Boylan & Povey, 2009). These stories give voice to the "emotional experience of mathematics"

(Boylan & Povey, 2009, p. 56). As such, mathematics becomes more than a school subject in which answers are right and wrong; it is a lens through which we view ourselves in binaries as smart or dumb, part of the group or isolated, and generally, normal or other.

Boylan and Povey share an example of Louise, a student who became disenfranchised with mathematics at an early age, who learned to hate and fear the subject and often reverts to a younger version of herself when thinking about the subject (2009). With these examples, mathematics educators learn the extent of the damage that can be done in the mathematics classroom and learn lessons about the effects our work has on students over the course of their entire lives. Further research shows us that these distinctions in lifelong identities, about general intelligence and our relationship to mathematics, are not limited to the individual, but are created in groups in school and in the home.

Esmonde et al. used what they refer to as “Math in a Minute” stories from families about the mathematics of the home and the mathematics of school (Esmonde et al, 2011). The researchers used semi-structured interviews in which they collected these verbal stories told in a group setting. Esmonde et al also address how these MIAM stories were “often tied to statements about the ‘kind of person’ someone was” (Esmonde et al., 2011, p.4). The authors expand this idea of types of people to include mathematical identity. Within these stories they were able to address three types of mathematical, school-based identity found by Drake, Spillane, and Huffern-Ackles (2001) of turning point, failing, and roller-coaster (Esmonde et al., 2011, p. 5).

While in some cases these self-identifications seemed relatively static and long-term, our data set suggest that a view of mathematical identity as individual and enduring is too simplistic. As discussed in the introduction, we use the term identity to refer not only to people’s beliefs about themselves in reference to mathematics, but to the ways in which they are socially and situationally positioned with respect to mathematics...A number of our stories exemplify the shifting and socially constructed nature of one’s

mathematical identity. (Esmonde et al., 2011, p. 15)

The authors use their work to support creating a version of school mathematics that more closely resembles home mathematics with more problem-solving and risk-taking approaches.

Home mathematics stories had a variety of tasks, used diverse kinds of math, and the problems were solved socially or as a group (Esmonde et al., 2011). These stories focused on getting it done rather than getting it right, represented mathematics as a fun family activity, and highlighted social and personal responsibilities for the individuals on their own and within families (Esmonde et al., 2011). Where home stories were rich with specific description and anecdotes, school stories were more generalized experiences, not individual stories.

With reference to family mathematics games, Esmonde et al. (2011) describe

When mathematics was the end goal of the game, like comparing distances on a long family road trip, or sending funny mathematics problems to one another via email - problem-solving was supported by multiple resources, multiple people, and everyone had a chance to be successful. Far from being mathematically barren spaces, we found that home environments abounded in mathematical activities that almost all family members participated in (p. 19).

The school mathematics stories, on the other hand, focused on teachers playing a central role. These stories included subject-specific problems (akin to textbook problems), experiences with teachers, and grades earned in class (Esmonde et al., 2011). The school version of mathematics was portrayed as for mathematics done for math's sake as opposed to the home version of mathematics that was portrayed as mathematics to solve a problem. Games from school mathematics stories are described as "prototypical 'fun' school mathematics activity – a competition – that serves mainly to differentiate winners (smart students) from losers (dumb students)" (Esmonde et al. 2011, p. 19). These excerpts from this research give us

insight into how we come to understand the complex mathematical identities of students and the influences on such identities. Thus, we are able to move forward to examine mathematical identities in a Latino community.

### **The Use of Martin's Framework in Latino Studies**

Quintos (2008) also used Martin's framework to look at the pedagogies of two teachers and to build case studies of students in a Latino community. In using Martin's framework, Quintos argues the deficit models describing African American students' intelligence, the role their parents play, and the expectations for these students held by the community all seem to parallel to the experiences Latino students (2008). Quintos focused primarily on the classroom level, pedagogy of a culturally responsive teacher and parental involvement in mathematical activities giving case studies of some children and their parents (2008). My work adds to this research by being centered on the mathematical identities of students, incorporating the mathematics identities of peers, parents, and teachers to better understand student mathematical identity.

### **Summary**

There deficit perspective in the literature in mathematics regarding high stakes testing and the existence of an Achievement Gap for both African American and Latino students in relation to mathematics test scores of their White peers. This deficit perspective, in which these students are often blamed for their lack of academic success, also accompanies differential perceptions of ability in school for African American and Latino students (Quintos, 2011). Rochelle Gutiérrez (2002) says

Equity is threatened by the underlying belief that not all students can learn mathematics...U.S. citizens tend to believe that mathematics achievement is more directly related to ability at birth. Therefore, the belief goes, no amount of effort will compensate for those students who lack innate ability or talent. (p. 146).

As opposed to the view of having an innate and inherent disposition towards mathematics based on natural ability, however, individuals have a dynamic mathematical identity that changes over time and through interaction with many influences, especially social and educational influences (Martin, 2000). And, in addition to blaming the students for their own lack of success, research exists that positions parents, rather than structural inequities, as scapegoats for subpar mathematical performance (Quintos, 2011; Gutman & McLoyd, 2000). While some researchers look to blaming individuals, others reference places of empowerment and support from parents and peers (Martin, 2000; Walker, 2006). The latter is where I position my discussion of a theoretical framework as I address students and the influences surrounding them in the creation of a dynamic mathematical identity.

In using Martin's framework, I am not suggesting that the experiences, identities, and socializations of Latino students are the same as African American students. I hypothesize that, despite some potential commonalities, their experiences are quite different. Martin's framework, as defined by the key themes, seems transferable to the members of the New Latino Diaspora. For instance, Latino students are consistently given differential treatment by being tracked into lower-level classes (Villenas, 2002). Further, Latinos in the new Diaspora are often relegated to lower wage and manual labor jobs with lower levels of education based on prejudices or policies that bar these individuals' access to higher education (Villenas, 2002; Murillo, 2002).

Having set the stage to use Martin's framework with successful Latino high school students, I offer four research questions which have driven my case study project.



## **Research Questions**

1. How do successful Latino students describe their relationship with mathematics, their dynamic mathematical identities at the high school level?
2. How is school success, mathematical or otherwise, related to ones perception of their own culture?
3. In what way do peers, teachers, and, parents influence these mathematical identities of these students?
4. In what way do students perceive their mathematical identity to affect their own educational and career mobility?

## **CHAPTER 3**

### **METHODS**

Case study research methods were used in order to move past the deficit narrative of Latino students in mathematics education that has been constructed by the Achievement Gap literature. I used Martin's (2000) framework, described in Chapter 2, to situate my research questions and used similar themes as a basis of early data analysis. This chapter addresses the use of case study as a mode of research and describes the rationale for selection of the participants and the data collection process for each participant.

#### **Case Study**

This research project used case study methodology to examine the mathematical identities of Latino males participating in a UBMP. Case study methodology was selected for this research project because it allows the researcher to describe individuals in great detail and, as such, is a method conducive to providing a counter-narrative to the dominant narrative. The dominant narrative of Latinos in mathematics education, described in Chapter 1, focuses on the lack of achievement among Latino students. By creating case studies of Latino students who have demonstrated success in school and in mathematics courses, this research provides stories of students that counter this dominant narrative.

Case studies typically involve in-depth and/or multiple interviews with participants, or cases, as occurred in this research project. And, in addition to being a legitimate way of producing counter-narrative, case study methodology is best applied when examining

interviews with individuals with great detail is an appropriate method of answering the research questions of the project (Hancock & Algozzine, 2011), as is present in this case. The analysis of the case study methodology, such as categorizing, recombining, and cross-checking (Hancock & Algozzine, 2011), are also appropriate to this research project.

Case study has been used by many researchers in various fields and can be described in different ways. Hatch (2002), outlines some important characteristics of case studies. First, case studies should focus on individuals representing a group. For this research project, the individuals are the four participants discussed and they are to a degree representative of the larger group of successful high school Latino males in the NLD. Second, a specific phenomenon is researched and the research is done in the natural context (bound time and space) of the phenomenon. The research of this project was conducted in the NLD, in the communities in which the students lived if not in their homes, during the time when they were in high school (i.e. not in transition to college, etc.). And third, the data sources are “richly descriptive” (Hatch 2002). Data, including quotes, anecdotes, narratives, and other techniques are “explored and mined” (Hatch 2002) for information that helps understand the phenomena.

According to Hancock and Algozzine (2011), case study should be exploratory as opposed to confirmatory. Part of this difference is that while questionnaire and rigidly structured interviews allow for only a highly controlled questions, often few in number, case study and its typical method of semi-structured interviews allow the flexibility to ask additional or follow-up questions, or to revisit and re-interview the subject and/or other stakeholders to seek additional information. Third, while other research methods tend to test hypotheses and/or previously examined relationships, the role of case study is to identify

themes that help to explain the particular phenomenon, as once again bounded by time and space (Hancock & Algozzine, 2011).

As summary of case study methodology Hancock and Algozzine (2011) say,

Merriam (2001) suggests case study research may be founded in ethnographic, historical, psychological or sociological orientation. Case study research design may be classified as intrinsic, instrumental, or collective (Stake, 1995). Types of case study research design include exploratory, explanatory, and descriptive Yin, 2003). (p.35).

The research project described herein, then, falls best into the categories of sociological, intrinsic, and descriptive. This research project is sociological because it is focused on how identities are formed through interaction with societal and educational influences. Gender, race, and status are central to the foundation of defining the unit of analysis, i.e. successful high school Latino students. This research project is intrinsic because it seeks to investigate not only just a group of students, but individuals within that group. And, this research project is descriptive because it expounds on previous research but is not focused on correlation or causation.

It is important to note that this study is focused on the lives and experiences of individuals and, as such, is not intended to be generalizable. Generalizing is not necessarily inherently bad all the time, but previously it has created a situation that allows us to gap-gaze or approach research from a deficit perspective especially as it relates to research on Latino students in mathematics education.

### **The University-Based Mentoring Program**

It is important to acknowledge that this research project is focused only on the individual participants and not the mentoring program to which these students belong. Since the University-Based Mentoring Program (UBMP) targets Latino students who have

demonstrated academic success, the UBMP served primarily as a great vehicle for identifying the cases in this research project. While this research project does not represent an evaluation of the program, a description of the program is necessary in order to provide insight to the identities and influences of the participants, and to further explore the context of the study. The UBMP will be discussed to provide a context for the study, but it does not represent a unit of analysis for this project.

While undergraduate mentoring programs (UMP) are usually contained within the university, in order to focus on college retention rates (Gershenfeld, 2014), this UBMP pairs university student mentors with high school mentees and focuses on first-generation, college-bound students and their parents being prepared for matriculation. In a review of UMPs, Gershenfeld identified five components that help to define mentoring programs. These are mentor-mentee ratio, voluntary or mandatory participation, compensation, frequency, and support. The UBMP in this study has a 1:1 mentor-mentee ratio, participation is voluntary and compensation is not provided. The frequency of mentoring session and the level of mentor-mentee support varies based on the mentor-mentee schedule and relationship but monthly events involving all mentors and mentees are scheduled. All participants in this project reported being active in the program and well-supported by their mentors on an average of a weekly or bi-weekly basis.

**Recruitment of mentees.** The UBMP has teacher liaisons and site coordinators at each high school that recruit Latino students who they think might be interested in the program. The coordinators for each site then interview and review the applications of the high school students from that site. The co-directors of the UBMP also often review most of the applications of the mentees. There is then an extensive meeting (usually for 5-6 hours)

during which all of the site coordinators and the co-directors meet to select mentees. Each year twenty five mentees in each high school class from sophomores, juniors, and seniors are paired with university-student mentors.

For mentees, the UBMP tries to select middle-tier students who have a strong desire to go to a four-year university. The program will often not select students at the very top of their class who would otherwise be able to excel without the program because they want to make sure that those who do need the program will have access to it. Similarly, the program does not select students who are in danger of dropping out of school. The program requires that mentees come to each academic event, which is for four hours once a month at the university. Mentees are required to complete twenty hours of community service a year and that they complete the program's academic assignments.

**Recruitment of mentors.** In order to recruit mentors at the university level, the program members advertises at the annual informational session for university students as well as in the library, dining hall, and student stores on campus. They hold informational sessions, do Facebook social media campaigns, and promote the program through emailing listservs in order to solicit applications from mentors. Each co-director, as well as one or two other student executive board members, interviews every applicant. The UBMP then uses a system so that two members of the student executive board, as well as one co-director, read through and rate each application. Finally, the group meets for an extensive meeting (usually 5-6 hours) to select mentors. When finding mentors, the governing body of the UBMP demonstrates a commitment to issues pertaining to minority groups and access to education. The program seeks out personable individuals with a strong GPA and experiences/skills that would translate into being a good mentor.

**Creating relationships.** The program is geared towards creating positive relationships between mentors and mentees. It is not a program for remediation of high school subjects, and it requires mentors to reach out to their mentees at least once a week. This outreach can be in person, via phone call or social media, e.g., Facebook message. They also encourage mentors to join a committee related to the internal workings of the program, such as the committee that arranges the community service events or the committee that organizes the professional development workshops. In terms of pairing mentees with mentors, all site coordinators and co-directors, as well as any other interested member of the Student Executive Board, meet for another 5-6 hour meeting session. All mentees and mentors are then paired based upon a variety of factors including background, family situation, extracurricular involvement, and academic/career interests.

In addition to mentoring and the academic sessions at the university, the program also offers students services to prepare them to apply to and be successful in college. There is a composition course to sophomore mentees, and a college preparatory seminar to junior and senior mentees and offer professional development workshops to all mentees, and this year have partnered with an exam preparatory company to offer a free, full ACT course to all juniors. The program also provide occasional health workshops, such as those related to mental health, healthy eating, and sexual/reproductive health.

**Study participants.** Although other high school and college students in the UBMP were interviewed at length, this research project focuses on four high school students involved in a University-Based Mentoring Program (UBMP). Each of the four cases presented in this research is a high school senior who has been in the UBMP for three years. In addition to interviewing these students, I also interviewed their mentors and, when

possible, their parents, but only to provide further information about the high school students. By their inclusion in this program, all participants selected were considered successful Latino high school students. The definition of success is important to moving past the deficit model Latino students, who are often described by the ways in which they lack mathematical knowledge or do not adhere to the white, middle-class paradigm of the school system in educational research.

Within their status as successful students, these four UBMP mentees still had a broad range in terms of their relationship with mathematics and school in general. They also have very different personalities and interests. David, Daniel, and Rafael describe themselves as hard-workers both in and out of school. They each are able to recount instances where they have had to work hard in order to excel in school. On the other hand, Mateo describes himself as lazy and not wanting to work very hard but having had school subjects come more easily to him. David describes himself as being very religious while the other three students did not mention religion in any of the interviews. In interviews with him and his family, religion seems to be a major driving force in their lives and work, but religion never came up in any interviews with other students. And finally, a few of these students showed great interest in societal issues and various forms of activism, while others do not bring those issues to light much. In all, working with these four students presented an opportunity to hear varied experiences even though in some ways these students could be categorized similarly. Since the purpose of this research was a deeper understanding of individuals, and not a generalization of the larger group of Latino males, these similarities and differences were compared at length before the cases for this study were selected. Of course, it is unfair to boil these participants down to a single identifying characteristic, but in the hopes of



acknowledging some form of maximum variation (Merriam, 1988), it is necessary to explain the defining characteristic for why each student was selected. These students are described in greater detail in Chapter 4.

Table 2

*Summary Regarding Selection of Cases*

<b><u>Cases</u></b>	<b><u>Primary Justification for Selection</u></b>
Daniel	On paper, the most academically successful of all other participants.
Mateo	Of the participants, the one least interested in pursuing a STEM degree.
David	Socially very different from all other participants.
Rafael	The participant most interested in pursuing a STEM degree.

My research is geared towards looking at the positive side of Latinos' relationship with mathematics, seeking to understand the bridges and barriers to a positive mathematics identity that might exist at a peer-group, school, community, or home-based level. The UBMP mentoring program is especially important because, unlike other mentoring programs which may pair students across different races or ethnicities, the UBMP mentees are Latino and their mentors are predominantly Latino. I focused on these students because, while there is certainly a need to understand the mathematical identities of younger students, mathematical identities grow and change over time. In order to understand some of the important, inflections points in the evolution of the students' particular dynamic mathematical identities I look at students who have had time to shift and change in their relationship with mathematics. Also, as high school students, the participants in the UBMP program are closer to, if not in the midst of, choosing their future school and career plans.

They are in a position where their relationship with mathematics is perhaps most meaningful for their future educational and career mobility, as there are often specific mathematical requirements for matriculation. This research is not necessarily generalizable as it is context specific, although people may find its lessons informative.

### **The Contexts of the Study**

Although all participants in this project were members of the UBMP, which was focused on serving Latin@ students in North Carolina, not all participants attended the same high school. For instance, David moved to a private school during his junior year in order to take advantage of athletic and academic opportunities. However, the general community and setting for this research project all took place in the same general area. In further exploration of this research project, I took field notes on the area in which these students lived. The context of this study is generally described via statistics in Chapter 1 and is described in greater detail from field notes in Chapter 4.

### **Methods**

**Semi-Structured Interviews.** Many of the questions I asked each participant were almost exactly the same because of the goal to understand both individuals' dynamic mathematical identities as well as the interaction between these mathematical identities. Below is the basic interview protocol for each participant, but interviews were not limited to these questions. Much of the value of a semi-structured interview is their dynamic quality. Semi-structured interviews allow for latitude and revisions within questioning. Based on student responses, hesitations, and/or signs of enthusiasm, I not only asked the interview questions outlined in my protocol, but also had the flexibility to follow down alternative lines

of questioning. These interviews were each about an hour or more in length and participants were interviewed two times.

### **Mentee Interview Protocol.**

1. Tell me a story about yourself involving mathematics. What does mathematics mean to you?
2. How would you describe your relationship with mathematics? What are some of the things [people, places, situations] that have affected your relationship with mathematics?
3. Has your relationship with mathematics changed over the years? Can you think of any turning points in your relationship with mathematics? If so, what were they? When did they occur? What do you feel the outcome was? How did it affect you?
4. To what extent do you think your relationship with mathematics plays a role in your life? Is it not important, very important?
5. Tell me about your [teachers/parents/peers]. How might they describe your relationship with mathematics? How do you think your [teachers/parents/peers] would describe their relationship with mathematics?
6. Tell me how you see yourself as a student.
7. Has being in a mentor relationship affected the way you think about [math/school/success]? If so, in what ways?

### **Analysis**

Using Martin's framework I identified some guiding questions for this work as well as an outline for how data would be collected and analyzed.

1. The interviews were transcribed.
2. The interviews were coded and categorized into early themes using software (Atlas.ti).
3. Some emergent themes were analyzed prior to additional interviews so as to inform additional questions posed to students in hopes of verifying themes.
4. The process was repeated after additional interviews were conducted.

Each of the interviews were recorded with the permission of the participant. Additionally, field notes were taken and analyzed for each interview. The interviews were later transcribed in full and qualitative software (Atlas.ti) was used to code each transcript. The initial forms of analysis included coding of transcribed interviews using Atlas.ti. I identified themes present in the participants' narratives. From there, I made the necessary updates to questions asked before the second interviews with the high school, UBMP students. Initial codes were mainly just topics of conversation, like "parents" and "peers," some of which were informed by Martin's original framework and the research questions of the study. These initial keyword codes later gave way to more thematic codes, such as "description of peers as others" and "missed opportunities for parents" as I worked more and more with the data.

Further, as themes emerged and I began writing, I continued listening to the interviews over and over again. This not only helped me make sure I was not taking the students' wording out of context (after having reorganized their quotes into thematic categories) but also helped me listen to them tell their stories again and again. I realized that as I was turning this into my project and my dissertation. I was at risk of forgetting that these are their lives and their experiences. Hearing their voices again helped me remember to keep them at the very center of this project, and it also served as a way to make sure my analysis was reliable. There is triangulation between and among interviews, and there is a confirmation of these themes found by comparing them to new literature in the field. I also offer, in discussing my role as a researcher, my own existing biases and efforts not to co-opt the stories of these individuals for analysis.

**Confidentiality.** In order to ensure confidentiality, I assigned double-code pseudonyms to all participants. There is control of participant information in a secure location and the pseudonym key is kept separately from all other data. Permission forms indicate participants are allowing me to share their stories. While my study never sought to out any undocumented families or students, participants in this project did reveal information about their status and the statuses of others to me. This information is both very sensitive and central to the ideas presented in this dissertation. As such, efforts have been made to secure the personal information of these individuals to the highest degree.

