

CALIFORNIA STATE UNIVERSITY, NORTHridge

SUCCESS STEMS FROM DIVERSITY

THE VALUE OF LATINAS IN STEM

A thesis submitted in partial fulfillment of the requirements

For the degree of Master of Arts in

Chicano and Chicana Studies

By

Eva Longoria

August 2013

The thesis of Eva Longoria is approved:

Mary Pardo

Date

Christina Ayala-Alcantar

Date

Theresa Montaño, Chair

Date

California State University, Northridge

California State University, Northridge
Table of Contents

Signature Page	ii
Abstract	v
Chapter One – Introduction	1
Demographic Overview	2
Why focus on Latinas?	3
Chapter Two – Theoretical Framework	6
Critical Race Theory	6
Cultural Deficit Theory	8
Literature Review	11
La Familia y Cultura	12
Socioeconomic Status	17
Academic Preparation	21
Teachers	23
Curriculum	25
Tracking	26
Four Year Institutions versus Two Year Institutions	29
Chapter Three – Methodology	33
Sample Population	34
Procedure	35
Data Analysis	36
Chapter Four – Findings/Results	37
Community Cultural Wealth	37
Aspirational Capital	37
Familial Capital	38
Resistance Capital	40
Socioeconomic Circumstances	42
Academic Preparation	48
Tracking	48
Teachers	53

Sexism	62
Chapter Five – Conclusion	68
Community Cultural Wealth	69
Socioeconomic Status	69
Academic Preparation	70
Sexism	72
Limitations	73
Recommendations	74
Recognize Cultural and Community Wealth and Partnership with Parents	74
Implement Early Preparation Programs and Encouragement in STEM	74
Recognize and Eliminate Sexism in STEM	75
References	77
Appendix A: Questions for Study	86
Appendix B: Oral Consent Form	89
Appendix C: Adult Consent Form	90

ABSTRACT

SUCCESS STEMS FROM DIVERSITY THE VALUE OF LATINAS IN STEM

By

Eva Longoria

Master of Arts in Chicano and Chicana Studies

Latinas/os only make up three percent of our nation's scientist and engineers according to the National Center for Education Statistics (NCES, 2007) and Latinas represented only one percent of employed scientists and engineers. This qualitative study is an examination of Latinas academically preparing for or entering the STEM (Science, Technology, Engineering, and Mathematics) profession. In particular, this study explored the issues, barriers, and successes experience by this group of women. Analysis of the interview responses revealed four common themes that impacted the academic and/or professional lives of these Latinas: 1) community cultural wealth, 2) socioeconomic circumstances, 3) academic preparation, and 4) sexism. Based on the findings, the study proposes recommendations for change and emphasized the need for increasing the number of ethnically diverse students, primarily Latinas, entering STEM programs in the United States.

Chapter 1 – Introduction

Introduction

The purpose of the study is to critically examine the barriers to educational attainment among Latinas in STEM (Science, Technology, Engineering and Mathematics) and to document how Latinas currently interested in STEM majors or currently working in STEM fields successfully navigated the educational system. This is a qualitative study that addresses the issues beyond the statistics and examines the lives of Latinas wanting to pursue a career in STEM fields and those who are currently employed in STEM jobs. The data collected from the study should allow us to create effective interventions that eliminate the common factors impeding STEM degree completion for Latinas and to identify and replicate the common factors that lead to success for Latinas in STEM fields.

STEM is an acronym that represents the fields of science, technology, engineering and mathematics. It has become a highly examined topic as we live in an increasingly technological world. It has also become a highly scrutinized topic as there seems to be a disconnect between educational demands and occupational demands. The key to strengthening the U.S. economy is highly dependent on what our education system produces. The reality is that our current education system cannot produce the talent companies need in the marketplace today. According to Carnevale, Smith & Strohl (2010) “all the information required to align postsecondary educational choices with careers are available, but unused.” According to an organization called Change the Equation (2012) there are 3.6 unemployed workers for every job in the United States compared to only one unemployed STEM worker for two unfilled STEM jobs. Today,

there are over 3 million available jobs available in STEM fields however they are going unfilled because we lack the people with the right skill sets (Carnevale et al., 2010). Furthermore, STEM employment is expected to grow at a far faster rate than overall employment. The President's Council of Advisors on Science and Technology (2012) predicted that colleges and universities will need to produce one million more STEM professionals over the next ten years in order to satisfy the job demands in the United States. Therefore, colleges and universities are burdened with the economic imperative to meet the demand of producing our nation's future STEM professionals.

Demographic Overview

The Latino population in the United States has experienced significant and consistent growth, particularly among youth and women. The 2010 Census determined that Hispanics are the country's largest minority group, including more than 50.5 million people. Hispanics now compose 16 percent of the total population. Latinos accounted for more than half of the nation's growth in the last decade and will continue to drive growth in the decades to come (U.S. Census, 2010). Latinos are a young population with more than 17.1 million Latinos younger than age 18 and unfortunately they have the lowest education attainment level of any group in the United States (Pew Hispanic Center, 2011). In fact, Latino graduation rates remain the lowest of all major ethnic groups in the United States and it appears that these rates will not keep pace with their population growth (Solórzano, Villalpando, & Oseguera, 2005). The growing number of school-age Latinos is significant. As of 2009, Latinos make up 48 percent of the public schools in California and 46 percent in Texas (Gándara & Contreras, 2009). Before the year 2030, Latinos will be 25 percent of the total school-aged population consisting of 16 million

students (Pew Hispanic Center, 2011). By the year 2040, the number of college age Latinos will increase to 8 million; however, only 1-2 million will actually enroll in college (Cole & Espinoza, 2008). But despite this growth Solórzano et al. (2005) state “Latinas/os still remain underrepresented at almost every level of the educational pipeline” (p. 286).