**Post-Critical Reflexivity.** It is also important to address my role as a researcher and my concerns over keeping a certain amount of critical reflexivity as a white researcher doing research on Latino participants. I am a White, arguably somewhat middle-class, female from a small, protestant southern community. In my own formative years in high school, I can recall the seemingly sudden influx of “Mexicans” in our schools. I use the term “Mexicans” because, despite their various nationalities, people in my home town only ever referred to them as “Mexicans,” in a purposefully derogatory use of the word. Although I may not have partaken in the name-calling or overt forms of racism as some of my peers did, I, as a middle-class, White girl naïve to the types of critical consciousness that awaited my future self, was complicit in the further subjugation of these students. Why? Because as a White person I was allowed to hear the comments that subtle racists would not dare speak in front of a crowd of mixed race/ethnicity. And, as a timid, shy, soft-spoken and uncharismatic young girl, I would not speak up and voice an opinion of dissent or correction. As part of my White privilege, I was allowed my silence and this silence still haunts me.

I have spent years coming to terms with my own socialized prejudices, my racism, and my role as part of a majority, White, and a member of the historically marginalized group, female. I did not stop, however, at being haunted by my past. This journey of self-exploration is constantly ongoing. Although I have made progress, I have been somewhat reluctant to take on the role of doing research in a Latino community. I do not want to co-opt their stories, benefit from their struggles and/or successes, or misinterpret their intentions based on different cultural values. But, I believe in this topic and I believe there is an important, valuable, significantly rich story waiting to be told. You will notice that, throughout Chapter 4, I rely heavily on the use of student quotes. This is done purposefully as I am aware that, as both a former mathematics teacher and a white, middle class individual, I am already, by the very nature of doing research, colonizing the experiences of these students by using my own words instead of theirs.

## **CHAPTER 4**

### **FINDINGS**

The four high school students selected as cases are presented in depth in this chapter. Each student will be defined in detail by characteristics such as their personal identity, goals and motivation, their relationships with mathematics, their perceptions of the role mathematics plays in their lives, their perception of parents, peers, teachers, their school, and their community. An initial discussion of the focus of the research project opens this chapter, followed by a general description of the NLD in which the research took place as described by high school students and their mentors.

The four participants highlighted in this section are Rafael, David, Daniel, and Mateo. All participants are Latino male seniors in high school planning to attend a college or university following high school. They each describe themselves as students who are academically successful, making good grades in school and having a positive motivation to excel in their classes. These four students were selected based on their backgrounds (natural born U.S. citizens vs. undocumented), similarities and differences between experiences in mathematics and education, the variety of their descriptions of self (as motivated or self-described as lazy, their interest in pursuing a STEM field, and the various depths of their interviews. Some students spoke at length about their experiences in all aspects, while others were more reserved in various areas. Although the students are very different in terms of personality and interests, themes common to their experiences in high school mathematics emerged, which will be discussed in Chapter 5.

## **The Students, Not the Program**

The UBMP is focused on providing college-aged mentors to successful Latino high school sophomores through their senior year. These students are considered successful based on the grades and references provided in their application to the program. Instead of focusing on struggling students or those in need of remediation, this program specifically looks for students who succeed academically, but based on language issues, immigration status, and/or being first generation-college goers, may need additional support in their preparation to apply to and attend college. Although grades and other application requirements are necessary for entrance into the UBMP, that information is not being scrutinized for participation in this research project and neither is the UBMP being scrutinized. Rather, the emphasis in this project was to let students identify themselves as successful or not in mathematics both in response to a direct question and in the way they talk about mathematics. This research project was designed to have students share stories about their mathematics identity creation based on sociocultural experiences as well as their experiences with mathematics both as a school subject and in the world outside school.

The primary focus of this research is on the high school students and their perceptions of their relationship with and education in mathematics. Both as part of understanding the high school students' mathematical identities, as well as a greater parental and community aspect of mathematical identities, mentors and parents of the high school students were also participants in the project but are not themselves analyzed as cases. From this program, high school students volunteered to participate in the project and participated in semi-structured, narrative-style interviews. That is, the participants were given prompts such as, "Tell me a story about mathematics," and were asked to elaborate when possible.



The context of the study is discussed in this chapter in order to provide the setting of the research project. Then the high students are discussed in this chapter based on their narrative-style interviews which were recorded and transcribed. The transcripts of these interviews have been coded thematically and analyzed for relevant emerging themes through a process described in Chapter 3. The themes from the interviews with the four students are summarized in Chapter 5 with implications for mathematics education and research described in Chapter 6.

### **Changing Community**

Driving through a New Latino Diaspora community in which this study took place, it does not appear dissimilar to other rural areas of the south. The downtown area is underutilized. During the middle of the day, parking abounds and businesses in the downtown area are under-populated. Some of the buildings appear to have fallen into disrepair. There does not seem to be vandalism; there are no broken windows and there is very little graffiti. No crime is apparent, it is just quiet. There are portions of downtown with an abundance of Latino shops, (i.e. grocery stores, book shops, etc.) as evidenced by Spanish names and signs on store fronts, but there do not appear to be any White patrons for these shops. And, in the case of the other places of business, ones without signs in Spanish, there seem to be few to no Latino patrons. Around the corner, but off the main street, there is a little ice cream and burger place. It is easy to see the extremely large confederate flag hanging as a banner over the counter from the street. There is one Latino family enjoying a meal while the rest of the patrons and staff are White. The area appears as a place where two largely different populations now co-exist, each claiming their own territories even in the smaller downtown area.

The closing of plants in the meat packing industry in 2010/2011 caused some of the Latino population to move away from the area. According to one UBMP mentor,

The area seems like it is getting more White than it used to be. I was there when it became more Hispanic, but now it seems more White to me. I mean, I am there at different times, like during the week day, so that might be why. But, I didn't realize that when some of my friends did not come back to school that it was because they moved out of the area. I just thought, you know, they weren't coming to school.

One UBMP mentor, who is planning on minoring in Latino Studies, mentioned specifically the racial profiling of police in the area as an example of racism in the community. He was able to describe a way in which members of his community set up a warning system when police checkpoints for undocumented residents were active. He also specifically mentioned that he did not feel racism was present in the schools. Either by majority rule or contemporary thoughts on race, he thought the school did not share all the same problems as the greater community.

While some high school students are looking to college as a chance to leave the nest, get away to a new place, and experience life in new, more urban surroundings, some of the mentors in the program have expressed an interest in moving back to their original communities, or at least back to live with and help their parents. Students from both high school and college also intend to try to give back to their families and communities, giving back to Latino students in the area.

When asked about the general feelings within the community, Daniel, a current high school student, was able to describe the area in context with the history of protests in the streets a decade ago.

SW: "Can you describe the community today?"

Daniel: "It's definitely not as bad as it was ten years ago, but I am still afraid a little bit. Not personally for myself, saying that I'm afraid of the community or them doing me harm. I'm speaking more that I'm afraid about the expectations that the Latino

community and the White community have on how people should act in public is going to prevent people from actually fulfilling what they can do.”

SW: “Describe that to me.”

Daniel: “For me, just an example, I’d have to be careful. I would have to live a double world. When I would be surrounded by the Latino community, I would have to be sure that I wasn’t acting too White or too Americanized. I had to show that I had connection to my Latino background, and I still hold true to them. However, when I switch to the White community just going into interviews I have to be careful that I appear Americanized and not just someone that is hell-bent on staying with my roots. And, that kind of limits me to actually being who I can actually be.”

SW: “If you didn’t feel any pressure from one group or another, how do you think you would present yourself?”

Daniel: “I think it would definitely be easier to get across to people on a deeper educational level, telling them how things works, letting them know that things are possible, that they can achieve higher things. Because when I talk with them now they just kind of look at it like, you know, ‘why are you telling me this?’ It doesn’t matter. Why are you acting like a White? You know those walls can actually be brought down. We can just think about listening to understand what I am trying to say to them. I think I would probably change a lot more of them and we would see a lot more students driven about their work...It’s gotten easier since I have progressed through high school because it’s time to discover who I really am. I owe a lot of what I have figured out now to the interviews that I have been going on because all my mentors have been telling me is just be authentic. Just be you. Just tell your story and make sure that you live by the word that you say. And it made me realize that what does it matter what anybody else thinks of me because I believe what I am doing is right... while I am doing this I am trying to leave behind a legacy that other students can follow. Like, ‘Hey I’m doing this! You can do it too.’ The support is definitely there from the school. [There perception of me] has definitely changed.”

And so, there may be a general perception of change within the community, or at least within the schools. Some of this change is perhaps confused with students having left the area, but there is not as much public focus on the fighting between races and ethnicities in the area as there has been in the past. While this might appear to be a move in a positive direction, people feel comfortable in their home town, this certainly does not suggest that all is well in the NLD. In fact, it could be the opposite – there is still turmoil but of a more silent

nature. Racial relations may not be at a boiling point, but that may mean less progress for Latinos in the area who have started to feel more comfortable in the area while their students are still potentially underserved educationally. The fact that members and former members of the community have identified what they perceive to be racial profiling to the point that support systems are in place suggests that there are still serious issues faced by the Latino community every day. Therefore, while there may be some positive changes in the NLD, old issues can still lurk below the surface.

**The High School Setting.** The community's public high school is located on an off-road just a couple turns away from the major highway. In the school year prior to this study, the schools reported size was saddled just between the district and state averages of 600 and 850, respectively (NC DPI, 2013). The average class size for mathematics is reported to be around 20 students. The average score on the mathematics portion of the SAT is listed as about 500 out of 800. About 5% of the students at the school are enrolled in Advanced College Prep Courses, matching state and district proportions, and nearly 20% of the school is enrolled in courses that are considered Career and Technical Preparatory courses, many of which are offered through cooperation with a local community college. The graduation rate is slightly lower than the 81.4% and 80.4% at the district and state level (NC DPI, 2013).

The Hispanic/Latino students comprise about 40% of the school, while White students represent about another 40% and African American students represent about 20% of the school. There is some representation of students that are mixed race students with a small percentage of American Indian and Asian. The majority of the students at the high school are on free and reduced lunch (NC DPI, 2013).

Dual language and Spanish-English programs beginning in the elementary schools

which feed into the public high school. The current high school students are among the first years of students in the area to have access to these program. The dual language programs in these schools offer courses like mathematics and science in Spanish with Language Arts and Social Studies in English. There have been conversations about continuing the dual language program at the high school level, in classes like mathematics.

In addition to potential changes in programs offered to students, the mathematics department is facing changes to the state mathematics curriculum. The adoption of the Common Core Standards in mathematics has changed the learning objectives and the assessment for students in mathematics classes, although none of the participants were enrolled in Common Core mathematics classes. And, more recently, additional changes to high school standards are taking place in the state, using Common Core standards and Mathematical Practices as a basis to create a state-specific high school curriculum.

### **The Mathematical Identities of Four Successful Latino Students**

Four high school students were selected as cases in this research project. The students participated in two lengthy, semi-structured interviews, one prior to initial analysis and one post. In general, for these interviews, I asked students to describe themselves, their relationship with mathematics, their beliefs about the importance of mathematics, their perceptions of their school, peers, and teacher, and their perceptions of their parents' relationships with mathematics. At some point in the interview, usually towards the beginning I would ask them to tell me a story about mathematics. This task proved to be difficult for many of the students who were unaccustomed to this type of question. An example of a similar response received is, "What do you mean? A story? About Math?"

Each of the following cases relies heavily on quotes and anecdotes from students. This is done in an effort to let the students present themselves to each reader with minimal yet necessary framing from an outside perspective in order to minimize the further colonization of already marginalized students. Some of the information in this chapter was also informed by interviews with their parents and mentors, but only serves to better describe each student by another perspective. The cases in order of appearance are Daniel, Mateo, David, and Rafael.

**Daniel: The isolated scholar**

At the time of this study, Daniel was a high school senior in AP Calculus. He has been in the UBMP for three years. Daniel was born in the US and English is his first language. He is the only member of his family who is a citizen of the United States, the rest of his family is undocumented. Daniel is a senior in high school, but he hardly seems to fit the profile of a typical high school student. Daniel exudes confidence. He has a very strong voice that has no trace of any discernable Southern accent.

Daniel describes himself as a very motivated student, and based on their recommendations, he said his teachers would agree with that characterization. He has been in honors and AP classes in mathematics and other areas and is, in ranking, one of the most academically successful students at his school. Daniel is a member of many school clubs, the manager at a local store, and a finalist for a prestigious scholarship, something he says would not have been possible without encouragement from his UBMP mentor. He describes his UBMP mentor as someone with whom he is very comfortable and feels immensely supported. Daniel describes how his mentor not only encouraged him to apply for the scholarship, choosing to nominate himself when teachers at his school failed to do so, but

also how she met with him prior to his interviews just to hang out, prepare him, and calm him down about the overall process. Daniel's mentor is not herself going into a STEM field and does not provide academic support for his school courses, but her emotional and social forms of support are immensely meaningful to him.

Daniel defines his relationship with mathematics to be that of both love and hate. He likes mathematics because it offers him a definitive answer, but Daniel says he hates the complexity associated with the high level of mathematics he is currently in, AP Calculus. Even though the class is going well and he is making good grades, he says he just scores better in his English classes with greater ease.

Being such an advanced student, Daniel acknowledges that he thinks his parents are very proud of him. He describes his older sister as having avoided higher level mathematics classes. Daniel indicates he believes this is because she was not really given an option, no one at the school ever seemed to challenge her to try harder. According to Daniel, no one ever asked her to take honors and AP level classes and so she did not. Their parents' highest earned degree is a high school diploma. Although his mother has a job in a health field, he says higher levels of mathematics never really played a large role in her life and his family in general is not focused on education.

While he is still figuring out exactly what he would like to do in life, Daniel's career aspirations are more focused on the medical field than anywhere else. For Daniel, medical school has always been the plan. His future goals, however, are not limited to academic goals, he also describes a passion for giving back to his community during and after college. He plans to do this by speaking to and encouraging Latino students in his community to look for opportunities to excel in middle and high school and pursue college. He says that he

looks forward to being a role model for his community. He would like every Latino to know that it is possible to achieve great things and move to higher education and higher paying jobs.

While sharing this enthusiasm for the potential within his community, however, Daniel acknowledges that the current situation for undocumented Latinos is grim. He specifically addresses undocumented Latino high school students facing out-of-state tuition for college attendance. Daniel is concerned the higher fees create a larger challenge for those interested in encouraging these students to take advanced class in high school and apply to institutes of higher education.

Daniel also expresses concerns that he has a negotiated relationship within his community. In many ways, he feels too Americanized to identify with his Latino peers at school and in the community. Though he tried learning Spanish and made attempts to embrace his cultural roots, he says his Latino peers see him as someone who tries too hard in school, making him seem more like a White student than a Latino student. Instead, most of his friends are White students who have the same or similar academic goals.

**Personal Identity, Goals, and Motivation to Learn.** Daniel is a highly motivated student and takes great pride in his academic accomplishments. He describes his success in school in direct opposition to his older sister's academic record, but does not describe their difference as one of intelligence, but rather a difference in their perception of possibilities while in school.

SW: Tell me about yourself.”

Daniel: “I guess you could say that I’m a fairly driven student. I pay attention in class.”

SW: “Could you elaborate on that?”



Daniel: “My story is kind of different because I am coming from a family where I am the only citizen in my family. And so, their opportunities for higher education are kind of limited and so was my sister. She kind of avoided the high math classes. I think the highest math class she took was AFM. And so, it is a completely new territory that I am in AP Calculus. And so, my parents - it’s kind of new to them too so they don’t really know what they should expect from me. They kind of kept it at the same level as ‘we want to see straight A’s. In Calculus, it kind of gets a little rough.”

SW: “What do you think you will do with your own education? Where do you think you will go from here?”

Daniel: “Originally I thought about going pre-med and that is something that I still want to achieve because I want to be a pathologist and help people. I actually think that is the main thing about it is that I want to find a way to give back somehow... I feel, ‘Who am I to reap the benefits and not give back to those less fortunate than me?’ That’s just selfish...” I definitely want to give back somehow. I have been looking towards educational reform and changing the ideas of how these students actually look at their future and change the idea of what they can actually accomplish. Not so much as a counselor. I guess it would be like a counselor but not so much in the way that I want wait for students to come to me, but I want to be able to be in the classrooms and have a presence because I know it’s going to start early on. By the time they get to high school, they have already started their bad habits. And, I just believe that somehow with my education if I could just go back and let them know that these roads are possible, there are higher things that they can achieve rather than just getting their high school diploma and then going straight to work.”

Daniel discusses talking to students at his school about his experiences in education.

As a senior he has been asked to talk to younger students about paying attention to their academics and starting to think about college. There is a general push at the school to get students to consider higher education instead of entering the work force. When I ask Daniel about speaking to these younger students Daniel says he describes both his motivation to do so and his concerns over some aspects of the greater educational system. Daniel says he speaks about learning from your failures while acknowledging that standardized tests have had a negative impact on the students in his school.

Daniel: “I think it is mostly because of my story and my background being so unique and different from everyone else’s, that I kind of able to tell them that ‘hey, I came from - what’s the word’ - it’s not privileged. I wouldn’t say that I was coming from a disadvantaged background. I would say that I was coming from a less privileged

background, however, it wasn't something that should stop me; it should be something to motivate me. And, I just want to be able to convey that because I don't want them to think, 'Hey no one is helping me. Why should I be doing this?' That's kind of the things that I focus on when I talk to them because the thing is these kids are so into this idea that they can't fail or that they shouldn't be able to fail. That failing is bad and as soon as you fail, you know, you are done. I told them that I thought I was smart until I got into my AP Biology course and I failed my first test, like absolute bombed it. I realized I could either cry about it or do something about it. And so, I think that was one of the main reasons why I want to go into the medical field and why I am also so concerned now with education. I think that is more the way that I am leaning now. I know standardizing everything is a problem. It's everywhere. Those [standardized mathematics tests] that we had to take last year; I know the morale of the class just tanked knowing that we had to take those exams. And, it all starts in those elementary days."

SW: "So, what do you do when you hit a big bump in the road like failing Biology or taking those [standardized mathematics] tests?"

Daniel: "I definitely had to change the way I studied. The way I study for Biology test was just kind of on my own re-reading everything and obviously that didn't work, so I kind of changed it to grouping. I had a friend and her and I would just go back and forth. Whatever she understood I could just explain and whatever I didn't understand she could just explain. It helped to have it reverberate inside my mind, hearing it from a person rather than just reading it from a book."

SW: "Do you ever stress about standardized tests?"

Daniel: "I've always had a kind of negative slant towards them. I never liked the standardized tests because I know some people do struggle to take the tests. I am not saying that is a valid excuse to completely bomb a test but, it's – just because a test is the same doesn't mean it is testing each student equally. There are some students that are better in some areas than other students. What one kid can excel at and the test is about another kid is completely struggling. And it's not - a standardized test does not at all reflect the student and what he's worth, like the ACT and the SAT. I know going in as a senior that was the biggest thing I was worried about, you know the ACT and SAT is going to determine my worth and whether or not a college is going to accept me, rather than my transcript and the big picture of what I am. I think that is one of the main reasons why I am against the standardized testing because it kind of undermines what the student has achieved."

Daniel seems to have a good perspective on who he is as a student and a person.

Daniel's narrative is one of perseverance and determination. He is also deeply reflective about how he is perceived by others.

**Perceptions of School Climate and Peers.** I talked to Daniel briefly about his

school and his peers. I first ask him to describe the students at his school in general and how they might feel about mathematics classes. At this point in the conversation, Daniel has mentioned his education as a US citizen in direct comparison to his older sister's limited options as an undocumented immigrant. He has also mentioned the lack of interest in Latino students that he perceives in younger students. Therefore, I ask him why he thinks these students are not interested in mathematics.

Daniel: "Yeah. I see a lot of students kind of duck the higher classes, not just in math, but just kind of duck the higher education classes and get by on the bare minimum."

SW: "And why do you think that is? Do you think that has to do with their status or are there other reasons that factor in?"

Daniel: "I think citizenship is a factor in everyone's history, but I don't think it is the definitive factor. I think it's the fact that people are saying that nobody has actually told them that it is not okay to not actually try hard. They just say, 'Do what you gotta do. Cruise by.'"

SW: "Would you say your high school, being in these advanced classes, do you think the population of your class reflects the population of your school in terms of diversity issues?"

Daniel: "Well, my AP class is mostly made up of Latino students. That's the majority that's in the class and at [my school] it is 51% of the population. So, I guess it does have some good diversity in it. It kind of reflects how the school is made up."

SW: "That's nice to hear. So, you feel supported by the teachers that you have had there?"

Daniel: "Definitely."

SW: "Do you ever work with people in your math classes?"

Daniel: "Oh definitely...like when we are in class we get into close groups whenever [our Calculus teacher] gives us our assignments we try to work in groups as close as we can. Because when you're trying to stare at an equation just by yourself you're kind of thinking, 'where do I even begin?' In a group, my friends are kind of like, 'I think we should take the derivative first.' And then, my friend says, 'Oh yeah. Let's start looking at these numbers.' And, it kind of all falls into place like that."

Since Daniel has mentioned the cultural make-up of his school and classes, I ask him

about the social setting within his school. I mention that while at some schools students hang out with other students of all races and ethnicities, at other schools there seems to be a little more of a divide between students of different races and ethnicities.

SW: "How does that go at your school?"

Daniel: "Um, that's usually the tendency. Latinos would associate with Latinos and the Whites would associate with the Whites and the Blacks would associate with the Blacks. I am kind of the black sheep here out of everybody. Here I am, Hispanic kid, and I am hanging around all these White, country-folk kids."

SW: "Is that weird at all for you?"

Daniel: "When I first started high school it was a little bit weird because I came from an elementary school where I was a minority there. I was exposed to the White community early and so I was kind of desensitized to it. It didn't really bother me as much. But, once I got to [my high school] it was a different diversity. Hispanics were the majority now and they kind of looked at me with a funny look because they would say I'm Americanized.

SW: "'Americanized,' that's a very negative term, right?"

Daniel: "Yeah. In the community, they use it as a negative. I never really see it as a negative because I don't see it as Americanized. I see it as myself becoming educated, driven and I guess it is just taboo for them to see it."

SW: "Is this true of the greater population at your school or just the students that aren't in the advanced classes? Or, does it carry over into students that are in the advanced classes?"

Daniel: "I think in the advanced placement courses it is different because I am surrounded by kids that are on my same caliber, so they are not thinking race or anything. They are thinking they have to study and how they can do the best that they can do in that class. I think the actual sign of different communities separated from each other actually goes into the school and even further into the community because there's always just some... I guess... they believe it to be a cardinal sin in the Latino community to become White as they say. You know, drift away from your roots."

SW: "If that's their perception of you, what's your perception of yourself? Do you ever feel like you are separated from your roots?"

Daniel: "Yeah, definitely. Like I said, when I got into my freshman year of high school. That's when it became apparent that I had definitely cut some roots to my culture and so I wanted to make sure that I could change that so I enrolled myself in Spanish speaking courses to improve on my Spanish. And, of course, that was another whole messed up world because of me being Hispanic and Spanish wasn't

my native language, English was. So, I didn't enroll in the native speakers' course. So that brought on some more weird looks but it didn't really faze me much."

SW: "Then you were born [in the United States]?"

Daniel: "Yeah."

SW: "Because of this, do you think the dynamic in your family is different?"

Daniel: "I mean, it's still my family. I also keep in mind that it is a completely different world. You hear people on TV talk about these illegal immigrants coming into the country, 'just stealing jobs' and 'why should we give them an education?' But, they're speaking from a third-person point of view, away from the action and I'm sitting in my living room watching the news and this different world is sitting on the couch with me just tossing me the remote. It's a completely different perspective and that kind of kept me grounded and it's kind of been a factor as to why I try to strive for these advanced courses and why I put so much... I don't want to say stress, but extra work on myself to make myself better."

Daniel feels the perception of him at his school has changed recently as he has received recent accolades for his academic successes, culminating in being selected as a finalist for a prestigious scholarship. I ask him how this recent attention has affected the way his peers and teachers at his school.

Daniel: "It was more that nobody really knew what I was doing or what was going on, but I think it definitely the way that they would have reacted has changed from a negative to a positive. Say that I was able to apply for this scholarship when I was a sophomore, had I gotten to the position that I am in today I feel like more people would look at me with envy and anger because I am succeeding, but now you know a couple years later people are supporting me. People I've never met see me in the hallway and they're like 'Hey, congratulations. I hope you get it.' ... I wasn't the only one that applied from my school, there were two other girls. And, in rank, they were higher than me but I got the position and they didn't. At first I was kind of worried that the only reason that I got the scholarship was because of my race and my color, but after I spoke with them they were just happy. They were happier than I was that I had gotten that far. They were so supportive. I realized that there wasn't anything to be really worried about. My high school has really transformed into a supportive community or at least my class has."

SW: "When your peers weren't aware of what you were doing, was the 'becoming White' because you were in advanced courses?"

Daniel: "I think definitely for a while there is still the hint of those that are not in the advanced courses looking down on the people that are taking these courses because

they only see them as “try-hards” and don’t really see why they are doing all this work. I think one of the reasons why I can network well with the White community is because of these advanced placement courses and most of my peers are White. They have the same academic goals as I have so it is easier to communicate it with them. I think that is one of the things that I faced going into high school was being drawn away from the Latino community because they weren’t taking the same courses I was. And now, senior year it has kind of changed.”

While Daniel has a really positive story to tell with relation to how his peers view him now, his story contains a lot of struggle and mixed emotion. It causes one to wonder, how would he feel if not for the recent attention and prestige he has garnered? How would these interviews have gone if they had taken place earlier in his academic career? While these questions remain unanswered, they pose an important reminder in this context, that identity is dynamic and ever-changing.

**Beliefs about Mathematical Ability.** Daniel has mixed emotions about mathematics. Despite typically being an “A” student in his advanced mathematics classes, he has started to struggle with the complexity of topics like AP Calculus. He says that subjects like English come to him more easily, but he appreciates mathematics for being able to find an answer with absolute certainty.

SW: “How would you describe your relationship with mathematics?”

Daniel: “A love-hate relationship. I definitely love it because there is a definitive answer, rather than English where it can be so abstract. Then again I also hate it because it can get a little complex as you get farther along in math.”

SW: “Yes. You are in Calculus right now. How is that going?”

Daniel: “It’s pretty good. I had a little bit of a rough start, but I was able to bring my grade up so it wasn’t that much of a problem. “

SW: “Have you always had this love/hate relationship with math?”

Daniel: “Yeah. I guess you could say that because I am one of those people who would always like a definitive answer, yet I can somehow find a better way to score higher on a reading test than on a math test.”

SW: “Have there been any teacher or situations where you felt you had a closer or further relationship with math?”

Daniel: “Nah. I guess it was pretty much neutral the entire time. When she’s teaching it, just pay attention and learn.”

With relation to our greater conversations, Daniel’s discussion of mathematics, when asked directly is pretty brief. One thing is clear, however. Daniel has a preference for excelling academically and having more simplicity and concreteness to what he studies. For these reasons, he has an affinity to mathematics as it is posed to him in the high school setting. This closed, static definition of mathematics, as always having a definitive answer, however, is challenged by mathematicians and those working with upper-level mathematics in STEM fields. It would be interesting to see if access to open-ended, subjective mathematics questions would challenge or enhance his affinity for the subject.

**Perception of Teachers and Beliefs about Mathematics.** This year presented a change for Daniel in relation to his mathematics classes. His comments about this change reveal information about his current class as well as his former ones. Previously, mathematics class for Daniel is more about following the examples given by the teacher, and replicating an algorithm for slightly different problems in order to find a solution. Now he is in a situation in which the information is slightly more theoretical. He and his classmates have had to adjust their learning styles in mathematics to handle slightly more open-ended posing of questions, rather than a banking method of being given the mathematical tools to solve problems. Part of this change is content-specific and part of the change likely exists from the increased focus on encouraging students to explain their mathematical thinking and understanding based on the revised North Carolina standards of the Common Core.

SW: “When you are in math class, what do you like and expect from your math teachers?”

Daniel: “Being in AP Calculus now I can expect that they are just a little bit less just walking us through every single step. They just kind of prompt a question. The first thing that I had to understand was it wasn’t just learn it in class and do homework about it, it was expanded problems, things that probe people to kind of think differently or think about the problem because we knew how to solve it; it was just different.”

Daniel is one of the only students to give an answer to this question that did not focus on mathematics as a required or prerequisite course. Instead he describes mathematics as an ability to understand trends and information he is exposed to in the world. Mathematics for him is a way to understand the world around him and judge situations, based on the numbers.

SW: “How important do you think your relationship with math will be later in life?”

Daniel: “I think it is going to be very important to me. I don’t necessarily love numbers but I love statistics and I love trends. And, I love discovering patterns of how things are going to be.”

**Math Story.** When I first asked Daniel to tell me a story about mathematics he mentioned that he often uses mathematics outside of the school setting in his job as the manager of a local store. But, beyond balancing receipts and keeping up with store finances and records, he quickly redirected and started talking again about how he appreciates the mathematical trends and statistics he sees in the world.

Daniel: “Right now, I know there is one thing that kind of sticks with me with numbers and that is 38%. That is a recent number that I came across saying the number of Latino students who were actually going to go on and get a diploma, like a high school diploma and then go farther on to college, so completing high school and then going on to a university. And I was like 38% is pretty decent number to go by, but then I started looking at what it took into effect and how many students it actually was. I was at a school where the population was over half Latino and then only 38% of them are going on to further education. That just for me sitting there looking at that number... it’s not enough. That number has just been stuck in the back of my mind, that statistic. Statistics are kind of against this whole community from achieving their education. It’s letting them know it is ok, we don’t expect that many of you to go we just need a certain amount to pass and it sets the precedent for not achieving as much as you can. I remember coming across that number and I was completely appalled.”

With his drive to give back to his community and encourage Latino students to take



more advanced level classes and think about college, Daniel's mathematics story is really one about changing the statistics he sees around him, for his community.

**Support Structures.** Daniel is not completely isolated in his life, just more-so at school. He says he has a very positive relationship with his UBMP mentor and the program in general.

Daniel: "My UBMP mentor is amazing. I definitely would not be in the position I am in today with this scholarship if it was not for her help because originally the way [the state] chooses their nominees, the school chooses them. And, originally I was not selected in the nominations, the other two girls were. The Tuesday before the application was due, I was told that on Friday I could self-nominate as a high school student. And, I remember looking over the application and what it entailed and I remember talking to [my mentor] and I told her, I was like I don't know if this is something I can complete in this short amount of time. I don't know if I can get through it, because if the school didn't believe in me why should I waste my time. I remember, she just put her foot down and said, 'Listen, you don't need to worry about being a nominee, you are a NC high school student so you are able to self-nominate. So, go ahead, just put your heart in your application and turn it in.'"

SW: "So what other interactions do you have?"

Daniel: "Definitely just like common interactions. A lot of it is schoolwork, education, service, program stuff, but there are definitely times where she is just like, 'hey. You want to go hang out in [a neighboring city] and get a bite to eat and forget about all the things that you are going through, because the day of my semi-finalist interview of course I had just been up all night worrying about the interview, you know. What are they going to ask me? What questions? I arrived there and I just kind of told her all the things I was worried about and she just said, 'Do you want to go grab a bite to eat?' She was like don't worry about it. We were just hanging out at this restaurant talking about sports."

**Beliefs about Parents' Perceptions of Mathematics.** Daniel seems a little more stand-offish when I ask him about his parents. In fact, discussion of his parents is the only portion of our conversations where things tense up. Daniel tenses up and squirms a bit in his chair. At all other times we seemed to have open lines of communication and wonderful, free-flowing conversations.

SW: “What is the educational background of your parents?”

Daniel: “The highest that they achieved is a high school diploma. My mother had a little bit of further training. She went on to become a physical therapist. So, she kind of took some of the prerequisite courses, but never anything farther than that.”

SW: “Does she like physical therapy?”

Daniel: “Yeah. It was something she could do. Whenever someone is sick in the family, it always go straight to mother.”

SW: “Do you think their relationship with mathematics important for them? Were there other things in play?”

Daniel: “I don’t think any higher math played a role in what they wanted to do. I think they had a pretty clear idea that they wanted to come to the country later. I don’t think they were more focused on their own education, I think they were more focused on my sister and me.”

SW: “How would your parents describe you?”

Daniel: “I think they would be pretty proud of me. The point where I am at [compared to] where I started and the kind of background I come from. I think they would be pretty proud of my progress.”

Despite seeming less comfortable in talking about his family and his parents, Daniel is still very open about how he feels his parents are more focused on the opportunities afforded to him and his sister. He does not say outright that his parents do or do not value math, his only perception on their emphasis on education is that they hoped more for their children. Daniel is not the only student whose parents moved to the United States from another country hoping for a better opportunity for their children.

Although I asked to make contact with his parents and to have interviews with them as well, Daniel was the only participant to turn this down. He said he did not think his parents would be interested in discussing math and school with them. In my field notes, I scribbled down a few questions, “Is Daniel uncomfortable with parental involvement?” and “Is he worried I will disclose his feelings or conversations to them?” I was never able to answer either of these questions, and did not want to alienate him by pressing the issue.

### **Mateo: The burgeoning activist**

Mateo was a 17-year old high school senior and was taking AP Statistics and AP Calculus at the time of this study. Mateo is a self-reported undocumented, male Latino student. Mateo's interests include hanging out with his friends outside of school, playing sports, playing guitar and writing poetry. He is a dedicated student, he even records some of his classes so as not to miss or forget important information. Although he does well in school and is now in advanced classes, he describes himself as lazy, never wanting to do school work and always waiting until the last minute.

Mateo is also a burgeoning activist. He is involved with an organization that is trying to challenge colleges and universities in the area to give undocumented students in-state tuition. He says his parents support him in his activism, but they wish he would work harder in school.

Mateo has also been in the program for three years and has both an official mentor and an unofficial mentor, neither of which are majoring in STEM fields. Mateo describes his conversations with his mentor to be about everyday activities. He describes his relationship with his unofficial mentor, another mentor in the program, as specifically being about supporting him in his activism and providing him with lot of support in finding scholarships specifically for undocumented students.

**Personal Identity, Goals, and Motivation to Learn.** Mateo describes himself as someone who understands topics, like mathematics and science, pretty easily. He describes his teachers as benign. According to Mateo, his teachers are there to help him when needed, which is rare. Mateo had some teachers in middle school that pushed him to take honors classes, but he did not want to at the time. In fact, sometimes feels pressure from his friends to not take honors level classes, but he is able to balance having a social group outside his

classes and good grades in high level courses. He describes his friends as less academically motivated and more likely to complain about their teachers, blaming teachers for their demise. But he dismisses this as his friends complaining, and not something he feels is valid.

SW: “Tell me about yourself. What are your goals?”

Mateo: “I aspire to be an engineer, because I have a good foundation in math and science. I like to relax and listen to music. I am really bad with homework; I leave it off to the last minute.”

SW: “You mentioned engineering. Do you want to do a specific kind of engineering?”

Mateo: “I’ve gotten a taste of designing mechanical parts with computers in school. It was last year in 11<sup>th</sup> grade that I started [a drafting course]. And, it was like basic shapes of a rectangle with like a circle cut out of the middle and stuff. I understood it fast while other people were like, ‘How the heck do you do that? I don’t even know how to draw a line.’ So, I followed up next year with [the next course] and it’s going pretty well. I can produce graphs, like 3-D drawings of objects real fast and people are like – our classroom has like bubbles, four desks in the corner, four desks in the middle and the rest and we call it island. They say, ‘Mateo carries that island over there and Deena carries this island over there –they are doing the most work.’ And stuff like that. So I have the mind to do that type of stuff.”

SW: “It’s great that you already have a background in it.”

Mateo: “Yeah, and it’s cool because the programs that we use in drafting, they offer them free to students so I have a few of them on my laptop in my room. So, I can use them whenever I want and it’s real useful. I can be learning at home and get ahead in class.”

SW: “What are your interests outside of school?”

Mateo: “Starting in high school, I was in marching band in 9<sup>th</sup> grade for the fall. In the fall of 10<sup>th</sup> grade I was in soccer, the next year I was in football. This year I decided to not do any extra-curricular sports or marching band, but I am focusing more on activist groups that I am involved in.”

More information about Mateo and his activist’s efforts will follow in Chapter 5.

They are central to his character and beliefs, but in this section I am trying to refer more specifically to his experiences in school, in general, and mathematics, specifically. He goes on to describe his relationship with mathematics, his peers, and his teachers.

**Beliefs about Mathematical Ability.** Mateo describes himself as making good grades in mathematics classes. While his peers often struggle with the material or the teacher, he says that mathematics comes pretty naturally to him.

SW: “When you say you have a good foundation in math and science, tell me a little more about that.”

Mateo: “Well, I mean I find myself more able in the areas of math and science. I have friends that study with me and they find some stuff harder, they just don’t turn it in. I have this one friend who failed chemistry and had to take it over again the next year, while I got a 96 in the class. You know we are really different but we still hang out. So, I don’t let academic barriers - or inability to learn at a pace like I do - to be a barrier for friends. And I also hear people complain about their teacher. They’re like, ‘Man! These guys don’t know how to teach and I failed because she didn’t explain it right or he didn’t explain it right.’ And, while I’m listening to it, in my head I’m thinking, ‘Well, my teacher explained it pretty well and I seem to understand it pretty well.’ So I don’t really have any problems and it goes by smoothly.”

SW: “Have there been any turning points in your relationship with math?”

Mateo: “Um, I remember in middle school, in 6<sup>th</sup> grade right when I entered middle school, they offered me [the chance] to take an advanced math course instead of regular math [class]. I decided not to do it because I thought it would be too much work and I was a little kid. And then, my math teacher in regular math [class] saw that I was good at math and wanted to put me in this afterschool math club, but I rejected that too. I didn’t want any extra-curricular [activities] or any extra work – because I was good at it. But now that I am in high school and a senior, I kind of regret it. I don’t know. I think you are just supposed to take advantage of the opportunities that you think will benefit – that you can do it. At that time I didn’t know it would benefit me.”

SW: “You must have really worked hard to get to Statistics and Calculus your senior year.”

Mateo: “Yeah, but if I would have taken those advanced classes the school had offered me in 6<sup>th</sup> grade, I could have been done with that last year. I could have been doing something else this year. I could have taken advantage of the time and been studying something else.”

SW: “When did you start taking the advanced courses in math, in high school?”

Mateo: “In middle school I took one class that qualified as high school credit, but it wasn’t any honors; it was regular Algebra 1 – and there were a lot of people in there, but I was at the top of the class. And then, when I got to high school that is when you

can take honors classes, so I took Honors Geometry, but I didn't do so well. I got a B, but I started off with a C so I brought it up, but I didn't get it to the A-level. ”

SW: “For people who like Algebra, Geometry can be pretty different. How did you bring it up?”

Mateo: “It was confusing and the teacher was strict, and I think I based the improvement on the fact that the teacher became pregnant and the substitute teacher for the second half of the year and he was more lenient. I mean, we were still learning, but there weren't as many proofs and I hate proofs. There are so many laws. I think math is more like an exercise. The more you do it, the better you are at it, but history it is just fact after fact that you have to remember. And, I guess once you get enough facts they start gluing together and making sense, but at first it is really challenging. That's when I stop and say, 'I can't even do this.' I'm sure if I stayed in there a couple minutes studying, it might have clicked.”

SW: “Are there people or situations that have played a role in your relationship with math?”

Mateo: “I think it might have been because I moved to [the state] at the age of 4, so I only knew Spanish. English was really hard for me so learning facts was hard, but working with numbers is universal so you pick up on that stuff faster and easier, so I saw that. In elementary school, while I was in [English as a Second Language] ESL, I was in a regular math class, because I could actually do that. Maybe that's it. I don't know. It's a theory. I never thought about it. It could be my parents or my father because he did well on the GED test. It's hereditary.”

Mateo's relationship with math by his own account is to some extent a mixture of great ease and comfort with some missed opportunities. Intrigued by this idea of mathematics talent being hereditary, we spoke further about his father's experience with mathematics.

**Beliefs about Parents' Perceptions of Mathematics.** When Mateo mentioned his father, I followed up with a question asking how his father felt about mathematics and about Mateo's education.