According to the American Council on Education (2006), colleges and universities must increase the number of STEM degrees earned by Latinos and African Americans in order to stay globally competitive and to best reflect the nation’s changing demographics. Since future generations of this nation will primarily be people of color, it will be up to this group to continue America’s “economic competitiveness” during the technology age (Anderson & Kim, 2006). Camacho and Lord (2013) contend that “on the basis of quantitative measures alone, among all underrepresented minorities, Latinos could have the greatest impact on the field of engineering” (p. 104).

Why focus on Latinas?

In their seminal report on the status of Latinas in education, the American Association of University Women (2001) noted that “Latinas now constitute the largest minority group of girls in the United States,” representing 8 percent of the total U.S. population (Ginorio & Huston, 2001, p. viii). According to AAUW research conducted by Ginorio and Huston (2001), the high school graduation rate of Latinas was lower than that of girls in any other racial/ethnic group, and girls who leave school are less likely to return. The U.S. Department of Education’s National Center for Educational Statistics (2009) reported that Latinas had a dropout rate of 16.1 percent compared with the White female

counterpart at 4.1 percent and Black females at 8.1 percent. What is even more alarming is that the dropout rates for other groups have been decreasing but have remained steady for Latinas/os. According to the National Center for Education Statistics (2006), 7.3 percent of all bachelor degrees were earned by Latinos compared to 65.1 percent earned by White, non-Hispanics. More specifically, 61 percent of all bachelor's degrees awarded to Hispanics in 2005 were earned by Latinas, but only 37 percent of those degrees were in STEM fields (National Center for Education Statistics, 2007). In fact, "Latinas enroll in college in greater numbers than Latinos, men greatly outnumber women in engineering programs" (Cantu, 2008, p. 225). Camacho and Lord (2013) found that underrepresentation of minorities in all majors is a problem, but the "underrepresentation of females is a problem unique to engineering and computer science" (p. 105). Given the fact that only 3 percent of Latinas intended to major in engineering in 2009, Camacho and Lord (2013) concluded that recruitment, not retention, was a problem that must be addressed. Latinas lag behind males in all degrees earned in STEM fields except biology and biomedical sciences where they earned 63 percent of all bachelor's degrees awarded to Hispanics (NCES, 2007). So the question becomes how do we tap into the fastest growing, natural resource of this country's young yet undereducated Hispanic population to meet the demands of the job market in the United States? Crisp and Nora (2012) boldly claim that "although federal STEM programs may provide critical support for a select group of minority students in the form of summer programs, internships, and career counseling, they do not address the underlying structural and institutional problems influencing the underrepresentation of Hispanic and African American students in STEM fields" (p. 3).

We do not have enough research dedicated to the issues, barriers, and successes which affect Latinas in STEM programs to guide education policy makers. This information is needed to assist in the development of outreach programs to increase the number of Latinas not only enrolled in college but in pursuit of degree completion. Specifically, we need programs that will ensure the academic success of Latinas in STEM fields and ultimately the workforce. This study will also allow us to identify the reasons for the uneven distribution of opportunities and knowledge in schools which result in unequal outcomes for Latinas in STEM fields. Inequitable education practices perpetuate differences in achievement that impedes the quality of learning opportunities available to Latinas which, in turn, will greatly affect their social and economic circumstances.

Chapter 2 – Theoretical Framework

Critical Race Theory

Angela Harris states that “Critical Race Theory not only dares to treat race as central to the law and policy of the United States, it dares to look beyond the popular belief that getting rid of racism means simply getting rid of ignorance, or encouraging everyone to get along.” – (as cited in Delgado & Stefancic, 2001, p. xx)

I used critical race theory (CRT) to explore the issues surrounding educational achievement for Latinas in STEM fields. CRT allowed me to explore how race and ethnicity relate to school hierarchies, academic preparation, tracking, testing, curriculum, effective teaching, family and culture, and socioeconomic status. By examining the intersectionality of race, gender, and class of Latinas in STEM undergraduate programs through a CRT framework, I was able to analyze their experiences and better understand the cause of underrepresentation of Latinas in STEM professions. Solórzano et al. (2005) contend that “policy makers need to theoretically understand the cumulative effects of inadequate educational preparation and schooling conditions of Latinas at the elementary and secondary levels and how that affects their educational attainment in college and beyond” (p. 277). I used CRT to critically examine the social conditions and the experiences of Latinas in STEM programs at each stage of the educational journey and then identify the strategies Latinas use to resist nonresponsive educational structures, processes, and discourses that impeded their progress. CRT allows us to answer the question “Do educational institutions adopt practices and policies that hinder the success of Latinas in STEM programs?” In short, “the classroom- where knowledge is

constructed, organized, produced, and distributed- is a central site for the construction of social and racial power” and CRT provides the lens through which we can assess this construction and attempt to deconstruct it (Parker et al., 1999, p. 5).

The genesis of critical race theory derives from legal scholarship but has now folded into civil rights ideology which has progressed from “equal opportunity” and “race neutral” identities to the study of race and racism within social hierarchies. Delgado and Stefancic (2001) define critical race theory (CRT) as a “movement interested in studying and transforming the relationship among race, racism, and power” that questions the foundations of equality theories and race neutral principles (p. 2).

The civil rights movement won many victories under the guise that workplaces and schools should be “merit based” and standards should not be measured by the color of one’s skin but by ability only. However, CRT challenged this idea by discovering that “merit standards are purported to be race-neutral and objective, but are actually race-specific because they were constructed in a context of racial exclusion, by elites who had acquired social power by explicitly excluding people of color” (Parker, Deyhle, & Villenas, 1999, p. 3). The national dialogue on race within the field of education includes debates on affirmative action, ethnic studies, and bilingual education programs to name a few. I will use the lens of CRT to explore educational systems in the United States.

CRT is applicable to the world of higher education because it provides a basic framework which allows us to identify and analyze the power structures and systems that maintain the marginalization of minorities using race, ethnicity, gender and class. Solórzano et al. (2005) states that “CRT in higher education challenges the traditional claims of

universities to objectivity, meritocracy, color blindness, race neutrality, and equal opportunity” (p. 275). CRT helps us identify racialized barriers that affect educational policy making and often “intersects with other components of one’s identity, such as language, generation status, gender, sexuality, and class” (Solórzano et al., 2005, p. 274). Solórzano (1997, 1998, 2001) developed five tenets of CRT that contribute to research in the field of education: (1) intersectionality of race and racism; (2) the challenge to dominant ideology; (3) commitment to social justice; (4) centrality of experiential knowledge; (5) interdisciplinary approach. The goal of the five tenets is to create a criteria that can measure and assess race and racism in the field of education in effort to eliminate it. Since teaching and learning occurs in the classroom, CRT leads me to explore the idea of cultural deficit theory.

Cultural Deficit Theory

The framework of CRT contests deficit notions of thinking and teaching. The most traditional deficit model is the cultural deficit theory which insists minority cultural values are dysfunctional and have no value in the classroom. Solórzano and Yosso (2001) claim “cultural deficit models name the internal social structure of families of color as deficient” (p. 6). Valencia and Black (2002) define deficit thinking as “a mind-set molded by the fusion of ideology and science that blames the victim, rather than holding oppressive and inequitable schooling arrangements culpable” (p. 81). Cultural deficit theory focuses on what students lack as opposed to what they bring to the classroom. As Gonzalez, Moll, Tenery, Rivera, Rendon, Gonzales, and Amanti (1995) note, “This emphasis on ‘disadvantages’ has provided justification for lowered expectations in schools and inaccurate portrayals of the children and their families” (p. 445). A common

mistake with deficit thinking is assuming that culture is static when in reality it is a dynamic concept. Past thesis, scholars, and public opinions erroneously assume that “Mexican American parents, particularly of low-socioeconomic status background, do not value education” and their children fail in school because “their families have internal defects that thwart the learning process” (Valencia & Black, 2002, p. 83). Deficit thinking blames the student as opposed to inequity in schools and policy that are structured to prevent optimal learning. Valencia and Black (2002) “see scholars evoke a long-standing deficit thinking tactic of shifting culpability away from structural problems in schools, to the backs and shoulders of Latino parents who are expected to carry the near exclusive burden of school success for their children” (p. 89).

Many scholars disagree with this model claiming that “the most damaging consequence is that in this process teachers fail to see that bicultural students already possess cultural values and community knowledge that are essential not only to their learning but also to their very survival” (Darder, 2012, p. 38). Yosso (2005) challenges the deficit view and argues that the education system should acknowledge the knowledge and skills derived from one’s culture. Yosso (2005) defines cultural capital as “knowledge students of color bring with them from their homes and communities into the classroom” and identifies various forms: aspirational, navigational, social, linguistic, familial, and resistant capital (p. 69). Cole and Espinoza (2008) refer to cultural capital as “the familiarity and ease with which one navigates the dominant culture of society” and claims “that success in the educational system often requires a predisposed cultural competence gained through family upbringing” (p. 287). Gonzalez et al. (1995) commenced a study to draw upon the knowledge found in households as opposed to classrooms. They called these household

resources “funds of knowledge” and defined it as “those historically developed and accumulated strategies (skills, abilities, ideas, practices) or bodies of knowledge that are essential to a household’s functioning and well-being” (Gonzalez et al., 1995, p. 446).

The study found that when a teacher was disconnected from the context of the household, the student suffered in the classroom. The teachers in the study also concluded that students were rich in cognitive resources which raised their academic abilities (Gonzalez et al., 1995).

Cultural deficit theory is relevant in my study because it dominates the literature on Latinos and education. The deficit perspective suggests that Latinos and Blacks who attend college have less interest in STEM fields than their white and Asian American counterparts. Graduation rates are the measure of success within higher education and the statistics show lower degree completion rates among blacks and Latinos in STEM fields than those of white and Asian American students (Anderson & Kim, 2006). But what the statistics also show is that “blacks and Hispanics enter higher education with the same level of interest in the STEM fields as their peers, but that they fail to persist in these majors at the same rate as their white and Asian American classmates” (Anderson & Kim, 2006, p. 1). In fact, Latinos were more likely than any other group, except Asian Americans, in 1995 to major in STEM fields (Anderson & Kim, 2006).

Why do students of color graduate, if they graduate at all, at different rates than other races? If Latinos have lower persistence rates but equal interest rates in STEM fields, what is happening during the students’ academic journeys which impede their success from graduating in a STEM field?

Literature Review

The current and past literature about Latina education differ in many ways, but they all agree on one point; Latinas lag behind other racial and ethnic groups in several key areas. According to a compelling study on Latinas in schools by the American Association of University Women (Ginorio & Huston, 2001) “schools are not meeting the educational needs of America’s fastest-growing female minority population- Latinas” (p. 10). The gap between Hispanic students’ academic success and that of their White counterparts continues to grow, but for female Hispanics, this gap is even wider. Cuadraz (2005) reiterates this argument by stressing the importance of studying this distinctive group and cautions scholars and researchers to steer clear of combining this group with women at large. Cuadraz (2005) articulates “Chicanas (*Latinas*) cannot be a chapter in a larger study, but rather should make up the central unit of analysis with the opportunity to generate distinctions and questions on their own ground” (p. 220).