Mateo: “My dad always told me that whatever you learn now is going to come back in the future classes, so you better pay attention. It's going to bite you in the ass if you don't pay attention.”

SW: “Did he learn that from his own experience?”

Mateo: “He's always been good at math. He graduated high school in Mexico and went to college, but he never graduated college in Mexico because he had to drop out

to support a family. And then, he came here and in the United States, in America, it doesn't matter what level of education you had in another country, it only matters what you earned here. So, he set out to get a GED and he set a high score for the math section of the GED. He broke the record from a person from a few years back. He likes to brag about that, but not a lot though. He's mentioned it three or four times."

SW: "That's amazing, but it also has to be really frustrating to not have your education count here. Would you say they push you or you push yourself more?"

Mateo: "I think both my parents value education in general, not just math, because neither of them finished or graduated from college. They feel the exhaustion from day to day work and physical labor and not mental though processes, like if they worked at a computer. They think if I worked at a computer my – I would be less tired instead of going home and resting up because your body aches. So, my dad tells me it's better to have headaches now than to have body aches at the age of 30."

SW: "What about your parents? How would they describe you?"

Mateo: "Lazy! My dad is always on top of me – do this, do that. Have you done this application? Have you done your homework? You would rather play video games than do anything else. But, in the end they believe I am a good student because they talk to other parents and they tell my parents how their child is struggling while I can have the leisure of playing video games and doing homework in a breeze and never have to worry about what you got on this test or the latest test. And, when I give them my report card all they see is the one or two B's and the rest A's. They don't have to worry about any D's or F's, C's stuff like that."

A few times in our conversations, Mateo volunteered information about his peers. In comparison, he feels things come easier to him than to his peers. Even though he admits that he does not always try hard or apply himself, he is able to succeed with less effort. He gives a much fuller description when asked directly about his peers and his school.

**Perceptions of School Climate and Peers.** Mateo describes two groups of students in his life, the students in his classes and his close, outside-of-class friends. The two groups do not seem to cross over much, and while his outside-of-class friends are not in his courses, he also does not associate much with the students in his courses outside of class. Previously in our conversation, Mateo even described his close friends as struggling or failing classes. I ask him to expand on this topic.

SW: “When you describe this group of friends that you are able to work on stuff with, you said there are no academic barriers between you and your friends, but are there different people that you go to for different classes? It seems like in high school there were a lot of my friends who I didn’t see in my classes because we kind of got separated along the way”

Mateo: “Yeah. That’s true.”

SW: “Do you have more friends that are separated or friends that are in your classes?”

Mateo: “I have a lot of friends in classes, but I do not hang out with them. I hang out with my friends during lunch but I never see them in my classes. They may take the same classes that I do, but we are just not paired in the same time period. A friend could have a class during [one] period and I have that class during [another].”

SW: “So, they are still in similar classes.”

Mateo: “Yeah. Like right now some of the friends that I hang out with during lunch, they take the same math classes I do, which is AP Statistics, but then they don’t take the other math class that I do which is AP Calculus BC. And so, that is where the difference is. And, we never have AP Statistics at the same time, but then I am the only one that has that other math class.”

SW: “One of the things that I used to notice teaching high school is sometimes there are groups of friends who are grouped – like maybe more Latino students hang out together and more African American students hang out together. Is it kind of the same at your school and with your friends?”

Mateo: “Yeah. Usually it is just people from – Latino. Usually it’s just Latinos, but people bump into you and they’re passing by in the cafeteria – we have table there. And so, we are in a really populated place and people come in and out and stay for a couple minutes and then leave. You know, we say ‘what’s up’. In that group of friends, we don’t really focus on – during lunch we don’t really focus on talking about school. We’re focused on kind of just messing with each other.”

SW: “Do you think that the diversity in the advanced classes are representative of the school or is there less diversity in your advanced classes.”

Mateo: “I think there is less diversity in the AP and advanced classes when it comes to minorities versus Caucasians and Asians. Maybe there is one or two Latinos or one or two Blacks, but that’s it. When you switch down to the regular classes, that is when you see the minorities be the majority; they’re the ones that are mostly in there.”

SW: “And why... Is there a reason for that?”



Mateo: “It could be peer pressure and stuff like that – all your friends are in the regular classes or all your friends are in the honors. Because I remember taking two classes, AP World History and AP US History, just because everybody else was taking it. I’m not really good at history so it doesn’t make sense for me to take an AP History class. So, that could be the reason or it could just be that people, um, don’t see their potential, they haven’t reached it yet, or they think they can’t accomplish it once they sign up for it. They don’t think they’ll get through it or they have too many sports or... that’s all I can think of.”

SW: “I was just curious because it seems like it goes on at a lot of school, where you lose diversity as you get to higher classes, and I always wonder why.”

Mateo: “I’ve been involved with this club...and it’s a national club and there’s an annual national meeting. This year it was in [a large metropolis] and we got to stay there for a couple nights. Their focus is to close the achievement gap between the Caucasians and Asians and the minorities, such as Latinos and Blacks. And, you know, we have set goals, like we should start at the middle school level and kind of teach them, those kids struggling at the middle school level, how to prioritize and get their work done on time and teach them good work ethic before they get into high school, so they don’t feel challenged by honors and AP [classes], so they can do it. I don’t know, maybe it is just the atmosphere. People think if you are Asian you are going to be a doctor or if you are Latino you are going to work in mechanics or carpentry. Maybe they just feel boxed in and they can’t fight the box, but there’s a few people that do, the exceptions.”

SW: “Do you think that there are sometimes teachers that feel that way about their students at your school?”

Mateo: “Um. I’ve never seen a teacher attack anybody on their ability to achieve anything in relation to education or career based on race. They’re pretty nice teachers. Sometimes there are teachers that just don’t care. They’re just doing their job, but nobody that actively hates on a student or tries to – de – what am I trying to say? Tries to make them feel sad or like they can’t do it.”

SW: “I don’t mean to insinuate that they would, but some students have told me they feel that way sometimes.”

Mateo: “I mean, I do hear stories about teachers making students feel bad because the tests get sent back out and people start comparing the scores and, you know, they did really well or maybe by some other thing that the teacher did. But, most of the time I just dismiss it because I think they’re just complaining and just have nothing else to talk about, because I personally just don’t see it. And, I get low test grades too and I don’t blame it on the teacher, I blame it on myself.”

SW: “What do you do when you get those low test grades? What does that mean for you?”

Mateo: "It means that I could really improve on my studying, on my - I didn't review long enough or maybe I missed something in class. But, usually I pay really good attention in class, so it's usually what I am doing at home. And, when I get those low test grades, it's usually in history classes."

SW: "You mentioned history earlier. What is it about history that you don't like so much?"

Mateo: "I think it's because history... the peer pressure of going into an AP because everyone else is doing it, when I am not really supposed to be there, made me feel bad at history which I probably am not; I'm just not great at it. That's where the low grades come in. I am sure if I had been in an honors or regular history class, I would have felt good about myself because I would be getting A's. And I think I am good at history, but if you put me in to the AP class, maybe I'll see that I'm not good at history or as good as I thought I would be, because there is so much more information and it goes so much more in depth and there are so many things that you have to connect in those classes. And I remember, my AP US History teacher told me, 'Even if you are getting bad scores in AP US History, you are still going to be learning more than you would in honors or in regular because there is just more information thrown at you.' The teacher links it up for you during lectures based on the reading at home and they are helpful but, they kind of make you feel like you are not doing something right because of the test grade."

SW: "From what I have seen it is good to have the challenge. When you get into college and have to take a history course, you will probably know more than you think you did."

Mateo: "Right. I probably won't be learning it for the first time, it'll just be like review. It'll be like, 'Oh yeah, I remember my teacher said that a couple years ago.'"

SW: "Would your friends say math is important?"

Mateo: "I'm sure they would. But, at the same time, they would be ridiculing it or the teacher [saying,] 'Nothing he says makes sense. That test was too hard.'"

SW: "Do you think their relationships with math will have an effect on their lives?"

Mateo: "I don't know. I don't want to prophesize any...I feel like it is fundamental and you should know it automatically, but you don't so that is why you take the classes. But, it is all common sense after that. After you take Algebra 1 or Geometry, whenever you see a simple math problem you are like, 'Oh. That is common sense.' But when you were in middle school, you didn't know how to figure that out. You didn't know what the slope was or the surface area of that shape."

SW: "Yeah. It's like learning to read a language. How would your friends describe you as a student?"

Mateo: “I don’t know. I guess they see me as an overachiever and they try to alienate me because of it but then I hit them with something back, another insult. I’m like, ‘You’re worse than me. You do x, y, z.’”

Mateo seems to have a dynamic relationship with school. While he wants to excel, and he acknowledges that he studies and works hard, he also describes himself as not wanting to work hard. He even describes himself as lazy, and as someone who has to play down his academic prowess. He describes a peer group that teases each other for trying hard in school and jokes about the classes they all take to fill the void.

**Perceptions of Teachers.** Despite the complaints of his friends, Mateo has had some pretty positive experiences with his teachers, even if his peers have not. Previously, he mentioned teachers asking him to take advanced courses, which he twice declined in middle school. I continued this conversation by asking him about his teachers at the high school.

SW: “Do you think that there are teachers who don’t explain it very well at your school?”

Mateo: “I’m sure the teachers sometimes don’t get to all the students. But, students may also exaggerate to make a point. But I’m pretty sure... I’ve had a teacher who people complain about and I have had him and I didn’t have any problems with him, but that’s just because I understood. And I’ve always been an introvert when it comes to those classes. Instead of asking the teacher how to do it, I figure it out for myself and if the teacher sets an example I try to follow that example until I get the right answer, so I’m not dependent on the teacher to tell me how to do it.”

SW: “You can look at the steps of the example and figure out how to do it?”

Mateo: “And there are some people who don’t get it even with the example. They’re like, ‘Wait! I still don’t understand.’”

SW: “What is your ideal [version] of a math class? Is it someone who gives a lot of examples like that or are there other activities that you enjoy in math?”

Mateo: “I think it is self-learning, self-learning and I don’t know – just work on the trouble spots. Don’t give a lesson and give homework and then the next day there is a group of questions from the lesson class work or homework that people got wrong – don’t go over the whole lesson again, just emphasize the trouble spots. “

SW: “Do you think teachers waste time going back over that sort of stuff?”

Mateo: “Yeah. I already know this, but maybe some people don’t. So, I guess it would be helpful to them but not to me.”

Mateo has a strong preference for self-directed learning. He is aware that his peers often need various levels of support, however. He seems to always have a positive outlook on most things, and we discuss how this plays out when it comes to mathematics.

**Math Story. The somewhat reluctant scholar, yet burgeoning activist.** Mateo was pushed to go into advanced mathematics courses and out of school programs starting in middle school, but he did not want to do the extra work. He also wanted to take classes with my friends. He has felt peer pressure – his friends joke about him being an overachiever, but he just come back at them with a joke. Mateo would have let his peers define his relationship with mathematics (good, but not an overachiever), but was pushed multiple times by parents and teachers to go into a higher level mathematics.

Like for Daniel, for Mateo mathematics is static, concrete and certain. Mateo’s appreciation of the subject is based partially on his ease with the subject and the lack of subjectivity. While mathematics has always come easily to Mateo, he does not seem to have much use for it outside of school.

SW: “Do you think math is important for your life?”

Mateo: “I don’t know. I really like math. It has always been a fast to pick up for me. And, I heard this one person say it is the most solid form of science. Psychology is an iffy subject; nothing is really sure. It is mostly theories and stuff. Math is concrete and you can rely on it. And, it does help you in a lot of job areas. Most jobs do require some level of math, while other jobs don’t require math– unless you are in the Medical industry.”

SW: “Tell me a story about math. How have you used math?”

Mateo: “Do you mean math outside of math class. I use it in drafting, kind of, to find tangent lines to circles. I try using the Pythagorean Theorem, but usually there is always a drafting trick or computer trick to ease it so you don’t have to use Algebra. I use it then. I don’t know sometimes I make poems and I have to count syllables. I write poems. Like my friend in [an activist group], he wrote a poem about graduating

and his high school diploma was like a death certificate or something because after that he hit a brick wall. And, he describes the instance where he asks his mother, like what am I going to do with my life. Why did you bring me to America? What's the point of begin here if I can't study or be successful here. And the mother replies, 'We brought you here so you wouldn't live the same life that we did, in Mexico.' And that guy in [an activist group], he has always been an inspiration to me so I want to kind of mimic him. Because he started [an activist group] along with some other people and he had just gotten out of high school so he took his demise or death certificate and turn it into a battle for success and livelihood. So, it's pretty cool. And, plus, I listen to a lot of music and a lot of rap and what they say is kind of like poems."

Mateo goes on to describe his interest in poetry and music.

Mateo: "Recently, I have been listening to this MC that goes by the name Immortal Technique. What he kind of says is like different because he talks about third world strife and poverty in the inner city. And how kids would go to the state pen instead of Penn State, because it is free board and tuition. I think those are the lyrics. I was listening to it when no one was home. I started blasting it and going along with the lyrics. They say some artists try to distract you with the idea of making money and success but then there are these artists who speak truth and facts that you don't hear on the news. And, it's the truth that sets you free... That's how [rap] originated, but it has been commercialized. [The music industry] just wants artists who have good voices and don't really say anything, they just have punch lines and stuff that flows together and that's it. [Rap] is not just music, it's the message too. It's nice to know that there are people out there who care. If I wasn't trying to be an engineer, I would like to do music production."

Mateo, while always positive and forthcoming, comes alive in a new and exciting way when he starts to talk about immigration issues and rap music. He also speaks with great enthusiasm about his recent experiences with a Latino rights advocacy group.

Mateo: "While I was in football, there was a parent meeting that my mom was at and she was my ride. So, I went to that meeting. And at that meeting there were people representing [an activist group] and they were telling me and telling the whole audience that undocumented students won't be able to do certain things after high school or in the work field. And, I always knew I was undocumented but I never realized that there were going to be some serious disadvantages. Then at the end of the presentation they said, 'But you can do something about it.' And my mom was the one who said, 'Mateo, this is a good group, you should get in it now.' And so, I got some contact information from the people but I didn't attend initially because I was still in football season and the meetings occurred while I was in practice, so I couldn't go. And, after that, I was in a dance group so I was busy after football, so another excuse to not go. After the dance was over, which was like around December I

thought, “No more excuses. I am going to see what this group is about.” And I went and the first meeting made an impression on me because everybody was talking about policy and injustice and I was never that heavy into policies and injustices, so it kind of inspired me and I stuck with it. And they grew on me and now it seems like we don’t do much but at first it was like a lot – whoa this is intense. But now, I am one of them so now it’s just like a regular thing.”

SW: “What are some of the major goals that you are working on?”

Mateo: “Now it’s getting a policy or a bill passed on the state level for undocumented immigrants to be able to go to college on an in-state rate instead of an out-of-state rate. That one of my big worries right now. And, you know people come up to me and say, ‘I’m really glad that you are doing this because I myself or my sibling has gone through that. They got through high school and got accepted to this really big school but couldn’t go because the price tag was too big.’ So, you know it does affect people. It’s real and it does mess up some plans. This summer I was part of a protest... We went to the [a local] community college campus and asked if we could register, because recently [a local] community college didn’t allow for undocumented students to even register to their school, but they changed it. So, we asked, ‘Can we register?’ They said, ‘Yes, you can.’ We asked, ‘Will we be charged out-of-state or in-state tuition for the classes we registered for? We are undocumented students.’ And before that person could answer, the Vice President of [the community college] came out and said, ‘Whoa! Whoa! What are you people doing here?’ Because there were police behind us and cameras. He tried to take us to another room, but we didn’t let him. We stayed in there and asked him the same question, ‘What’s the price for these classes?’ And, he left and came back with a packet of laws. And he said, ‘Here’s the law. It says right here you have to pay out of state tuition. That’s the law in [the state]. I can’t do anything about it; I’m sorry. I do think it is an injustice, but I have no power.’ After that, we were like - we are not going to leave until this changes because I am trying to study this career path that the school offers but the price is too high and that messes it up, so we are not going to leave. And we sat down and told our stories and then the police arrested us, but it wasn’t even an arrest. It was like [being] detained, because they never read us our rights. And then we were in a detention center for 8 hours. That’s how I spent my summer. I mean, I did other stuff too. I was working at a pool. I was going to writing classes. I went with [a couple clubs] to a national event in DC, a march for a DREAM graduation – a mock graduation to symbolize the dream to be educated. Even though you are going to tell us that the price is too high, we are not going to give up. We still want to be part of this educational system. 2013’s dream graduation because we were being backed up by the LSGBT – like there was a mock wedding in there too – to symbolize, you know, we support you.”

SW: “It’s nice to show support against oppression in general as a unified group. Are the people at your school supportive of your work with these groups?”

Mateo: “I do because I printed my experience about getting arrested at [a local community college] in the school newspaper. People were reading that and they were giving me good feedback, but in terms of proportions of people that gave me or told that they read it versus everybody in the school it was really small amount, maybe like 1:100, maybe less 1:50. Some people were like, ‘Dude, good going.’ Or, ‘you did a great job.’ I had this one girl say, ‘Mateo, when’s the next arrest? I want to be a part of it.’ I was like, wait. Slow down. I don’t want to get arrested again. One arrest is enough because you have to pay for court and if you are back there a second time, they take you more seriously. The first time they just kind of dismiss it and they give you 25 service hours to do before six months.”

SW: “Being undocumented, were you nervous about being arrested?”

Mateo: “I wasn’t nervous. We practiced it before, but I didn’t realize it was happening until I had the handcuffs behind me on my hands, both my wrists. I was like, ‘Whoa. I just got arrested.’ It didn’t hit me.”

SW: “I didn’t realize until recently how important it might be to practice getting arrested, so you don’t resist.”

Mateo: “Yeah. You don’t want to add any extra charges.”

SW: “Do you ever learn about activism like this in your history class?”

Mateo: “We did, but it wasn’t any in-depth stuff. It was just like there were these people who – of course, we studied the Civil Rights movement, but that was about it. I’m sure if I read my textbook I could have found out a lot more, but... they prefer to talk about wars and how it changed the friendships with countries and stuff like that... but last summer I did go to an anti-racist workshop where they teach you about the Civil Rights movement and other movements where they trace racism back centuries and they tell you racism didn’t exist and they created to – well, I forgot what they said- but, it’s artificial. It’s not true. You have more chance to be biologically similar to someone in Wisconsin to someone in Mexico.”

SW: “Yeah. I have seen studies like that.”

Mateo: “Yeah. They showed, during the Civil Rights Movement, Martin Luther King gathering a lot of children and having them by their choice getting arrested for anti-segregation. And it showed that youth can take a part in the movement and have an effect. I think president JFK made a public service announcement saying, ‘You have to stop. This is tearing our country apart. We are having children arrested - like kids getting arrested- and it’s just not right.’ But it wasn’t just two or three kids, it was like a whole town and neighboring town. All the kids gathered there and said, ‘Arrest me now.’ And, the shipped them off in buses, and the jails were overcrowded [with children]. The interviewer would ask the child, who told you to do this, to get arrested? And the child was like a little baby and couldn’t even say freedom. He mumbled it, but that was the only response he could give. That really hit me.”

SW: “What happens to the undocumented students that you know about?”

Mateo: “Well, the one I told you about in [the club] that is part of the [university] program, he is undocumented and he has applied for deferred action, but it’s been delayed because he was one of the ones who was arrested with me, but ten days before he was arrested in some other county. I think because of the multiple arrests, they are holding him back. And he hasn’t been in school ever since the [university] program, which is only for a semester. And there’s this other person in [the UBMP]. He’s not undocumented but he’s Latino. He got into college on a full ride, so I am guessing UBMP helped.”

SW: “It’s scary to think what’s going to happen – I’m making all these good grades and it might not matter.”

Mateo: “Yeah it is. Like, what’s it for? I’m going to be working in a fast food restaurant for the rest of my life, why am I in AP math. I should be working after school. I should be not even going to school. I should have dropped out in middle school if all I am going to be is a fast food worker. But you have to keep faith and have to hope things will change and even take action. Get involved. Get your parents involved.”

SW: “And you have parental support for your activism.”