The guiding questions in my research are: What are the educational conditions and related outcomes that exist for Latinas as they navigate through STEM fields, and why do these conditions continue to exist? I begin by reviewing current and past literature to better understand the underrepresentation of Latinas in STEM programs. Latinos continue to be underrepresented in STEM fields with Latinas lagging behind males in all STEM fields except biology and science (National Center for Education Statistics, 2005). According to a more recent study by the National Center for Education Statistics (2012), 15 percent of Hispanic males with a STEM degree were employed as engineers or architects versus 6 percent of Hispanic females. The research shows that Latinas who arrive in the college classroom are exposed to systems which have traditionally denied

access or marginalized their aspirations to enter into STEM fields. Many distinct factors influence the educational outcomes. These factors are complex and often overlap. Latinas face barriers which are tied to socioeconomic status, class, culture, language, assimilation, racism and stereotypes, lack of preparation, poor curriculums, lack of role models and mentors, campus climate, sexism, ineffective teachers and inferior schools. These challenges are of monumental proportion, but are not impossible to defeat. To expand upon and further illustrate the academic conditions of Latinas in STEM fields, I have grouped the literature into four sections which were the most common themes among the factors for achievement gaps: *La Familia y Cultura*, Socioeconomic Status, Academic Preparation, and Four Year Institutions Versus Two Year Institutions.

La Familia y Cultura

To better understand the underrepresentation of Latinas in STEM fields, it is important to begin with their experiences in the home. Culture is a dynamic experience and one Latina's experience of culture may be different than another Latina, due to an array of factors such as immigration, acculturation, socioeconomic status and gender to name a few. This diversity of cultural experience in relation to education is evident in the literature. The literature explores the interconnections of parenting practices and home life with academic achievement, or lack of, for Latina students.

A common theme in the literature has to do with traditional gender roles for women within Latino families. Many girls in the Latino community face stronger cultural pressures than boys because the family may depend more heavily on the women to cook, clean, and tend to the younger siblings while the men join the work force (Cantu, 2008; Gándara, 1995; Ginorio & Huston, 2001). Cole and Espinoza (2008) state that racial and

ethnic minorities are challenged to balance “home” culture and “school” culture and emphasize how nonacademic activities such as housework and childcare translate into less time spent on academic work which can negatively affect their GPA. In addition, Ginorio and Huston (2001) found that home and school cultures have conflicting values for Latina/o children. Latino homes reflect a style that is authoritarian, nurturing and cooperative while mainstream school culture encompasses a more democratic, independent and competitive atmosphere (Ginorio & Huston, 2001).

Ginorio and Huston (2001) found this traditionalism interacts with educational expectations and family goals which are often contradictory for young women and split their thoughts about “gender-appropriate” behavior in and out of school. Ginorio and Huston (2001) also discovered that many Latino households feel girls do not need to be educated as much as boys but school culture thinks both sexes should be educated equally. Along this same line, most Latino families expect that their children, especially daughters, stay close to home which rules out “going away” to college for many (Ginorio & Huston, 2001). Latinas who have a desire to pursue a degree are often conflicted by these culturally structured gender roles because pursuing higher education would require postponing motherhood and marriage, this often conflicts with cultural norms of Hispanics (Ginorio & Huston, 2001). This conflict for Latinas is compounded in STEM fields due to the length of study needed for STEM degrees.

Parental involvement has been identified as one of the most critical contributing factors to the success of a child by many studies. Many researchers have relied on deficit models, claiming that lack of parental involvement is responsible for the low academic attainment of children from poor and minority families (Ceballo, 2004). Gloria Cuadraz (2006)

argues that high academic achievement is not considered “normative” within the minority communities based on the cultural deficit model that blames the culture for low academic achievement. She believes this model has been long outdated but that the idea that ethnic values and family practices counter academic success continues to persist in Chicano culture. Cuadraz (2006) deduces that “as in the case of cultural deficit theorists, it is insufficient to reduce and blame the lack of educational outcomes on a Chicano cultural context; similarly, as in the case of revisionists, it is insufficient to explain achievements *because of Chicano culture*” (p.104). Even though the model is outdated, there is recent evidence, although not conclusive, that claim culture can contribute to lack of parent involvement especially if these parents have low education levels themselves. Most Latino students are less likely to have a parent who attended college and therefore cannot help their child navigate the system of schooling (American Council on Education, 2006). Cole and Espinoza (2008) claim that the level of parental education plays an important role in their child’s academic attainment because individuals with college-educated parents have better access to social and cultural capital which “leads to a better understanding of academic culture” (p. 288). Nearly 65 percent of students who completed a degree in a STEM field had at least one parent with a bachelor’s degree compared with 38 percent of students who did not complete their STEM degree (Anderson & Kim, 2006). This literature concludes that parental educational levels can influence their child’s educational process.

Even though many parents hold high expectations for their children and place a great importance on education, they still did not feel qualified to help with school assignments (Ceballo, 2004). Whether it was a lack of proficiency with the English language or low

education levels, Ceballo (2004) reports that many Latino families voiced discomfort with assisting their children with homework. In a study researching Latino parental involvement by Zarate (2007) found that “for many Latino parents, language was an insurmountable barrier to participation in their children’s academic tasks” (p. 9).

Demanding work schedules of parents can also result in educators assuming that Latino parents are unreliable or are minimally involved in their child’s education (Quicho & Daoud, 2006). Zarate’s study (2007) concurs citing that inflexible work schedules of Latino parents who were predominantly hourly workers prevented them from fully participating in their child’s schooling.

Although lack of parental involvement is true for some, it is clearly not the case for others. In a study of ten undergrad Latinos at Yale, Ceballo (2004) found that parental support was critical to their educational success. Cantu (2008) documents how many of the successful Latinas in STEM fields credit their families for their academic achievements. They assert that their parents were “extremely supportive of their educational efforts and placed a high value on education” (Cantu, 2008, p. xix). As Cantu (2008) notes, this is significant because it challenges the master narratives that claim Latino communities do not value education. Gándara’s (1982) research found that high-achieving Latinas grew up in a home environment that was contrary to the “stereotype of male authoritarianism and female submission within the context of the Mexican home” and the majority of her subjects described their parents as non-authoritarian (Gándara, 1982, p. 172). “I could not do the dishes because I had too much homework that night...my mother knew she could not help me with my homework, so she helped me by changing the rules of the house to accommodate me” (Cantu, 2008, p.

66). Cantu (2008) concludes that Latina parents support their child's educational objectives and provide "*intellectual scaffolding*" in the form of advice, financial resources when possible, or even small *dichos* that carried them through life (p. xix).

Valencia and Black (2002) disassembled the myth that Mexican American parents do not care about education by presenting literature that documents "the high expectations for children's education and positive beliefs held by Mexican American families" (p. 95).

Research shows that both Whites and Latinos have similar expectations for their children's academic attainment and college enrollment (Valencia & Black, 2002). Many researchers have found that Latino parents do have high expectations for their children's education but felt excluded from the school community or had no understanding of how to navigate the school institutions (Gonzalez et al., 1995; Jasis & Ordonez-Jasis, 2012; Quiocho & Daoud, 2006; Valencia & Black, 2002; Zarate, 2007). A study by the Educational Forum (2006) found that teacher's perceptions greatly contradicted parent perceptions and realities. "Latino parents often misunderstood their role in their children's education because they didn't understand the concept of involvement as defined by the schools" (Quiocho & Daoud, 2006, p. 257).

Although Latinas within the Latino community may live under traditional gender roles, they also live in larger communities which consist of extended family members such as aunts, uncles and cousins who can support a Latina in her educational journey by providing child care, temporary housing, or money (Cantu, 2008). Such as Lupita, who had a cousin live with her during this time to take care of the child during the day as he went to school at night. "I had a very tight schedule, working during the day, breast-

feeding by pumping at least once a day and coming home by 5:30pm” (Cantu, 2008, p. 111).

Much of the research determined that Latina/o children feel much pressure to contribute to the economic status of their family and often leave school in order to work, a topic which is covered in depth in the next section. This commitment to family often leaves Latina/o children torn between family expectations and teacher/school expectations (Villar, 2001; Ginorio & Huston, 2001). Villar (2001) agrees with the Ginorio and Huston (2001) study and concludes that “...at home, lack of resources, family responsibilities, and weak support for schooling endeavors thwart their educational progress” (p. 21).

Socioeconomic Status

“The bridge to the 21st century is being crossed by those who are prepared, but what many Hispanics don’t understand is that this bridge is a toll bridge.” –
(Munoz, Trowbridge, & Loffredo, 2002, p. 23)

The 2010 U.S. Census revealed that there is a higher concentration of poverty within the Latino community than any other ethnic or racial group. Using the new alternative measures researched by the Pew Hispanic Center (2011), the Hispanic poverty rate is 28.2 percent, greater than that of Blacks at 25.4 percent and Whites at 11.1 percent. Gándara and Contreras (2009) explain that schools are “the first response system for social, medical, psychological problems for low-income Latino students” and most schools that have a large Latino population usually reside in neighborhoods of concentrated poverty which lack resources and effective teachers (p.86). According to

the Latino Educational Opportunity Report (2007) “Latinos are more likely than any other racial group to attend schools with large concentrations of low-income students” (p. 6). Oakes (1990) explains that “High-ability students at low-socioeconomic status, high-minority schools may actually have fewer opportunities than low-ability students who attend more advantaged schools” (p. vii). Most low-income Latinos are enrolled in secondary schools that have “less-intensive and less-demanding” science and mathematics programs (Oakes, 1990). Because inner city, high-poverty, high-minority secondary schools seem less desirable to teachers, administrators and principals are forced to hire the least qualified teachers who teach low-ability curriculum which directly affects how and when a child is exposed to science and mathematics. Oakes (1990) analysis revealed that “Students in low-income, high-minority schools have less access than students in other schools to computers and to staff who coordinate their use in instruction, to science laboratories, and to other common science-related facilities and equipment” (p. 3). Much of the research agrees that economically advantaged schools are able to employ more qualified teachers who often hold higher degrees in their relative subjects such as a bachelors or master’s degree which often results in engaging instruction (Frankenberg & Lee, 2002; Moller & Stearns, 2012).

Ginorio and Huston (2001) state that “one of the most pervasive difficulties with interpreting data about ethnic/racial minorities in the United States is untangling the effects of poverty from the effects of culture” (p.18). The concentrated poverty in Latino communities normally leads to low-income Latinos having fewer options for early education, affecting children’s cognitive development which prepares them for elementary schools (Gndara & Contreras, 2009). Because a large number of Hispanics

live in poverty, they start out with a disadvantage because schools assume that children should come to the classrooms with resources and materials. This gap in school readiness between poor kids and middle-class kids has exponential effects on their ability to reach educational achievement, specifically in science and mathematics.