Mateo: “Yeah. I had to get parent consent for the arrest. And the first time it was introduced to me, I was at a meeting. The leader kind of asked everybody, “Do you want to be part of an arrest? You should get parent consent. It’s going to be at Wake in three months, think about it.” And some people were already dismissing it because they said that their parents wouldn’t let them, that they would smack them upside the head if they did or like beat them or something just to exaggerate. But, I know my dad and he has been through stuff like that too. He has been in a protest. He was in a protest back in Mexico. It was a 40 day protest boycott of the school. Nobody was allowed in because there were some teachers that were doing some bad stuff with – like trafficking grades for sex. So he has been in that type of activism, so he supported me the whole way. My mom was like, “I don’t know. It sounds kind of dangerous.” But, you know, me and my father said it would be fine. We did a lot of planning and rehearsing and we talked to multiple lawyers, like immigration lawyers, the regular lawyers. We practiced interviews because we knew we were going to be interviewed a lot. So, if you didn’t know what to say you could have a way to turn the conversation around and turn it back to the subject that you are trying to push and your talking points.”

SW: “That’s fantastic that you were able to talk through it and control the story.”

Mateo: “I’ve seen some media stories about it and they are not that long. They just say five kids arrested and get one paragraph and that is it. I feel like if I were an editor or a writer I would write why they are doing this and why would somebody



risk arrest. Why during summer vacation when they should be resting or relaxing, why are they doing this? Why at [a local community college]? And there are answer to all of that. The [local community college] is a big school, so it makes sense to do it there because they have the power to set an example that other schools can follow, because they are a huge school. Why there? Because it affects the education of 50,000 undocumented students in [the state], the ninth biggest undocumented holding state in the country.”

Mateo has serious frustrations with the lack of opportunities afforded to him and his friends due to their status. He uses music and a nascent identity as an activist to help deal with these tough issues. For Mateo, both are outlets that help him describe and work through his frustrations with society.

**Support Structures.** Mateo does not only find support in his activist efforts, he also shared positive interactions with his mentor that provided support to him when he felt like he needed it.

SW: Do you ever talk about this stuff in UBMP or with your mentor?

Mateo: “Yeah. My mentor, he was I think in New York this summer and when he got back we met up at a restaurant and when we did he told me he heard about it and said – ‘Dude, you are really brave for doing what you did. I’m really proud of you. Most people are worrying about the superficial and what I am going to do tonight instead of worrying about what am I going to do for the rest of my life. I’m proud of you.’ And then there’s this other mentor of one of my friends who is also in high school. She mentors her and that person in UBMP the mentor, her name is Sarah. She really pushes me and meets with me even though I am not really her mentee. She’s like, yeah let me look over your essays and give you tips and advice... Some people are just more enthusiastic and she saw that I have been involved with activism. And she sees that I have – she sees something and she wants to help me. And she emails me constantly and says, ‘Hey there’s this scholarship for undocumented students, you should apply.’ And she’s helping me because I didn’t even know about it and that scholarship is basically built for me.”

### **David: The athletic apostle**

Like Mateo, David is a very confident high school senior. But, very different from Mateo, David prides himself on working hard both in academics and sports. David has a

good relationship with mathematics although he likes science more. He says as a child he struggled in mathematics but now he feels he can take on any mathematics class and accomplish anything. Although David's overall feelings about mathematics are positive, he says he would have avoided all the memorization of geometry, and is happier when studying Pre-Calculus or Algebra.

Recently David switched schools from public to private in order to have a more competitive edge playing for a higher profile sports team in the area. He spent the last month of the previous school year involved in a hybrid of classes, attending class for a short time and then completing assignments online to get credit for the course. He feels he spent a lot of time teaching the remaining chapters of the course to himself as they were off-pace with his new school's Pre-Calculus class. David says the new principal and his new teachers were as supportive as possible, but sometimes they were just unsure of how to help him in some cases.

David describes his relationship with his UBMP mentor very positively. His mentor is a university senior who is studying to become an educator, but David says that his conversations with his mentor are hardly ever about academics, other than just checking in occasionally, or encouraging him to reach a new level on the ACT. David says his mentor did help him a lot with his college essays, but that is the only time their relationship really focused on anything purely academic.

**Personal Identity, Goals, and Motivation to Learn.** While David's heart is in playing sports professionally, he is not letting that come in the way of his academics; his back-up plan is to be an engineer. His parents are not sure of his abilities as it relates to professional sports and want him to focus on his education, but David says that this disbelief

only drives him more towards his goal of playing professionally.

David is not just academically motivated, he is also concerned with social issues. In his last year at his public high school, he focused on petitioning the principal to reevaluate and improve the educational opportunities for special education students at his school.

David is very religious, as are his parents. He attends church four times a week and is very active in his church. He describes one of his goals as to help his peers come to know God. In all his endeavors, David says that he is willing to put the hard work in, himself, but he feels the outcome is up to God's plan for him. David used this explanation as solace recently, after not getting into the college of his first choice. He has other opportunities for his collegiate education, however, due to excelling both academically and at sports.

**Beliefs about Mathematical Ability.** While David describes himself as a hard worker, he does not always see the same in his peers. He defines his peers into a few categories, those who understand mathematics and those who do not. Beyond that, however, he perceives a distinction between those willing to put forth the effort and those who are not willing. David sees mathematics all around him and insists that one needs to be able to figure out its use in situation in the real world. For David, mathematics is not simply memorization, but application of skills.

SW: "What do you see with your peers, your classmates?"

David "When I was back in public school, it was basically the laziness. Yeah. And, just not knowing how to do [math]. Because there are people that they get it and then that's it. But there are people that don't get it and then it takes a very long time for them to get it because in my opinion, and there are people who agree with me, you can't memorize math. It's like, it's hard. You just have to have it right there. You can memorize formulas, but whenever the problem comes right there, you can't remember the facts or anything you're just going to have to know how to do it because word problems – there could be any type of real world problem just like Starbucks, how many Starbucks are here and how many serve the Frappuccinos – basically all of them– you're going to find the percentage. You just can't memorize math...I think about mathematics as word problems and being able to use

[mathematics]. I don't think about being able to use it in real life, but I've gone so far in it that I could take any mathematics that I can. Whatever I put into it, I'll be able to accomplish it. And, I mean, some people will be like 'Wow, your transferring to private school so early, it's going to be a new environment and new teachers,' but I mean whatever teacher I have with mathematics I'm able to just correspond with it. Because, this year I'm working, and then my mom put me as a cashier. And, I don't even have to use a computer, I usually just make the math out of my head. Well, at work it's just like basic multiplication, subtraction, but what I've learned from Pre-Calculus going into Calculus is you've got to learn more about the unit circle and all the shapes and angles."

SW: "Have you always had a positive relationship with math."

David: "Yeah. Math has never been like a struggle to me. The real struggle has been especially in the social studies thing because I have some trouble remembering some facts. Whenever I have something that is laid out [in math], you know solve the problem and then go into it and double check."

SW: "Is memorizing the formulas in math a problem, or do you practice them and it gets better?"

David: "It gets better. I just had that trouble when I was in middle school, now it is not a problem anymore. Basically because I started at a young age. My mom wanted me to memorize really quick facts in church. I am an Evangelist so I have to study really big things."

SW: "Is there a part of mathematics you did not like or would not like to revisit?"

David: "I didn't really like geometry because it was about angles. It was about... I just didn't like it. And, then whenever I got into Algebra and Pre-Calculus I was like – it was a lot of word problems, but maybe it was the teachers. All of [my teachers] had a good attitude towards me. Unless one really had a bad day or just got through a divorce or something, they'll put it towards their students. So, it's really unpredictable. There are other subjects that I'm really good at, and then math is right there in the middle. It's not my worst."

David seems to have a stronger preference for the algebraic, contextual aspects of the mathematics he has learned. He says that he has never struggled with math much, but it is apparent in talking to him that he appreciates solving situation more than simply memorizing facts in mathematics.

**Beliefs about the Importance of Mathematics.** As David already alluded to, the use of mathematics in the business world, we talk more about the role mathematics plays in

the community. Here, as David describes, math is limited to more elementary or discipline-specific topics.

SW: “What about within your community, is there an emphasis on math?”

David: “Science mainly – because it is used for medicine, and math is used to run a business.”

SW: “But, you said upper level math, like Calculus has not translated that much into real world stuff?”

David: “Not really. Because, well, I don’t know. Basically how it corresponds – I think real world is just using subtraction, addition, multiplication, division and all that other stuff. [The unit circle] could be used too, but it’s not really part of everyone’s life. It’s going to be a part of me. It won’t leave.”

SW: “Why is that?”

David: “It’s just a requirement. I mean, I’m not going to do [math] like in thirty years. Everyone is going to grow up, have a family, enjoy [life], but I want to be different. I want to be a professional athlete, but if that doesn’t work out I always have the back-up which goes into engineering... My only thing is when [my parents] don’t believe me. They don’t appreciate it that makes me want to work harder. And, I don’t know, I don’t blame them either. Because they are looking at the thing that is 100%. I could go into that, I could be successful, but being a professional athlete, that’s like one in a million chance. I mean my math teacher, he was going to be a professional baseball player but they cut him off the team, and he became a math teacher. That was [my math teacher] back in the public school. So he had something to fall back on, and it was math. So, math did help him. It was a big part of his life. I mean, it could be a big part, it could not.”

And so, David is unsure how he might use upper-level mathematics in his real life.

Even though he enjoys the subject, the practical aspects are limited to elementary knowledge for David. Right now, mathematics is a requirement that might benefit him later, not something that he does just for the sake of the subject itself, like a hobby.

**Perceptions of Teachers.** David has mentioned his teachers in a positive light so far. He does separate the teacher from the individual, saying that sometimes when teachers are going through something personal, they are not as nice or helpful. For the most part, however, his experiences with teacher is that they try to be helpful when they can.

SW: “Do you think he likes doing that, teaching math?”

David: “Yeah. I mean he likes the kids. He likes teaching math.”

SW: “Do you think the teachers you have had have been good with working with all students?”

David “Whenever I was in public [school] they really helped me. When I went to [private school], I went because I wanted people to get to know me. I don’t want to be that outsider. I really got to know people, but they put me in an online class. I just had to finish two units of Pre-Calculus and I went into a unit not even the private school went into, it was probability. The private school teachers were really concerned because they’d never taught it so I was really surprised when I passed it because no one helped me. I even asked a teacher and she got the problem, the answer, wrong. So there’s going to be some times when you’re just going to have to find it on your own, because even the highest level math teacher can’t know what to do. I was scared. I thought I was not going to get my credit. It was really scary. There was classes there they would put me in for like an hour and then I would do an hour on the computer. At my public school they were in Chapter 4, but the private school would be like two units ahead but they would be going back to Chapter 4 after Chapter 6, they were scrambling. They didn’t want me to go in there and do another subject or unit that I was already taught. And, the principal was always really cool with me because he was the coach, so he was like ‘Yeah, I’ll help you out, but you’re going to have to take the exam and take the final test.’ And then, I finished them, I passed them, and he was like, ‘Ok, we’re ready for you next season.’ Everything worked out. People didn’t really think it was a good move, but I knew that. I told my parents that I will invest in myself, because there are people here that have to waste money. But, you have to waste money to make money. The investment part scares me, but I know I’ll make a good investment [in myself].”

SW: “How do you think your teachers would talk about you as a student?”

David “Well all the recommendations they wrote were like I have a good attitude. That’s basically the number one thing they’ll put for me. And then, other characteristics are like I’m very focused, I like to do homework. I never turn in stuff late. Whenever I have a question, I’m not afraid to ask for help. And that’s the number one thing that, especially with the advanced students, they never want to ask for help. You know., they’re the ones that are going to be most afraid because they want to keep that high grade point average...I haven’t been in a class where there’s people struggling [in math]... I struggled at first because everybody struggles in math. I mean you look at the problem, and it’s like, ‘how do I do this? And then here comes the teacher to the rescue, but whenever I did struggle, my only thing was like wanting to get better because I knew every year that I had to go into a higher math, so it’s just going to get harder. I know whenever I finish Calculus, there is going to be Calculus 2 when I go to college and it is going to be really, really hard.”

David’s experiences with teacher have been different when comparing his former,

public school to his current, private school. His transition to private school opened the door for some uncertainty, and he had to become his own teacher for a time, through self-directed learning. His perceptions of teachers, however, is apparent in the way he talks about their role, even when they fail. He almost describes teachers as a form of superhero, coming the rescue. When he describes the difficulty of his online work even challenging the teacher, it seems like that was something he never considered before. When it comes to his parents', however, David does not want to say it, but he feels he really does not need their help academically, at least not at this point.

**Beliefs about Parents' Perceptions of Mathematics.** David's parents both have their high school diplomas and work as managers in their respective businesses. David says his parents motivate him to do well in education so as to avoid physical labor. They have a two story home in a relatively new subdivision with lots of children from diverse backgrounds, i.e. White, African American, and Latino.

SW: "Can you talk about your parents influence over your school?"

David "I don't want to be mean to them, but they stopped helping me in school when I was in 7<sup>th</sup> grade because I didn't really need help anymore."

David goes on to describe how he is the one that helps his younger siblings with their mathematics homework if/when needed. He is a very caring individual. David is motivated and determined in his goals and how he goes about achieving them. He has a great amount of inner strength and demonstrates lots of perseverance. He says he is strengthened by the doubts of others. His self-determination has served him well both in sports and switching to a new school in the middle of the year and so close to the end of high school.

### **Rafael: The symbiotic competitor**

Rafael is a high school senior who hopes to go into a STEM field in college. He has a

very positive self-image as an individual and as a student. He cites his membership in many clubs in high school, including the Science Olympiad and a ranking official in his school's student council, as evidence of his academic and social prowess. He describes his relationships with his peers as a supportive yet competitive group who works together to get good grades. As applications for colleges and scholarships have grown in importance, the group becomes increasingly competitive and little less symbiotic, according to Rafael.

Like the other participants, Rafael has very positive things to say about his mentor. In fact, Rafael is the only participant to mention that his mentor, who is majoring in a STEM field, has helped him academically in his science classes, like Chemistry. When asked if the mentor has ever helped him with mathematics, Rafael replied that there was no need.

**Perceptions of School Climate and Peers.** Rafael describes his advanced level classes as being dominated more by White and Latino students than African American students. He and his friends belong in the more academically elite group in school, the top academic performers. They are in all the advanced courses and are focused on applying to colleges. Although they are friends and have travelled through their courses together, this new stage of life – where they are actively competing against each other and vying for privileged spots in institutions of higher education – they acknowledge the level of competition in classes has also risen. Rafael views access to the advanced classes and success within them as a product of individual motivational factors.

Rafael: “I’m a Latino high school student applying to colleges, and I am a person who does really well in school. I’m [on the student council]. I’m into all these clubs like robotics club – just a really good student is usually what teachers say.”

SW: “What are you hoping to do?”

Rafael: “Um, [I’ll] probably go into some type of STEM program, either engineering or mathematics.”



SW: “Do you think at your school there is diversity in higher level courses?”

Rafael: “In math classes they are pretty diverse, but there’s more Latino and White people than, you know, colored people, so I don’t really know how you would interpret it... The school is diverse and they are really good at trying to make - in being diverse. Unfortunately, it’s not as diverse as you would see around the school in very advanced courses. ”

SW: “What is keeping students from being in more advanced classes?”

Rafael: “Yeah I don’t think they want to be in [advanced classes] at all, because I don’t know. The just don’t. There isn’t any motivation to take those classes for those people.”

SW: “Do you feel you have a good solid group of friends to help you in these classes or do you feel that you are one of a few students who are in some of these classes?”

Rafael: “Yeah. I do have that one group of friends to help me in math classes which is pretty cool because if one gets stuck on a problem, the other one gets it and we will just work out the problem. I have a good group and in high school we try to like race against each other to get this grade or do better in the class. Classes are so... I guess the competitions are getting tougher this year. There get to be less [students] in number, the people in advanced courses, but you know to get into a good college and get good money you have to take advanced courses.”

Although he has always liked mathematics, he thinks there are some improvements that could and should be made in the way mathematics is taught. Rafael describes himself as a visual learner and would like mathematics to be less about memorizing formulas and repeating procedures and more about visualizing problems in a real-world context. He wishes his mathematics teachers would teach less from the book and more about the way mathematics relates to the world so he might use this practical application when he enters a STEM field later in life.

**Perceptions of Teachers.** Rafael describes his teachers as primarily supportive.

Although he has some general frustrations over the way his teachers handle particular subject, he appreciates their willingness to problem-solve when he struggles with a particular topic. He does not depend on teachers all of the time, when it comes to reviewing previously

learned topics, he has a preference for trying to figure things out on his own.

SW: “Do you feel supported by teachers or do you work on it on your own?”

Rafael: “So it depends. Sometimes teachers don’t offer [help]. Sometimes they don’t teach the way you would like. You are accustomed to the way another teacher teaches, but I’ve found that they’re really supportive because if you have a problem they will help you out and maybe you can teach them a different way from what you were taught. Sometimes I have had to teach myself, with things they expect you to know. You might get some of it, but you are missing that one little piece holding things together and they are not there. Yeah, they are always supportive.”

**Beliefs about Mathematical Ability.** Rafael is interested in majoring in a STEM field in college. He feels he has a positive relationship with mathematics, as evidenced by completing the advanced mathematics courses offered at his school. He displays a great amount of confidence in his mathematical ability, appreciating mathematics for being a subject in which the answer is definite. Still, he does not feel he has had access to understanding the way mathematics works in the world. He spent the majority of his school career learning mathematics from completing textbook problems and not performing mathematics in lab-based, hands-on, or discovery setting.

SW: “What are some of the things that you like about math? What has brought you to want to major in a STEM field? ”

Rafael: “Well, I’ve taken all the math courses offered at my high school, ya know. I just like that sometimes there is an answer and there’s steps to getting that answer. It’s not like English where you interpret... there is a straight forward answer and solution, there’s a number. And in English where you have to interpret, I just don’t like it.”

SW: “What are the ways that you like to learn math? What are the things that you like to do in class? ”

Rafael: “More visual learning, not just straight up from the book. The book is not enough, they need maybe more visual and more world type of relations with math. I just don’t like stuff you will never use. When they put a scenario that is like real-world and that you might come across, I learn more and get more out of.”

SW: “Has your relationship with math changed over the course of your life?”

Rafael: “Yeah I think so, I think in high school and thinking outside the box. And the teacher I guess yeah, made math interesting. Yeah, because you know in elementary school the teacher taught everything and they’re not specialized in one area. And in high school, I felt the teacher was really good in math and she really liked what she did. And, I mean, that interested me, I was like, “oh, cool.”

SW: “You mentioned how your teachers would describe you, if you had to describe what it meant to be a good student, what would your definition of a good student be?”

Rafael: “Definitely ask questions when you have problems with anything, because math is like a build-up. It builds topics onto each other and if you don’t get that one part that will mess you up for the future, so: ask questions, pay attention to the teacher (the stuff she’s telling you) and take good notes.”

SW: “In your mind, are there things that are different than that that people can do to be successful in math?”

Rafael: “I don’t know. I think it’s like a thing, I guess you either like it and you get it or you just don’t get it.”

Rafael likes mathematics. He feels he has always had a positive relationship with mathematics because it has been able to understand the content with relative ease. He has taken all the available advanced and AP mathematics courses offered at his high school. He describes these advanced mathematics courses as diverse in relation to White and Latino students, but with few African American students. Rafael’s favorite thing about mathematics is that you can follow a step-by-step process to find the definitive answer. He puts this quality of mathematics in direct opposition to his English classes, which he does not like for their open-ended nature.

**Beliefs about the Importance of Mathematics.** Rafael acknowledges that mathematics is important for him as it relates to handling his finances, but focuses primarily on how mathematics is important in life because it is a requirement.

SW: “Do you think math is important for life?”

Rafael: “Yeah, I do. Yeah, I really do. I’ve been to summer camps and they’re always given at college and universities. And, they all have a type of mathematics that you have to take, even if you are going into social sciences and whatnot. You

know [math classes] are important, you have to take them. And even in the everyday when you go shopping you have to make sure they are not ripping you off and stuff.”

**Beliefs about Parents’ Perceptions of Mathematics.** Rafael’s idea of being good at mathematics involves a proactive aspect. Rafael specifically mentions asking questions when you need help, not letting confusion build up and taking good notes in class, creating step-by-step models to follow for future problems. But his definition of what it takes to be successful in mathematics is more innate. That is, Rafael explains that there are just some people who do not understand mathematics and others for whom it does not present a problem. Rafael describes both himself and his father as being very good at math, and says that although he never required help from his father in the subject, his father would be willing and able to help him with the subject.