Another factor is the family's economic status which often leads children to feel obligated to work and contribute to the family. Students who participate in the workforce often have little time to study or to participate in extracurricular activities that could further encourage them to advance in school (Ginorio & Huston, 2001). Crisp and Nora (2012) agree that "financial concerns, family responsibilities, and full-time work commitments have all been shown to be factors external to the college that pull Hispanics away from STEM fields" (p. 7). Students are more likely to persist in degree completion when not employed during this time (Anderson & Kim, 2006; Crisp & Nora, 2012). Full-time students who did not have to work had more time to study and were more engaged in school academically and socially which has proven to have a positive effect on degree completion. Even though 47 percent of students who completed degrees in STEM fields "came from families with parental income in the highest third of the national average", a student's socioeconomic status goes beyond having the ability to finance college (Anderson & Kim, 2006, p. 11). A direct correlation for low-income families is their inability to pay for better facilities as often they live in areas with inferior schools and teachers which result in mediocre schooling (Villar, 2001). Crisp and Nora (2012) agree that unfortunately "the quality of academic preparation many Hispanic students receive is negatively impacted by disparities in teacher quality, school funding, and monies spent on instructional resources" (p. 4). All articles reviewed agreed that class barriers lead

Latino students to attend schools that lack economic resources and have difficulty attracting high-quality teachers which can result in a low quality education.

In Patricia G  ndara's study of high achieving Chicanas/os, she found that most of the successful participants she interviewed came from families which were economically stable as most of those families had "one foot in the middle class" and attended highly integrated schools which exposed them to Anglo culture and expectations (1982). This meant that these women had resources to aid them in their educational route along with role models and examples to follow. Villar's (2001) came to the same conclusion stating "Latina students with higher socioeconomic status are less burdened with family responsibilities and more likely to persist in school" (p. 21). Poverty-stricken schools have a compounding effect on the schooling experience of Latinas because they curtail their perception of access to wider opportunities which can leave Latinas with a sense of powerlessness and educational apathy (Villar, 2001). Ironically, most Latinas recognize education as an important factor in attaining success, but even with their high aspirational views, their socioeconomic status prevents momentum to achieve and limits their ability to pursue higher education. The U.S. Department of Commerce (2009) states that those workers with a bachelor's degree on average earn \$20,000 more per year than workers with a high school diploma or GED certificate and Ginorio and Huston (2001) found that "Latinas with a bachelor's degree earned 82 percent more than those with a high school diploma" (p. 13). This proves that if we can keep Latinas in school, get them to graduate and enroll them in higher education, their future is bright. But, this can only be achieved if they are able to navigate through the educational bureaucracy that is embedded in our schools and the poverty that they face in their homes and communities. Socioeconomic

status has a stronger relationship with college access and success than race/ethnicity, influencing college financing options, student retention and graduation rates (Anderson & Kim, 2006). Our labor market is related to educational inequalities since unequal learning opportunities lead to different types of employment (Moller & Stearns, 2012). Since economic mobility is dependent on educational attainment, we must take a look at how we are academically preparing our students for college.

Academic Preparation

“We seriously doubt that existing preservice programs are adequately preparing teachers to meet the instructional challenges of ethnically, racially, socially, and linguistically diverse students in the 21st century”- (Gay & Howard, 2000, p.1).

Human abilities are incredibly diverse, but do our schools reflect this diversity? The articles and books reviewed in this section examine discriminatory mechanisms and practices in schools along with racist substructures. Both discriminatory mechanisms and practices produce differential outcomes and are in need of dismantling in order for Latinas/os to prosper. The rapidly changing demographics of the United States guarantee that school staff and faculty will encounter more culturally diverse families and these professionals will need to develop a better understanding of the values, traditions, and beliefs of those cultures. In regards to the Latino student experience in U.S. schools, we must analyze the barriers to access of early education, effective teachers, curriculum and tracking, allocation of resources, and stereotypes.

Inadequate academic preparation has been identified as one of the major factors contributing to lack of interest and lack of degree completion for Latina STEM students

(Crisp & Nora, 2012; Gándara, 2006). According to Darder (2012) basic inequalities still exist within our educational system and traditional pedagogy perpetuates the underachievement of bicultural students. Darder (2012) claims that both pedagogical perspectives, liberal and conservative, consistently “reproduce economic inequalities and social exclusions” (p. 4). In short, traditional educational practices flow from an unequal educational system where American classrooms are “producing, reinforcing, and perpetuating the dominant culture of privilege and power” thru hidden curriculums, tracking, and textbooks (Darder, 2012, p. 21).

In order to analyze the cumulative effects of deficient educational preparation we must review the schooling conditions of Latinas at the primary and secondary levels and examine how educational practices create and perpetuate inequity in schools at these early stages. Oakes (1990) claims that by the time low income students reach secondary school, “their science and mathematics experiences are strikingly different” (p. 3). Oakes (1990) asserts that “during elementary grades, the science and mathematics experiences of children from low-income families, African-American and Hispanic children, and children who have been clustered in ‘low-ability’ classes differ in small but important ways from those of their more advantaged and white peers” (p. 3). Solórzano et al. (2005) states “the underachievement and underrepresentation of Latinas and Latinos at each point in the educational pipeline might be better explained by investigating the educational conditions at the elementary and secondary levels” (p. 276).