SW: “What about your parents? Were they successful in math? ”

Rafael: “Oh my father was really good in math. He helped my brother, but not me. But, yeah. He does have some different methods of how... the way he figures it out and it’s really interesting, if he did help me.”

**Math Story.** When I asked Rafael to tell me a story about mathematics, he said he did not really understand the question. I tried to pry, at various times, a little further by telling him my own narrative about mathematics or suggesting that he could describe a positive or negative experience with mathematics, but he never felt he had a mathematics story to share or one he was willing to share.

### **Summary**

All four students describe themselves as having an overall positive dispositions towards mathematics and are planning to major in STEM fields or fields that require higher levels of mathematics. They also all seem to associate mathematics with having importance based on being a prerequisite for college and professional fields more so than an appreciation

for the study of mathematics itself. School mathematics is dominant in their lives and many of the students have difficulty describing instances of using higher level mathematics (above addition, subtraction, multiplication, and division) outside of a classroom setting.

Additionally, the students reported feeling different and set apart from the other Latino students at their school, those who are not as academically successful. The next chapter expands more on the themes from interviews.

## CHAPTER 5

### DISCUSSION OF THEMES

Martin’s work (2000) was a basis for this research project and was used in initially analyzing results, therefore a modified version of the Martin’s model for analysis was used on this data and is used in this chapter to introduce the major themes of the project. Although the cases were described in detail using quotes from interview in Chapter 4, this chapter will revisit some data and quotes in order to fully explain the themes presented. Additional quotes from participants will also be used to further support and explore themes.

Table 3

*Key Themes of Participant Mathematical Identity* (influenced by Martin 2000, p. 166)

<u>Themes</u>	<u>Daniel</u>	<u>David</u>	<u>Mateo</u>	<u>Rafael</u>
Personal identities and goals	Positive	Positive	Positive	Positive
Perceptions of peers	Critical	Critical	Negotiated	Critical
Beliefs about mathematical ability	Positive	Positive	Positive	Positive
Motivation to obtain mathematical knowledge	High	High	High	High
Desire to pursue a STEM field career	High	High	Medium	High
Valued the importance of personal mathematical knowledge	Yes	Yes	Yes	Yes
Experienced differential treatment from peers	Yes	Mixed	Mixed	No
Existing support structures outside UBMP	No	Yes	Yes	Yes
Positive Latino Identity	Negotiated	No	Yes	Yes

**Personal Identity, Goals and Motivation to Learn.** The students described in cases in the preceding chapter are all primarily self-motivated, high achieving students who, to some degree are interested in STEM fields. These students are confident in their intellectual abilities, although they are each in some way uncertain about their futures. They each describe a general desire to be successful, which for them means to have a high paying job that requires a college degree of some sort.

**Perceptions of School Climate and Peers.** While many of these student describe their high school as being diverse, most acknowledge their advanced classes to either be a mixed majority between White and Latino, with few African American students, or lacking in diversity (and mostly White or Asian) with some variation present based on the subject in question or the class schedule of the student. Beyond the classroom diversity of the advanced mathematics classes, they acknowledge segregation among different peer groups based on race and ethnicity in the hallways and lunchroom of their school. And, despite a large Latino population within the school and community, none of the students have had experiences in which they learned about the various cultures of Latino youth in their school. Instead, they describe the school as stripped of culture, with no cultural heritage explicitly taught or supported in the school.

***Large Hispanic population, small but increasing representation.*** While research still shows underrepresentation of Latino students in advanced and AP courses (Walker & Pearsall, 2012), these four high school students describe currently having a majority of Latino students in their AP Calculus class. According to the students, recent trends at the school show more Latino students in AP Calculus than before.

SW: “Do you think at your school there is diversity in higher level courses?”

Rafael: “In math classes they are pretty diverse, but there’s more Latino and White

people than you know, colored people, so I don't really know how you would interpret it."

SW: "Is it reflective of the school?"

Rafael: "The school is diverse, and they are really good at trying to make classes diverse."

This suggests a trend towards increased enrollment of Latino students in Advanced Placement mathematics courses over the past years. When asked about the peers at their school, however, many describe the Latino students in regular courses as a separate entity from more academically successful Latino students. This group of Latinos in regular classes are described by the students as low achievers with no motivation. This description creates a divide for these successful students with the other members of the Latino community within their school, which they define as lazier.

**Perceptions of Teachers.** Many students were able to share their appreciation for their mathematics teachers in middle and/or high school, but the enthusiasm for teachers was limited to teachers of advanced classes or a teacher of a regular mathematics class who saw the potential for a student to enroll in advanced classes. These teachers are described as good people who care about their students. For instance, Mateo had a teacher in a regular mathematic class who encouraged him to take higher-level mathematics classes which left a lasting, positive impression even though he did not take the opportunity at first. These "good" mathematics teachers are also described as having a focus on the application or real-world use of mathematics when possible, albeit of the elementary variety, and a fair teaching style. When describing their advanced mathematics courses, students talked about positive aspects such as the teachers being less focused on harsher discipline than non-advanced classes. They also discussed the increased motivation of their peers within advanced courses and the ability to occasionally have mathematical conversations, not always having to just



practice similar examples to those done by the teacher.

In contrast, there were times when students gave very negative portrayals of their teachers. Students who had been previously enrolled in non-advanced mathematics classes tended to have a negative view of those classes and their teachers. Describing regular mathematics classes, students spoke of rote copying of examples, experiencing behavioral issues within the classroom, and general apathy from teachers and students towards the subject and the class. Two of these negative portrayals actually centered on the same teacher who the students felt did not know the subject well enough to teach it.

A third student who presented a negative portrayal of a mathematics teacher recounted a story in which he felt his teacher treated another student, his friend, as inferior in mathematical ability based solely on his English proficiency. The teacher was confounding language fluency with intellect. According to the student, because his friend was still struggling to learn English, teachers kept giving him remedial tasks, even as an honors student who excelled in mathematics. The friend is in community college now, trying to get into the university system. The friend had to start at the community college due to immigration status issues, but is reportedly doing well academically.

Aside from a few strongly negative comments about teachers, for the most part students described their teachers in very neutral ways. Mathematics teachers in particular seemed to primarily serve their purpose in just showing students how to do algorithms and solve a series of problems. They describe their experiences in mathematics as having to teach themselves often and asking questions seldom. These students already felt confident in their mathematical abilities and, when faced with new challenges, had the ability to rise above a bad experience. That is, no students reported a shift from feeling negatively about

mathematics to positive feelings by a particular influence or pedagogy.

**Beliefs about Mathematical Ability.** The students interviewed, whether they had an entirely positive or mostly positive relationship with mathematics, cited some similar characteristics of mathematics that drew them to the subject.

**1) Mathematics ability as innate.** Students described their proficiencies in mathematics with great pride and were excited to talk about earning good grades in their classes. Both Mateo and David spoke of the ease of mathematics, especially compared to other subjects.

Mateo: “I think it might have been because I moved to [the state] at the age of 4, so I only knew Spanish. English was really hard for me so learning facts was hard, but working with numbers is universal so you pick up on that stuff faster and easier, so I saw that. In elementary school, while I was in [English as a Second Language] ESL, I was in a regular math class, because I could actually do that. Maybe that’s it. I don’t know. It’s a theory. I never thought about it. It could be my parents or my father because he did well on the GED test. It’s hereditary.”

David: “Yeah. Math has never been like a struggle to me. The real struggle has been especially in the social studies thing because I have some trouble remembering some facts. Whenever I have something that is laid out, you know solve the problem and then go into it and double check.”

This natural ease provided comfort with the subject for these students and is primarily responsible for the positive attitude towards the subject. Had the students not considered themselves to have positive abilities in mathematics, or if they felt they struggled more than they succeeded, their perception of mathematics would likely have changed.

**2) Mathematics as a closed system.** Questions lead to answers. Practice leads to perfection. Students consistently described liking mathematics for its finite nature and for questions always having a right answer in mathematics. Because mathematic questions have a correct answer the students felt they were able to excel in it, sometimes even with little practice. These students put mathematics in direct opposition to their English classes, which they

described as having more open-ended answers. They seldom mentioned critical thinking skills in relation to mathematics, perhaps as a result of not being challenged to think critically about mathematics in their classes. Cabrera, Lopez, and Sáenz suggest this may be because teachers feel “handcuffed” by standardized testing (2012, p.240). That is, the focus on standardized testing has teachers scrambling to stay within the prescribed curriculum and rote algorithms, and is instead responsible for not taking time to incorporate an emphasis on critical thinking skills. Whatever the cause, Rafael gives a clear picture of his definition of mathematics as devoid of open-ended, critical thinking questions even though he has a desire to connect more strongly with the subject.

Rafael: “Well, I’ve taken all the math courses offered at my high school, you know. I just like that sometimes there is an answer and there’s steps to getting that answer. It’s not like English where you interpret... there is a straight forward answer and solution, there’s a number. And, in English where you have to interpret, I just don’t like it.”

SW: “What are the ways that you like to learn math? What are the things that you like to do in class?”

Rafael: “More visual learning, not just straight up from the book. The book is not enough, maybe more visual and more world type of relations with math. I just don’t like stuff you will never use. ”

At no time when prompted for a story about mathematics or a description of mathematics did the students say that they enjoyed mathematics because it was a beautiful subject or because they enjoyed mathematical inquiry. Instead, they said they enjoyed mathematics because there was always a right answer and because they had a natural affinity for it.

**3) School as the only domain.** I would often start my conversations with these students with “tell me a story about mathematics.” This was a question that I viewed to be very general, open to stories of school or home mathematics. Students in each interview,

however, would launch into describing themselves as a good or bad mathematics student in their high school or college classes. I found that in order to elicit a story about mathematics in the home I had to ask them about how they use mathematics in their daily life. Still, this concept as mathematics as access to mobility was present in most interviews. Even the home mathematics examples tended to focus on work, traveling or shopping expenses. These students have not made a connection between the advanced mathematics they are learning in their high school classes to anything relevant for their lives, but they are excited about mathematics and proud of themselves for excelling in it. The students feel really good about being good at mathematics.

4) **Learning mathematics in isolation.** Many students described working on mathematics as a solitary endeavor. They would describe teaching themselves mathematics by going back and practicing problems until they got them right. They did not seek out help often. Daniel and Mateo referred to working with class friends, rather than their social friends, on occasion, but students mostly spoke about self-directed learning when it comes to mathematics, rather than cooperative learning in mathematics classes.

### **Beliefs about the Importance of Math**

1) **Math as a means.** The students interviewed talked about mathematics as a prerequisite for their fields of interest. They feel they need to take mathematics and excel in it because it will help them be a more marketable candidate for professional or graduate school. Additionally, students have mentioned how the rigor of mathematics – learning hard material, memorizing formulas, or working hard to make sure you get the right answer, persevering in solving problems – are skills that will serve them in life, but not the actual mathematics itself. There is potentially something wrong in mathematics education if students who are in the highest levels of mathematics offered in the public school systems

still have no idea about its purpose.

**2) Mathematics at an elementary, not secondary, level.** For all the emphasis on word problems and making mathematics meaning in the lives of students, none have been able to describe how they can use higher level mathematics in their home life. That is, when I asked about the use of mathematics in the home, they would typically give examples of going to the grocery store or setting up an appropriate budget. While these are appropriate uses of mathematics in a real world context, none of these topics go beyond arithmetic. No one yet have mentioned how they might use higher level mathematics in their daily lives, despite all having taken quite high levels of mathematics.

SW: “Will math be important to you in life? At home?”

David: “Not really, because well, I don’t know, basically how it corresponds but I think real world is just using subtraction, addition, multiplication, division and all that other stuff. [The unit circle] could be used too, but it’s not really part of everyone’s life.”

There are some potential counter examples to this lack of context. Students often described mathematics they used not at home but in their respective jobs.

Daniel even had responsibilities, using mathematics in his role as manager of a store.

SW: “Do you feel like you often see math outside of the school context?”

Daniel: “Outside of school, definitely at my job. I work at [a store]. I work as an office assistant so I have the accounting reports for the night and I have to make sure that all the finances are where they need to be, and where the safe is at.

SW: “That’s a huge responsibility for someone in high school. How did that happen?”

Daniel: “I don’t know, I just kind of got in there one day and worked my butt off. My manager said that one of the sales assistants at work had put my name out there and said she would trust me and that I could do more than I actually was because at the time at the entry level position I was just bagging groceries and getting carts. Because bagging groceries and getting carts the only thing I was facilitating was lines and I wanted to take on more responsibility and be able to help out in a bigger way. I guess when I first started my training it was a little overwhelming because I was the only teenager in the office and the only male Hispanic in the office and so I just

didn't want to give anybody the impression that they made the wrong decision.”

Although there was some discussion of the use of mathematics in life, these are not counter-examples to the theme of only elementary and school-based math, however, because their descriptions still center primarily on balancing budgets and basic mathematical skills of addition, subtraction, multiplication and division.

**Beliefs about Differential Treatment and Peers.** The students all described themselves as successful students, especially in relation to other students in their community. Coming from a community with not a lot of jobs that require higher levels of education and where most of their high school aged peers join the workforce instead of attending institutions of higher education, these are the students who feel they are rising above their community influences. In their descriptions of themselves, they are set apart from the majority in their communities.

A common theme of the interviews with students is that of how they refer to other Hispanic and Latino/a students at their high schools. This arose largely because I would ask students about the racial make-up of their advanced-level classes, if it was proportional to the rest of the school. I would then follow up by asking them why they felt some Latino students did not take advanced level classes. The general description of these students is that they are either too immature or lazy to excel in mathematics. Many of the participants described the larger group of Latino/a students at their school as “class clowns” or those who were “more interested socializing than in school work.” In this way, the successful Latino students interviewed were setting themselves apart from these students.

Ríos Vega found a similar discussion of peers by more successful Latino students. The Latino students in regular classes were portrayed by their more successful peers as not

having tried their best in comparison to the efforts and resiliency demonstrated by the more successful students who felt they did work hard (Ríos Vega, 2015). Similar work in mathematical identity development has noted that race plays a part in how students identify their peers' relationships to mathematics. That is, Latino students will often categorize Asian students as high-achieving while recognizing Latinos as low-achieving as whole (Zavala, 2012). In identifying themselves as successful in school and mathematics, these students are separating themselves from their Latino peers who are not as successful.

The students in this study felt isolated or in a minority of Latino students who were/are focused on education. With conversations about individual determination present in many of these interviews, the idea of meritocracy arose. In initial interview, students felt they deserved to be in advanced classes based on their own individual work ethic while seeing the academic failures of other Latinos as brought on by laziness or lack of intellect. But, in further interviews, another story came to light to explain the situation of these Latino students in regular classes.

*The DREAM Deferred and Activism in High School.* Daniel specifically referred to differences he perceived in his educational success compared with his older sister's as ones of educational expectations and opportunities rather than intellectual ability.

SW: "With your sister, do you think she kind of avoided the higher math classes because there was a terminal point of education for her or does she just have an affinity for other subjects?"

Daniel: "Um, I think for her, I guess it was more just the fact that she just wasn't given the option. It wasn't something that was bored into her that she needed to achieve higher mathematics. It was just that she needed to do what was recommended or what was needed for her intended major."

SW: "Do you see that a lot at your school with undocumented students? Do you think that affects them?"

Daniel: "Yeah. I see a lot of students kind of duck the higher classes, not just in

math, but just kind of duck the higher education classes and get by on the bare minimum.

SW: “And why do you think that is? Do you think that has to do with their status or are there other reasons that factor in?”

Daniel: “I think citizenship is a factor in everyone’s history, but I don’t think it is the definitive factor. I think it’s the fact that people are saying that nobody has actually told them that it is not okay to not actually try hard. They just say ‘Do what you gotta do, cruise by.’”

SW: “Is that what a lot of students at your high school do? Do you mean more with Latino students or just in general.”

Daniel: “In general, yeah. I have been speaking to this one class of freshman, this one kid who is like 14. He was failing his class and I was asking you know to go into further details. He told me that wasn’t worried about getting anything higher than C’s and B’s because he just wanted to get his diploma so he could go out and work. And right from there that kind of opened my eyes because if that’s how 14 year-old freshmen are thinking, then there is something definitely wrong. I think it is mostly because of my story and my background being so unique and different from everyone else’s that I kind of able to tell them that ‘hey, I came from’ - what’s the word - it’s not privileged. I wouldn’t say that I was coming from a disadvantaged background. I would say that I was coming from a less privileged background, however it wasn’t something that should stop me, it should be something to motivate me and I just want to be able to convey that because I don’t want them to think, “Hey no one is helping me. Why should I be doing this?” That’s kind of the things that I focus on when I talk to them because the thing is these kids are so into this idea that they can’t fail or that they shouldn’t be able to fail. That failing is bad and as soon as you fail, you know, you are done. I told them that I thought I was smart until I got into my AP Biology course and I failed my first test, like absolute bombed it and realized I could either cry about it or do something about it... . I have been speaking to this one class of freshman, this one kid who is like 14. He was failing his class and I was asking him to go into further details. He told me that wasn’t worried about getting anything higher than C’s and B’s because he just wanted to get his diploma so he could go out and work. And, right from there that kind of opened my eyes because if that’s how 14 year-old freshmen are thinking, then there is something definitely wrong.”

In some ways, the way these students describe their peers can be pejorative. After all, they see themselves a very different from the students who have chosen to take less rigorous classes and those who are not, in their perception, as motivated as they are. In other ways, however, they see these students and their lack of accomplishment in high school as a result of lowered expectations and limited possibilities in their community.



Even though some students were easily able to put the regular education students at their school into the category of class clowns, others were able to describe the plight of these students with reference to structural inequalities in American society. According to both Daniel and Mateo, the reality of having to pay out-of-state tuition at local colleges and universities has created the perception among these students that college is an unattainable goal. And, if students are not planning to go to college, where is the incentive to excel, strive hard, or even sign up for honors and AP classes? Instead these students focus on joining the workforce after high school. So long as these lower performing students do not cause trouble along the way, many of them are left alone by the teachers and counselors to simply move on to the workforce as often happens within the community.

In my initial conversations with students, I would ask them to describe their community, schools, and peers. Each time I would ask more generally and then focus on the role of mathematics in the community. Mateo addressed the lack of options for Latino students in his area. He more specifically focused on the high cost of education for undocumented Latino students and the limits this cost places on their access to higher education and professional mobility.

Mateo: “People think if you are Asian you are going to be a doctor, or, if you are Latino you are going to work in mechanics or carpentry. Maybe they just feel boxed in and they can’t fight the box, but there’s a few people that do, the exceptions. Now [my goal] is getting a policy or a bill passed on the state level for undocumented immigrants to be able to go to college on an in-state rate instead of an out-of-state rate. That’s one of my big worries right now... Like my friend, he wrote a poem about graduating and his high school diploma was like a death certificate or something because after that he hit a brick wall. And, he describes the instance where he asks his mother, like what am I going to do with my life. Why did you bring me to America? What’s the point of begin here if I can’t study or be successful here. And the mother replies, ‘We brought you here so you wouldn’t live the same life that we did, in Mexico.’”

Both Mateo and Daniel recognize documentation status as deterministic barriers for academic success. For Daniel the barriers is developmental due to the role documentation plays in determining the success of the Latino students in his community. Daniel says documentation status is responsible for lower expectations and lower perceptions of scholastic aptitude for these students affecting their academic success. Mateo's description, on the other hand, focuses on the effect of immigration status on matriculation even after a student has been academically or mathematically successful. Both descriptions present a bleak view for undocumented Latino students in mathematics education.

Stories of students who are not able to go directly to a four-year college based on having to pay out of state tuition, like Daniel's sister, are common narratives within the immigrant Latino community in the state in which this research took place. The failure of the Development, Relief, and Education for Alien Minors (DREAM) Act, which would have allowed immigrants living in the state to be considered in-state students, has put into question whether post-secondary education is realistic for a large population of Latinos within the state. Researchers have found that the lack of access to higher education due to either financial barriers (Cabrera, López, & Sáenz, 2012) and legal status may cause students to drop out (Gill, 2010; Ríos Vega, 2015). Mateo, in particular, has been particularly active in a group working to call attention to the cause.