According to the U.S. Department of Education (2006), Latinos are the least likely to be enrolled in preschool programs with only 43 percent of Latino children enrolled in 2005. Fuller, Eggers-Pierola, Liang and Holloway (1996) conducted a study which found that a

primary reason Latino children did not attend preschool was that they had fewer options for early childhood education in their neighborhoods. Budget cuts to the federally funded Head Start program has had a direct impact on the amount of eligible children it is able to serve. G  ndara and Contreras (2009) conclude that “if high quality preschool programs were available, affordable, and culturally sensitive, there would be no reason that Latino parents would withhold their children from them” (p. 90).

As the children get older and advance in school, studies have found that inadequate school facilities have played a large part in the educational outcome of Latino children (G  ndara & Contreras, 2009). High teacher/student ratios, large class sizes, and unsafe conditions are a few of the concerns that plague the public schools which Latino children predominantly attended. G  ndara and Contreras (2009) claim that poor conditions in schools often lead to higher teacher turnover since the working conditions, more than salaries, highly influence a teacher’s decision about where to teach. Teachers do not want to teach in unsafe conditions and often leave for better schools when they get the chance, which indirectly has a high impact on student achievement. “Principals at schools enrolling large concentrations of low-income or minority students or at schools in inner cities also report that fewer of their teachers are highly competent” (Oakes, 1990, p.viii). It is a common practice for most secondary schools to assign their least qualified teachers to instruct low ability classes and students. Oakes (1990) concludes that as a result “high-track students in the least advantaged schools are often taught by teachers who are less qualified than those teaching low-track students in more advantaged schools” (p. ix).

Teachers. Substantial evidence suggests that teachers have the most profound effect on a child’s realization of academic success. The AAUW (2001) study found that

teachers, faculty and staff are not properly trained in dealing with cultural sensitivity which would encourage Hispanics as opposed to dissuading students from pursuing their studies. A similar study concurs, stating “institutions would be well served by studying the sociological, psychological, epistemological, and cultural issues facing Mexican Americans” (Munoz, Trowbridge, & Loffredo, 2002, para 3). One theory is that teachers hold stereotypes of Latinas regarding their educational possibilities and promote an “education-dismissive environment,” meaning they have low expectations of Hispanic students and perpetuate the image these students are fed by society and their own communities (Ginorio & Huston, 2001). In particular, with children of color, teachers need to have a greater belief in a student’s learning potential and their learning abilities in order to have a positive result in regards to their academic potential (Gndara & Contreras, 2009). Often times, research has shown that cultural differences between students and teachers contribute to a teacher’s low opinion of the student’s academic abilities and leads to teachers softening the academic curriculum in order to sympathize with their “difficult” lives. Robert Ream (2005) refers to this as “negative social capital” when teachers lower their standards and diminish their curriculums out of a desire to not “make the students feel bad”, which leads to downward educational mobility for students of color. It has been difficult to prove that the cultural mismatch between student and teacher is the cause of low educational attainment, but what has been proven is that engaging teachers who care about their students’ home lives and communities have a greater impact on the students.

Ineffective teachers aren’t the only factor that can cause a student to disengage; the curriculum which they receive has a large effect on their long term educational success.

The U.S. Department of Education (2006) has stated that exposure to a rigorous curriculum is more foretelling to academic success than family socioeconomic status. Alexander and Pallas (1984) agree stating that “a student’s academic background was far more important than demographic variables such as gender, race/ethnicity, family composition, and socioeconomic status in relation to test performance” (as cited in Adelman, 2006, p. 66).

Curriculum. Ginorio and Huston (2001) state “Latinas are the least likely of any group of women in the U.S. to complete a bachelor’s degree” which can be caused by the lack of opportunity given to them to pursue the more challenging curriculum (p. 10). The American Council on Education (2006) found that “all students who had earned a bachelor’s degree by spring 2001 in STEM fields were significantly better prepared for postsecondary education than those who had not earned a degree” (Anderson & Kim, 2006, p. 11). The study also found that Latinos students who had not taken a highly rigorous high school curriculum were less likely to graduate (Anderson & Kim, 2006). Darder (2012) also argues that traditional curriculum favors certain forms of knowledge believed to be important by the dominant culture which can legitimize the dominant culture at the expense of students of color. Particularly for Latinas, instructional content may not be relatable since school curriculums often function to marginalize the histories of women and/or racial minorities (Darder, 2012). So not only are Latinas/os not being exposed to a rigorous curriculum, the curriculum in which they are exposed to does not accurately reflect forms of cultural capital within their communities. When coursework is not challenging, relatable, or intellectually stimulating, students tend to disengage and perform poorly and this performance gap only widens over time.

Inadequate instructional offerings can lead to Latino students being tracked into lower-performing groups from as early as pre-school. This process of tracking in early grades can lead to students having lower-level curriculums which can damage their self-esteem as they come to see themselves as “not as smart” (Gándara & Contreras, 2009). Oakes (1990) determines that “assessments of academic ability, placement in different tracks or ability-grouped classes, and the reduced educational opportunities that characterize low-track classes often parallel race and social class difference” (p. vi). Consequently, this low-tracking leads to unequal access to science and mathematics curriculums which further widens the achievement gap with these groups (Oakes, 1990). Oakes (1985) argues that minority students are disproportionately affected by the disadvantages of low-tracking.