*Injustice and Activism.* David has also played the activist at times. At his former, public high school, he sent the principal many letters to address the condition of special education students at his high school. He perceived these students as having limited educational opportunities, being tracked into vocational classes rather than academic ones and even being used to clean the school grounds. In his letter, he likened the Special

Education students to the Epsilons in *A Brave New World*, who were reduced to one remedial job, like operating elevators, so that the rest of society, the Alphas, could function happily with all the choice and benefits of a good life. He told his principal having them cleaning the building was similar to telling them their lives were over. Despite many pleas, the principal never really responded, and then when David left the school he had to leave his activism there behind. He says that the principal likely had good reasons, or other pressing matters to attend to and was not discouraged by never getting a response.

Having a presence of mind about injustice and a willingness to act in response to injustice seems to be a common trait among these students. As high school students, David and Mateo could both describe particular instances where they stood up against injustice as an activist for a particular cause. And, Daniel has described an interest in giving back to the community. These students are not only successful in a school sense, but in the sense that they are ready to play the role of the agent. They are empowered and motivating their efforts forward.

Students have had experiences with early activism. Although these students were able to identify areas of preferential treatment for particular groups, students who had already graduated high school and moved on to college-level seemed better able to share examples of personal racism, like racial profiling or sharing stories in which they or their friends felt persecuted at school or by peers. High school students focused on structural racism, like the DREAM Act but did not share many stories about racism within their community other than to say their school was segregated in the social spaces, but not so much in the classroom. Perhaps with more distance from their community they would be able to better reflect on their experiences.

### **Beliefs about Parents' Perceptions of Mathematics.**

*Parents' Mathematical Ability.* The students interviewed had various perceptions of their parents' mathematical abilities. Students like David, Mateo, and Rafael said their parents were very good at mathematics and there was an implication that mathematical ability and general intelligence may be an inherited trait. However, the parent educational levels did not seem to weigh heavily on the students' perceptions about mathematics. To them, their mathematical prowess was an individual trait that was more likely a result of their inherent ability and their access to resources such as higher level courses and good preparation in mathematics.

*Parents' Opportunities.* The parents of these students all expressed a desire for students to succeed in mathematics and education so that they will have greater opportunities in the job market. Within their stories, there is a common theme of moving, to a new country or a new state, as a means of educational and economic mobility for their children and less so for themselves. Many of the participants' parents were or are seeking higher education (GED, etc.) for themselves in order to be more marketable in looking for jobs. Often, for Latino parents, the attainment of a bachelor's degree represents the opportunity for economic security, and the end to the kinds of struggle the parents' themselves have experienced (Cabrera, López, & Sáenz, 2012).

Mateo's father completed his school and took some classes in college in Mexico, but he did not receive credit for his education when he came to the United States. Instead he took a labor job working construction. While working he still went back to school to get his GED. He got the highest mathematics grade in his GED class, a point of pride for him. Mateo's father tries to instill in his children that working hard in school now will mean not as

much hard work (physical labor) later. He is proud of his son's accomplishments, but wishes he would work harder in school and wishes he would apply himself more. He often tells Mateo that he would rather Mateo be mentally exhausted than physically exhausted at the end of every day.

David's parents came to the US during their elementary school years. They had a family when they were very young and had to start working straight out of high school. At times it has been a struggle for them to make enough money to get by, but they have each reached the level of manager in the respective companies for which they work. David's parents use their lives as a lesson for their children. They do not want their children to fall into the same mistakes they have made, as they refer to them. Instead they constantly urge their children to do well academically in school and focus on going to a good college. In our conversation, David's father echoes Mateo's father's message, "It is better to work with your mind than your body."

***Parents' Missed Opportunities.*** Parents who were denied access to education based on gender or economic issues want their students to succeed but feel limited in helping their students succeed academically once their children pass a certain (usually elementary) level in education. Many of these parents had their children at an early age, having to forgo their education, and now focus on seeking out opportunities for their children.

David's parents are able to describe ways in which they have encountered racism. For David's father, racism in the workplace is a part of his daily life and work. David's father is manager of a local business. His subordinates include a group of White men that he refers to as Southern rednecks. He says these White men have issues taking orders from a Latino male. He described having to adjust to Southern culture, especially spending the

earlier part of his life in the United States in California. In California, he said, they have a zero-tolerance policy for discriminatory behavior and he would not be asked to put up with this. He does not feel that is the culture of town in which he works. Instead, he constantly strives to rise above, to ignore their behavior and present a model for the type of behavior he feels belongs in the workplace. In this way, David's father does not actively fight the racism he encounters because he feels it would be against his character and counterproductive to his goal – to provide for his family.

David's mother says that although she has encountered racism in her life, she does not encounter it frequently in the work place. She attributes the difference to working as a manager over women, and more specifically women of color, Latinas and African American women. She agrees with her husband, however, that instances of racism should be handled by being the more mature individual, and not succumbing to the frustration they can cause.

Some parents, however, have quite different narratives when it comes to experiences with racism and differential treatment. Mateo's mother and father have encouraged him to be involved with activist efforts on behalf of statewide Latinos. In their lives, they have taken up causes, marching and protesting for the rights of individuals. They are very supportive of his activism and show support for him in these endeavors.

**Parental Support.** In a study of 81 Latino elementary school children of immigrant parents, Goldenberg, Gallimore Reese, and Garnier (2001) found that, rather than the typical excuse of Latino parents setting low expectations or example for their children in school, Latino parents set high expectations for their children in school and highly emphasized their children pursuing post-secondary education. Similarly, this study found that, in terms of support from parents, the students in this study described their parents supporting them

emotionally and wanting them to excel academically. They also say that their parents have not been able to help them academically past a point in either elementary or middle school. For academic support they instead turn to a small group of academic (and not necessarily social) friends. Or, they would work through issues on their own, in isolation.

### **Isolation vs. Support**

Themes of isolation were quite strong in the interviews with high school students, but there were some also themes of support, especially when it relates to the UBMP itself. Daniel, Mateo, and David all expressed the idea of being isolated in some way at their schools.

For David, it was transitioning to a new, private school from his public school for the purpose of having a better chance to play a sport at a collegiate level. In order to get to know the students and the school setting, he spent the last month of the previous school year at his new private school. His friends told him he was crazy for moving to a new school so late in the year and he had to spend some of his class time isolated, finishing the remaining chapters of some classes online.

Mateo expressed isolation because, even though he has friends in his advanced classes, his actual friends are in lower-level courses. Mateo has appropriated the ability to navigate between the two worlds, while feeling somewhat divided about his relationships with his peers in school. Daniel, on the other hand, described at much more length the ways he felt isolated.

Daniel felt isolated from the Latino community and even his parents. He described his peers' perception of him as "acting White" by taking advanced classes and being friends with White individuals. Daniel said he felt he was losing his culture and took active steps to reconnect with his culture after having conformed to a white-dominant school system. He

started taking Spanish, but was then picked on for not already being fluent enough to ace the course without trying. Daniel even felt isolated from his family as the only American citizen. Rather than feeling ostracized, however, the students mentioned how other students from their culture support them and how they look to a small number of peers or the mentors and leaders of the UBMP for support. There are various support structures mentioned by these students, and usually include their parents, a select group of peers, a supportive academic influence like a teacher or UBMP-involved university professor.

All of the students past and present suggested the program was a wonderful source for support. They described great relationships with their and even other mentors, both academically and socially. The program seems to be doing a great job of making these high school students feel like they are prepared to apply for and go to college. Many students focused specifically on their relationship with one college professor associated with the program. In most interviews his name came up as someone who had supported their application to various schools, written recommendations for students, provided academic support for classes or ensured that once accepted the student had an on-campus job.

### **Summary**

Examining the mathematical identities of these four successful Latino students opens the door to some harsh criticisms of current mathematics education. In doing so, it also offers an opportunity for mathematics students, teachers, and teacher educators to grow from this and future research. Implications for students and educators, as well as for the NLD, will be addressed in Chapter 6.



## **CHAPTER 6**

### **CRITIQUE, IMPLICATIONS, AND FUTURE RESEARCH**

This chapter begins by first revisiting the research questions posed at the end of Chapter 2. Then I offer a critique of some of the elements underlying this study, such as the implied homogeneity of the Latino experience, the importance of mathematics and STEM education and White-dominant definitions of intelligences. I also revisit my own post-critical reflexivity in doing this research before addressing implications and future research stemming from this project.

#### **Research Questions Revisited**

The participants in this study suggest some answers to the research questions:

1. How do successful Latino high school students describe their relationship with mathematics, their dynamic mathematical identities at the high school level?

Overall, the high school students seemed to have had mostly positive experiences with mathematics. Even if all their experiences have not all been positive, they all still feel relatively confident in the subject and confident about themselves as students in part based on their positive relationships with mathematics. Although some negative experiences were shared, these were mostly associated with lower level classes and the negative experiences of their peers. Also, these negative experiences did not seem to permanently alter the way students perceived their own relationships with mathematics.

The students said that what they liked most about mathematics was that there are clear-cut answers and processes. For these students, learning mathematics is learning about

the absolute processes of determining right and wrong answers, leaving little room for subjectivity. While the mathematics taught in K-12 is typically more definitive in nature, not all areas of study in the field of mathematics have clear cut answers. It is possible the views of these students will change as they move into more abstract, inquiry-based mathematics in college. Also, there have been movements within the mathematics education community to try to encourage students to understand contextual subjectivity within the study of K-12 mathematics through the use of modeling and critiquing mathematical arguments.

2. How is school success, mathematical or otherwise, related to ones perception of their own culture?

Within this study there was no singular effect of culture on academic success. Instead, a spectrum of relationship with culture to academic success was represented in the four students. For instance, with Daniel and Mateo there was a great difference in relationships between academic success and culture.

While Daniel was more academically successful, he feels much separated from his culture. He referred to other Latino students seeing him as “Americanized” in a negative sense. And, he attributed the lack of effort and “ducking” honors classes to their lack of success, yet he also identified that immigration issues may play a role in their lack of effort. And, for his part, Daniel wanted to serve as an inspiration or tutor in order to help these students, or their younger counterparts be successful.

Mateo, on the other hand, had fewer classic markers of academic success than Daniel, but is still a strong student. Mateo also had a strong inclination to be an activist for the Latino community. He is impassioned by the struggles of his peers and wants to fight the system of oppression and barriers faced by his friends, family, and other Latinos across the state. Mateo had a very strong sense of himself as a member of the Latino culture and

community, one that is much stronger than his successful academic identity, while Daniel had a strong sense of his academic identity and almost no sense of this Latino culture and community.

For Daniel, academic success separates him from his Latino/a peers and his culture. Daniel is highly aware of and is sensitive to this separation, in part because he feels so isolated from his family. While Mateo says he faces ribbing from his friends about excelling in school, he does not feel that his success separates him from his culture. Mateo views his academic success as a means to being able to fight for future generations of Latino/a students. This message is reinforced by his parents and friends, who support him.

In light of these very different students, academic (and mathematical) success is not deterministic to a students' relationship with their culture, nor vice versa. From these interviews it appears that parents and peers have a much greater influence on one's perception of connection to their culture than simply academic success alone.

3. In what ways do peers, teachers, and parents influence these mathematical identities of these students?

The mathematical identities and experiences of the parents were somewhat varied. Although there were references to a potential for inherited mathematical ability, a parents' negative experience with mathematics or education did not seem to create a negative mathematical identity for the students. These students all felt that they were capable of achieving success academically in high school, even if post-secondary options were limited by documentation status. What was also clear for all students was the high level of expectation for academic success they perceived from their parents over the course of their academic careers.

The teachers were described in both positive and negative terms but, overall, did not seem to be the central influence for the mathematical identity creation of the students.

Teachers were represented primarily as animated versions of textbooks. Based on the interviews with the students, it seems the primary role of the mathematics teacher, in the eyes of the students, is to present repeated algorithms for solving problems until the students have learned the strategies well enough to apply them to new situations. Students did not describe transformative experiences with teachers and, in general, both parents and teachers seemed to have far less effect on these students' mathematical identities than did the experiences with their peers.

Peers seemed to come up much more often when students tried to define their mathematical identities and academic success. These students saw themselves as successful in mathematics primarily in comparison to their peers. The high school students seemed to separate themselves from the peers they deemed too lazy to be in their advanced classes. The students' description of their peers echoed the contrapositive of meritocracy. Meritocracy presents the idea that if a person works hard, they will achieve great things. The contrapositive, then, is if a person does not achieve great things, then they did not work hard enough.

Although one might wonder in reading the students' responses about their peers whether the high school students were falling victim to Freire's idea that the oppressed become the oppressor, it is also likely that they are justifying their own position in advanced classes through the perception of meritocracy. That is, the students interviewed felt that they deserved to be in their advanced mathematics classes because they excel in mathematics and

are good at it, and, therefore, the other Latino students in the school who were not enrolled in these advanced courses did not deserve to be in them.

4. In what ways do students perceive their mathematical identity to affect their own educational and career mobility?

For these students, the definition of mathematics and the application of its use in the real world is limited to elementary mathematics. Most of these students felt pretty comfortable in their mathematical knowledge but are unsure how they would use upper level mathematics in real life contexts. Also, for them, success in mathematics counted as a traditional marker of success as a student as whole. Success is described in conventional ways for a student as obtaining good grades, getting into a good [post-secondary] school, and having those two correspond to the ability to get a high-paying job.

Mathematical success alone is not enough to allow for this route to success, as evidenced by the limited access to post-secondary education based on documentation status. Ability in mathematics does not outrank documentation status in terms of educational and career mobility. And so, contrary to what grades a student earned and what relationship they might have with mathematics, later success is not possible for everyone, and these students were aware of it. They do, however, see achievement in mathematics as necessary for future success even if not wholly deterministic.

### **Critique**

It is important, before concluding this discussion of the mathematical identities of successful Latino males, to critique some serious elements underlying this work. For instance, by focusing on mathematics education, even among successful Latino high school students, this project positions mathematical knowledge above other forms of knowledge, and relies on an understood value of mathematics that is perpetuated by the high stakes

testing model of education, the very essence of what this research project is trying to challenge. Also, at the center of this research, we see definitions of intelligence and success in the US are social constructions stemming from a paradigm of White dominance and Western ways of knowing and learning. There is a need to address the critique of traditional definitions of success and intelligence, and offer alternative definitions. And finally, just as post-critical reflexivity was explored throughout the duration of this project, it is addressed within and in closure of the critiques provided in this chapter.

### **A Critique of Examining Mathematical Identity of Successful Latino Students**

**The “inherent heterogeneous” Latino population.** As Ponjuan, Palomin, & Calise, (2015) remind us, the Latino population in the US is “inherently heterogeneous” (p. 59). This heterogeneity can be characterized by differences in country of origin, family structure and history, gender identities, and many other facets of human experience. This heterogeneity is not explicitly addressed in this research project, nor is it present in the existing framework of mathematical identities. In this framework, there is room for such heterogeneity and intersectionality due to the focus on studying individuals, but this is not addressed sufficiently in the existing literature. In fact, Martin’s original framework (2000) does not specifically address what are potentially powerful implications for this research in looking more into the intersectionality of ethnicity, gender, and mathematical identity for members of the Latino population, and moreover the Latin@ and Latinx populations. Therefore, not only it would be irresponsible to take this study and assume that any it represents a homogeneous group, but also I acknowledge the limitation of this study in not addressing intersectionality within the mathematical identities of successful Latino students.

**The reification of the power of Math and STEM.** In Chapter 1, I wrote about choosing STEM, and more specifically mathematics, as the focus of this research project due to the prevalence of mathematics in the world of education. And, with every word, in doing so I am inadvertently contributing to the implicit power of mathematics and STEM in the world of education. After all, my focus on mathematical identities of the participants in this project does perpetuate the importance of mathematical knowledge, and links success in mathematics with broader Western definitions of success.

To some degree, this reification of the power of mathematics and STEM is inherent in this study due, in part, to the lack of critique of the implied importance of mathematics existing in Martin's original framework. While Martin's original framework critically analyzes the historical context of the marginalization of African American students (2000), he does not critically analyze how his own work, and a general focus on mathematics perpetuates the dominance of mathematics in education and inadvertently helps to fuel the focus on mathematics achievement levels, which are measured by high stakes testing and most often reported on in ways that gap-gaze.

By focusing on mathematics, we must ask ourselves: what intelligences, students, and subjects are silenced or marginalized? It is arguable that we know some of the answers to this question, but on a very surface level and in ways that still ascribe to the White-dominant model of schooling. I ask this question not to answer, it as it is seemingly endless, but rather to offer a critique to my own work. There is also some question as to how well the students understood STEM and the use of mathematics within STEM fields.

**Students' knowledge of STEM.** Students have been told repeatedly in school, by parents, and through various influences of media, that STEM is important and represents the

future of professional careers. In discussion with these students about their potential futures, there is a sense, however, that they have very little knowledge of what these STEM careers entail and how mathematics might be used within them. That is, mathematics is a tool by which those engaged in STEM fields answer often open-ended questions. Performing mathematical algorithms in itself, is not the focus of all STEM careers, but mathematics does provide the structural basis for the field in general. Though STEM is widely used as a buzz word in education, with most of the specific elements of STEM careers are left unexplored by high school teachers and students due to lack of access and personal experience. Therefore, it is not known how great an understanding or appreciation for the realities of working in a STEM field are for these students. Giving students access to experiences in which they are able to better understand the true work of the fields in which they show interest, may increase the retention rate of students in these fields as they enter higher education, allowing them to be successful in their goals.

*What is success?* As a researcher and a mathematics educator, I certainly do not believe that a student needs to be successful in mathematics in order to be successful in life. I do, myself, appreciate the study of mathematics and I acknowledge its importance to high school students in its role as a gatekeeper, for good and bad. Primarily, I challenge the question of whether mathematics is necessary for success by raising the questions: What is success? How is success defined differently in various contexts and at various stages in life? On the other hand, I would suggest that the participants in this study, at this stage in their life, feel they have a strongly defined definition of success, and that is: getting good grades in mathematics classes so as to be able to go on to college and pursue a high-paying (STEM) career. This definition of success, and its accompanying characteristics, likely comes from



messages sent by educational research and media, and is perpetuated by teachers and parents in hopes of ensuring academic success and focus in educational goals.

### **A Critique of Intelligence and Success**

Hatt (2016) describes a historical perspective on the social construction of smartness and its severely racialized history in the Western world. Summarizing scholars like Skiba (2012), Gould (1996), Deschenes, Tyack, and Cuban (2001), Hatt says,

The linking of white superiority, genetics, and intelligence testing provided room for those in power to essentially claim enslavement, colonization, and apartheid as justifiable because the slave owners, colonizers, and separationists are simply smarter and that how they came to be the ones in power. Furthermore, the physical violence and marginalization of people of color were justified by denying humanity as a result of supposed lower intelligence. What followed in the early 1900's was the institutionalization of smartness as white superiority through schooling and the explanation of school failure vs. success and denial of access to schooling... Schools as cultural institutions became shaped and centered upon the cultural tropes of whiteness and smartness in the US...Artifacts such as grades, test scores, and college preparatory curriculum associated with smartness represent some of the gatekeeping mechanisms (Hatt, 2007; 2012). The students who succeed in getting past the gatekeeping points are told that they have succeeded due to working hard and being smart. The students who fail to pass the gatekeeping points are told that they are lazy and/or not smart enough. (p. 1142-1143)

As such, there is a frightening history in defining intelligence as it relates to high school students of color.

The students in this project were given the opportunity to define their own intelligences and successes. And, we can see from the initial descriptions of themselves and their peers in non-advanced courses, these students uphold and perpetuate the aforementioned stories that are told about students who are and are not able to pass through the gatekeeping points Hatt describes. In short, these students feel they are intelligent and successful because they make good grades. They acknowledge, to varying degrees, that this

has at times required hard work on their behalf, and so they feel they deserve their success. Contrarily, they assume that their peers who have not been successful were not interested in succeeding in school due to laziness, and therefore did not try.

Within each of these descriptions, the individual is wholly responsible for their success or failure. And, it is important to remember that the White paradigm of success is one of individual success and determination, not one interested in a community of learners for a common good. The students reinforce this idea when they discuss mathematical learning as an individual pursuit, mostly accomplished in isolation. In doing so, they seem to show signs of assimilating into the White dominant paradigm of education.

*Students assimilating into White-dominance.* While this study finds students who uphold aspects of the White paradigm of schooling, other researchers have found that students often struggle with internalized and structural racism within their schooling experiences. Irizzary & Raible (2014) describe a cohort of Latino/a students in a struggling school within an economically depressed community learning. Through critical discussions in a supportive classroom environment students are able to critically challenge the structural and internalized racism they experienced in being held to a White paradigm of schooling.

They say,

Although rarely named in the process of public schooling, the students in the study struggled with the pervasiveness of Whiteness and the accompanying system of race-based privilege embedded in their schooling experiences. They constructed their identities in contrast to what is held up to them as the norm, or standard.” (p. 442)

In contrast, the students in this study did not seem to struggle with challenges from perceived Whiteness in their schools. In fact, Daniel and David have negotiated and no real sense of positive Latino identity, respectively, and they show no contrast with the norm or standard, but rather assimilation to the White dominance paradigm of education.

Both David and Daniel describe hindrances and adversities in their educational careers, but these are described more in the sense of struggling with new or advanced material in a course. These students do not perceive themselves as different from their peers in advanced courses, who are succeeding. Instead, they separate themselves from the students in non-advanced courses, and specifically other Latino students in non-advanced courses. Daniel and David, view themselves as part of this standard, or norm, not against it. Additionally, neither Mateo nor Rafael deliver a critique of the Whiteness in their schools. While the students see race and ethnicity within the schools, they also describe the schools as cultureless, a characteristic that scholars would argue upholds the White paradigm, and suggests some level of subconscious assimilation with the mechanisms that perpetuate the White dominance of schooling.

Undoubtedly, this subconscious assimilation is in part due the lack of experiences these students had with critically examining issues of race, ethnicity, and gender in their school experiences thus far. Just because they do not yet critically analyze potential structural racism within their schools, does not mean they do not have an appreciation for Latino students experiencing differential treatment. Mateo is easily able to see inequalities that exist for Latino students in the greater community and society, and he is encouraged to do so by his peers in activist groups and mentors within the UBMP program. Thus, in the examples of these students, we see some element of the colonized becoming the colonizer, however, the students were able to identify elements of structural racism in lowered expectations for undocumented students, even if they did not have the experience in social critique to call it by name.

With this description, it is easy to fall into thinking that Latino students who are academically successful at some point must ascribe to, and thereby assimilate to the White dominant paradigm of schooling, but Carrillo (2016) reminds us that Latino students are often able to both achieve academically and use their cultural capital to counter oppression and injustice, while being able to be critical of hegemonic ideologies. Carrillo (2013, 2016) presents a *mestiz@ theory of intelligences* that describes the ways in which students of multiple heritages live hybrid lives, traverses various cultural worlds and achieving academic excellence while committing to a social justice-oriented activism which contests structural oppression and its effects on the individual. And, Carrillo is not the only scholar to offer a non-White dominant framework of intelligence for Latino students.

In introducing his definition of *diasporic community saberes (knowings)*, Luis Urrieta (2016) traces the history of the knowledge of students of color from origins of being treated from a deficit perspective as critiqued by scholars like Delgado Gaitán, Ladson-Billings, and Gutiérrez through to more post-critical representations of knowledge of students of color, such as Luis Moll's (1992; Gonzalez, Moll, & Amanti, 2005) *funds of knowledge* framework and Yosso's (2005) *culturally wealth paradigm*. Much like Urrieta's own work, these post-critical frameworks focus on the assets students bring to education through their own cultural background, emphasizing experiences, cultural influences, family and community relationships, among other resources.

Urrieta describes *diasporic community saberes (knowings)* as complex, dynamic, and multiple in nature. These saberes include time and opportunities for children to learn about their family and community, and more importantly how they are belong within each group and what that sense of belonging looks like. Children take on responsibilities for themselves

in social settings and, when proven competent, are often asked to attend to adult tasks, like handling family finances or taking care of others in social or familial roles.

Chavez, Ke, and Herrera (2012), in a study of retention of Latino, Mestizo, and Native American college and university students, outline constructs of teaching and learning which challenge the Western focus on grades and test scores as traditional markers of intelligence and success. Students in the study described, through narratives, the process of learning as learning first by doing, then through storytelling and by example, and finally through abstraction, and in each way learning the connections between the subject and its contexts. Beyond this, students described the need to connect learning to the world around them, their own experiences, and the experiences of teachers and students complete with acknowledgement in the emotions of learning and time for reflection. And, the students felt it was necessary to share their knowledge and experiences with their peers. Students described “first as sense that their own learning suffered when they did not have opportunities to process ideas with peers, and second, a feeling of responsibility for both their own and others’ learning” (Chavez, Ke, & Herrera, 2012, p. 792). In this way, learning is not an individual pursuit “as a critical contribution to collective rather than individual purpose” (p. 787).

With the description of these forms of knowledge and learning, we can get a sense that the way students talk about learning mathematics is very different from the ways in which they may take in other initial information as children. For instance, what would a math class look like if first students were asked to focus on finding their role and their own sense of belonging in the class? Or, what if students were given adult tasks, such as taking responsibility for leading discussion, answering student questions, or deciding what topics to

cover? And, what if instead of non-contextual algorithms, students used mathematics as a way to critique social injustice, while bolstering activism among students? Rather than lofty questions posed to the void, there already exists at least the underpinnings of a pedagogy in mathematics which could look this way, answer these questions, and provide a much needed critique of sociopolitical factors all while introducing students to high level mathematics in context.

### **An Opportunity for Critical Mathematics**

Mathematics is often referred to as a universal language. This description is problematic because it seems to suggest that mathematics happens outside of the sociopolitical spectrum. While that may be the case for the typical high school mathematics course, there are scholars who argue for the inclusion of sociopolitical matters into all aspects of education. Irizzary & Raible (2014) argue that educators have an obligation to address sociopolitical factors, putting an end to silencing of students that occurs when educators are unwilling to bring this issues to light in their classrooms. Irizzary and Raible (2014) use CRT and LatCrit as analytical tools to examine how Latino/a high school students' experiences with institutionalized racism contributed to an internalized sense of oppression, and the relationship between these experiences and the school-to-prison pipeline. The authors also found that critical dialogue within a supportive classroom environments could contribute to an enhanced reflectiveness among the students and a critical understanding of their experiences, moving away from their previous feelings of shame.

Within mathematics education, the clearest path to addressing these kinds of issues can be found in critical mathematics, i.e. reading the world through mathematics in a Freirean sense (Gutstein, 2003; Gutiérrez, 2008). The goals behind critical mathematics are

to have students be able to develop a sociopolitical consciousness about the world, using mathematics to ask and address questions of racism and oppression in society and, in doing so, develop in their knowledge and appreciation of mathematics as a tool used for answering real-world questions (Gutstein, 2003). In practice, critical mathematics has highlighted using statistics to make sense of structural discrimination such as disproportional incarceration rate for African Americans or racism present in housing pricings in the US (Gutstein, 2003).

Examples of how critical mathematics can be applied for Latino students include:

- 1) Using mathematics as a class in which students can embrace the history of the Chicano and Latino movements in the US and challenge the status quo.
- 2) Empowering students to think critically about their communities, schools, and legislatures.
- 3) Turning the lens on mathematics as a gate-keeper in the mathematics classes as a way to learn mathematics.
- 4) Examining mathematics as a factor of educational mobility while also questioning the status of mathematics in education.

One wonders how David or Mateo would have taken to a course that used mathematics to talk about social just issues. Not only would their understanding and appreciation of mathematics increase, so would their ability to critique the world in such a way that would enhance their activist tendencies. This work can be applied to many levels of mathematics education. For instance, it would be interesting to see what would happen in an elementary classroom learning fractions. When we teach fractions, we often teach students that fair sharing means equipartitioning. Equal is not always fair, however, and we can challenge the myth of equal opportunity using mathematics as an entry way. In this way, we can use mathematics to have students read the world with a critical lens starting at a very early age.

### **Reflecting on a White Female Researching Successful Latino Males in a UBMP**

**Points of Access and Exclusion.** In order to begin this research project, I had to gain the approval from the board of the UBMP. In doing so, I also gained the tacit support of the

higher levels of the organization. I was given the opportunity to introduce myself to the members of the program in one of their monthly meetings and various mentors and program affiliates even suggested that mentees contact me to participate. In this way, I was granted a lot of access to these students, and they probably associated me with having some sort of role in the program.

While this positive association with the program had some great benefits for me as a researcher, there is also another side that perhaps limited by access to students' stories. Because I was associated with a program that they hold in such high regard, students may have felt like they should only say good things, and present their experiences in a positive light. Since students were able to offer negative stories and provide levels of critique within our interviews, I became less worried about this positive positioning as the project continued.

Since all participation in this project was completely dependent on the comfort level of the student, I was only given access to certain information and people. In my description of Daniel, I briefly discuss his reluctance to have his parents involved in the research project in any way. While I completely respect this decision, and would never want to make Daniel feel uncomfortable, I wish I had more access to his family in order to have a clearer picture of him as a person. My experience with David, on the other hand, was completely different from my experience with Daniel.

David was enthusiastic about his parents being involved in the project. And, while I also spoke to them each separately at length, David's parents even joined us for part of my second interview with David, to some extent derailing the conversation from my initial semi-structured interview. In fact, too much access to David's family was, briefly, counterproductive to the research project. With David and his parents involved in some of



the interview, what was once an open dialogue between the two of us felt much more like a performance on David's behalf, and was too much a religious advertisement on his parents' behalf to include those excerpts in this research project.

As is likely present in all qualitative research, my data and findings are all only based on what the participants allowed me to access within their stories. These elements are also limited by the parameters of my inquiry, and what I experiences and information I sought out. As such, they may not be fully representative of these individuals, but that does not detract from the value within the information they presented.

**Reluctance to Critique Participants.** In my initial analysis, I was very hesitant to address themes that I felt were critical of the participants involved. To some extent I am still hesitant to say that these students are colonizers of their peers or assimilating to White dominance. After all, these students are coping as best they can with situating and identifying themselves in their own worlds with the information and tools they are given. As a white, female researcher of Latino males, I may not want to be critical out of respect for these individuals and reverence for their participation in this project, but I cannot exclude various aspects of the themes that emerged; to do so is to silence these students and deny aspects of their experience. It is better for me to be critical, albeit in perspective, if and when necessary than to commit the error of not respecting these students enough to critique certain aspects of their narratives.

It is important to keep in mind that the information the students provided and the critique thereof are all influenced heavily by this project being just a snapshot of these students at a particular time. While in high school, these students are somewhat insulated by their schooling experience. Once they move beyond this stage, they will have more

experiences to compare and contrast with the experiences they had in high school, which could lend itself to other levels of critical consciousness not previously available to these students. While the perceptions of these students will likely change over time, it is still important to acknowledge and understand their feelings at this particular time in their lives, as they plan to make the transition to post-secondary education.

### **Implications**

The significance of this research is to highlight the importance of case study in rewriting the narrative of Latino students when it comes to mathematics education. In using case study of successful Latino students' mathematical identities, there we gain access a different perspective than the one we get from asking remediated students or focusing on low test scores and dropout rates. In fact, there are successful Latino students who appreciate mathematics and consider themselves successful in the subject. Even within this group of students, however, there are some lessons for mathematics educators.

First, mathematics is seen as a list of inarguable facts and procedures, a closed system that not everyone has access to, and merely a set of prerequisite classes for a successful future in most high paying jobs rather than a field of exploration, especially at the high school level. Second, there is not enough connection between the higher level mathematics in which these students are enrolled and the way it is used in the real world. Perhaps if Latino students were exposed to more true-to-life mathematical inquiry from an earlier age, we would see an increase of Latino students into STEM fields both in recruitment and retention. As Mateo said, "When they put a scenario that is like real-world and that you might come across, I learn more and get more out of it."

And finally, within the stories of these students is a startling narrative. They feel their peers are giving up at an early age based on a potential combination of lacking motivation,

lacking support from educators, lacking economic opportunity in their community, and based on their immigration status. Responsibility for these shortfalls does not rest solely on mathematics educators but, once aware of these issues, mathematics educators can certainly play a role in providing the needed encouragement to provide support for their students and even activism in political matters.

### **Implications for Mathematics Education**

When we consider how even successful Latino students define mathematics and struggle to contextualize higher levels of math, it is no wonder we are losing students in mathematics fields, even the ones in STEM fields only see mathematics as a requirement for higher education. Students see mathematics as a list of facts to memorize or simple calculations to be done, with repetition. And worse, students see the role of the mathematics teacher as to fill in the blanks of a rigid curriculum rather than to facilitate interest in a meaningful topic. We will continue to lose these students in STEM fields if the perception of mathematics does not change.

There is a strong need for us to break the binaries when it comes to mathematic education. The first binary to break is the one of right and wrong. Mathematics is not seen as a space for ambiguity or multiple interpretations, even though it very much is. The second binary needing breaking is the perceived binary of ability and the existence of two groups of people existing, those can and cannot “do” mathematics. And, third, we need to break the racial binary, of White and non-White, in mathematics achievement research. By constantly comparing non-White students to the White, middle class paradigm of education, we continue to gap-gaze. This project has been an exercise in breaking this binary, while also addressing a gap in mathematics education research. In addition to filling this gap in

mathematics educational research, this project has implications for all members involved.

**Implications for Students.** Through the process of exploring their mathematical identities, there exists a chance for catharsis and deeper self-understanding. The students all seemed to enjoy the opportunity to talk about themselves and their experiences in mathematics. Even in initially self-identifying as successful students, the participants were given an opportunity to talk about their achievements and, I think, genuinely enjoyed the experience. In future endeavors, this work may lay the groundwork for research in which students' can begin to rehabilitate negative mathematical narratives but at present the students saw the opportunity to talk about mathematics as an affirmation of their progress thus far.

**Implications for Teachers.** With so much emphasis on test scores, teachers sometimes make abstract judgments about Latino students. Rather than see Latino students as individuals with distinct, dynamic mathematical identities, some teachers see only poor test scores or discipline issues. By sharing understanding students' mathematical identities, there is an opportunity to expose these pre-service and in-service teachers to a new, positive way of looking at their Latino students. Also, this work can begin to highlight the important ways that teachers influence mathematical identity of their students and send the message that mathematics teachers should teach with great care as to how they might influence their students' mathematical identities.

The work in mathematics education must move beyond limited or blanket additions to pedagogical content knowledge. For instance, Wilson (2016) suggests that teachers should have a Pedagogical Content Knowledge for Teaching Mathematics to English Language Learners. While this may provide a start, this alone would not apply to multiple participants

of this study who are Latino but are not English Language Learners (ELLs). Also, it lacks the critical component of using mathematics as a lens to read the world and treats all ELLs as though they are one large group, not individuals with various needs and backgrounds.

Additionally, the lack of contextual understanding of higher level mathematics needs to be addressed and could be by the inclusion of context and critical problem solving within the classroom. Mathematics education researchers have argued both for project-based curricula (Jurow, 2005) and for teaching students mathematics through using complex problem solving within the classroom (Boaler, 2008; Secada, 2009). This type of teaching and curricula goes beyond rote memorization and opens the door for students to engage in meaningful conversations and arguments within the mathematics classroom and opens the door for critical mathematics to address sociopolitical factors (Gutstein, 2003).

**Implications for Mathematics Teacher Educators.** Mathematics teacher educators can encourage mathematics teachers to expose students to open-ended mathematics questions at an early age. Mathematics teachers need to bring discussion and ambiguity to the forefront of the mathematics classroom. It is also important to introduce theoretical conversations, not just rigid, rote memorization of strategies into the mathematics classroom. And, in order to encourage life-long learners of mathematics, it is important to show students how upper level mathematics can be used in life and in professional fields.

Mathematics teachers and teacher educators can also teach social justice through mathematics as a way to engage students and have them see the value of mathematics, through the incorporation of critical mathematics. In addition to encouraging the use of critical mathematics education for high school students, mathematics teacher educators can encourage support structures within mathematics classes. Investigate support structures (in

and out of school) for their Latino students, for all students. They can also change how teachers are perceived by students. For the most part the teachers were described as individuals who presented a model for problem solving and then stepped in every once in a while to correct mistakes. We need to go past a definition of mathematics teaching that at its base is “do no harm” and simply show examples of algorithms. This transition would require teachers to take a more active and activist role, especially when it comes to Latino students. In doing so, teachers can empower students within their mathematics classes.

### **Implications for the New Latino Diaspora**

There are both signs of hope and signs of distress for the NLD. In terms of signs of hope there has been an increase in support and services for Latino and ESL students (e.g. dual language programs, UBMPs, etc.). The students involved in this study describe the school, at its worst, as not harmful and, at its best, as supportive. The schools provide a sense of hope for the students. While there is advancement of Latino students in school for some, the community and state are still suffering from gaps in achievement. However, there seems to be a general lack of interest in math, outside it serving as a prerequisite for other careers. In this way, just as there are signs of hope, there are also signs of distress.

Although the mentors were not used as cases in this project, they did address instances of racial profiling in the community. Mentees and mentors also described a high dropout rate and a low matriculation rate into colleges and universities. And, there are areas of concern for other marginalized students. Despite the students referring to equal numbers of Latino and White students in their classes, they did point out the absence of African American students and the general divide between groups at the school.

And, even in the signs of hope, there may also be signs of distress. The lack of

controversy and/or confrontation in the area are perceived as improvements for the Latino community, but they may not be. These perceived improvements in racial relations over the last ten to twenty years are, according to the participants in this project, evidenced by the fact that people are no longer demonstrating in the streets either for or against the Latino population. On one hand, this could indicate an overall improvement in the perception of Latinos and, it could indicate that the resources and opportunities for Latinos are better within the communities. On the other hand, this lack of demonstration also may indicate a lack of agency or ability to organize on behalf of the Latino community. Latinos may instead be left in a type of holding pattern, unable to advance their cause because it is not visible enough.

While the community may not be subjected to riots on a daily basis, the lack of a full demonstration hardly means everything in the community is wonderful. After all, how are things getting better when undocumented Latino high school student sometimes feel that they have nothing to work for and no options? Or when community members have to fear deportation? Making college affordable to undocumented students and decreasing the threat of deportation through meaningful and humanist forms of immigration reform are the only true signs of meaningful hope for this community as a whole. As educators and researchers Latinos need our support, but not our ignorance, avoidance, or further colonization.

### **Implications for Future Research**

There are many possibilities for the further exploration from this research. I will address the two that most immediately follow from this work.

**Transitions from high school to college.** There are some critically important question that arise in ending the stories of these students in high school. For instance, in

what ways might these students' mathematical identities change as they continue their education or go into the job market, especially if they pursue STEM-related fields, as planned? As these students matriculate and gain exposure to the other influences of college as well as potential change in how mathematics is defined at the collegiate level, will their overall relationship with mathematics change? And, what can lessons learned from these potential changes in mathematical identity teach mathematics educators at the high school and college level?

**The role of gender.** A second question for further research is, what role does gender affect Latino/a students' mathematical identity? The research on Latino males discussed in Chapter 2 suggests that their Latina peers are not held to the same negative expectations, wherein they are profiled within schools as trouble-makers or low-performers. Latina high school students, however, are presently positioned at the intersection of both gap-gazing, deficit model perspective of Latino/a students in mathematics and the historically male-dominated field of mathematics. A case study analysis of Latina high school students would almost certainly paint a different picture of mathematical identity and definitions of academic success than one of their Latino counterparts.

Also critical to the discussion of the role of gender, is not limiting this study to the male female binary, but exploring Latinx (LGBTQ) students as well. With its emphasis on exploring the in-depth stories of individuals, the framework for mathematic identity framework is certainly capable of expanding to see how the intersectionality of race, class, gender, and ethnicity might influence mathematical identity.



## **Summary**

Without the in-depth process of case study, we would not be able to gain insight into the experiences of participants to the same degree. By focusing on the stories that participants choose to tell, we get a greater sense of how individuals view themselves, how they perceive others to view them, and even a sense of how they would like to be viewed in particular contexts. While this research is still in its infancy, already there exists a new story to be told about Latino students in mathematics education, one that starts more positively than the previous constructions but also has important lessons for mathematics educators. This is a field that needs more research and further understanding. This project was only meant to give tell the story of a particular group of students in a particular program. As such, it was not meant to explain the stories of all Latino students and parents even within this one community. For the purpose of this project, however, there are some lessons to learn which others may find useful in working in mathematics education and research, and within the New Latino Diaspora.

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