Tracking. Tracking has many disputed definitions and can be interchangeable with “ability grouping” which is the practice of dividing students into different groups, high, average and low achievers, for teaching purposes which usually involve teaching different texts or curriculums tailored to perceived ability. Oakes (1985) defines tracking as “any effort to organize a system that results in students who seem to be alike in ability being taught together, separated from others” (p. 3). A more recent study by Moller and Stearns (2012) defines ability grouping as the concept of which students are “channeled into different tracks” to maximize achievement based on ability which can begin early in the child’s schooling (p. 1026). There are many arguments for and against ability grouping/tracking. The assumptions of tracking are that it promotes overall student achievement because students learn in groups with similar academic capabilities and that less-capable students may suffer emotionally if they interact with smarter peers in a

competitive classroom environment (Oakes, 1985). Proponents of tracking assume that due to an increasingly diverse student population, tracking is the best system to address individual student needs which require different learning experiences. In addition, many argue that higher achieving students will suffer with a “teach to the middle” curriculum because they will be bored in classrooms where lower track students may need more time comprehending or retaining lessons and information. Feldhusen and Moon (1992) claim that high-ability children suffer most when grouping is not used in schools because “they will get no special attention in mixed classrooms” (p. 63). “Grouping them with low and average level learners cannot help but retard their progress in learning” (Feldhusen & Moon, 1992, p. 63).

The effects of tracking have been widely studied and the majority of research, not all, concludes that tracking systems do not provide advantages for students who are placed in high tracks and most literature suggest that students in low tracks do not suffer emotional stresses in heterogeneous classrooms (Burris et al., 2008; Frankenberg & Lee, 2002; Moller & Stearns, 2012; Oakes, 1985, 1990). In fact, most of the literature and studies argue that students in lower tracks “suffer clear and consistent disadvantages” that prevent academic growth (Oakes, 1985). Moller and Stearns (2012) concur with Oakes (1985) that tracking “creates and exacerbates inequality in schools” which produce uneven opportunities for further achievement (p. 1025). Wheelock (1992) believes that middle and lower groups are underestimated and finds that “research on effective schools confirms that students succeed in a climate of high expectations founded on two major beliefs: 1) that all students can learn and 2) that it is the responsibility of schools to see

that they do learn" (p. 115). Wheelock (1992) believes that children in low ability groups in schools are being taught far less than they can learn.

Professor Oakes has long studied the effects of tracking and concludes that there is a large disparity in achievement between students assigned to different tracks and this disparity is greater concentrated within racial minorities, middle and lower-class Hispanic and black students. African American and Latino students are overrepresented in low-track classes which Burris, Wiley, Welner, and Murphy (2008) argue "is evidence to show that tracks stratify students by race and class" (p. 575). Given the increasing number of Hispanics/Latinos in schools, research on tracking is very important because it illustrates the continued segregation in schools and identifies "how tracking forces schools to play an active role in perpetuating social and economic inequalities" (Oakes, 1985, p. 40). Frankenberg and Lee (2002) identify two trends "rising segregation and increasing diversity" and note "patterns of segregation by race are strongly linked to segregation by poverty, and poverty concentrations are strongly linked to unequal opportunities and outcomes" (p. 3).

According to the AAUW study, Ginorio and Huston (2001) found that Hispanics are also underrepresented in Gifted and Talented Education programs and in Advanced Placement courses that would allow for students to earn college credits during high school. More specifically, Latinas are less likely to enroll in AP Mathematics and science and they also take fewer AP tests than any other group of girls (Ginorio & Huston, 2001). More recently, the Latino Educational Opportunity Report (2007) also states that "Latino students are less likely to be enrolled in the advance math and physics courses that are offered at their high school" (p. 12). The opportunities to participate in Gifted and

Talented programs and AP classes have proven to put students on a pathway for college preparatory.

Because lack of academic preparation is one of the most critical contributing factors preventing Latinas from pursuing or completing a STEM degree, could early tracking be an underlying contributing factor? Does tracking prevent educational attainment rather than promote educational goals? Specific to this study of Latinas in STEM fields, do Latinas, primarily tracked in low achieving classes, have equal opportunities and access to the education needed in these increasingly important fields of science and technology? Does tracking promote an uneven distribution of opportunities to learn science and mathematics? Oakes (1990) declares “...it seems obvious that students won’t learn what they are not taught, and that they won’t learn well if they are not taught well” (p. 2).

Four Year Institutions versus Two Year Institutions

“Successful transfer depends on alignment between the community colleges and the four-year college, currently, that type of alignment is the exception rather than the rule. Too often, students who are promising future scientists leave their major because particular credits did not transfer, or because they do not feel invited into the science community at four-year institutions, not because they don’t have the talent” Packard (2012, para 11).

Latinos are disproportionately enrolled in 2-year colleges where nearly two thirds of all Latinos begin their postsecondary education (Solórzano et al., 2005). Although 2-year colleges are successful at providing job training and vocational programs, they are

unsuccessful at transferring Latino students to a 4-year institution (Gndara, 2005).

Many students from a 2-year institution join the workforce with a 2-year degree that isn't as competitive as a 4-year degree in the job market today and research shows that students are more likely to complete bachelor's degrees if they start their postsecondary education at a 4-year university or college (Solrzano et al., 2005). Community colleges have seen the largest growth in higher education primarily because of lowered admission requirements and affordable tuition rates compared with a 4-year institution (Gndara, 2005; Solrzano et al. 2005). Although the tuition and fees at a community college are significantly less than the tuition and fees at a 4-year university or college, it is still difficult to factor in available financial aid at a 4-year college or university not to mention extended costs once a student wants to transfer out of a 2-year college to a 4-year institution. Solrzano et al. (2005) found that "Latinos are disproportionately found at the lowest socioeconomic sectors of U.S. society and appear to be overrepresented in community colleges" (p. 281).

In addition, 2-year colleges have become a place of remedial coursework since many Latinos experience the cumulative effects of low-tracking in primary and secondary schooling; and they have yet to be exposed to college preparatory counseling and classes. The 2000 NCES-PEQIS (2000) survey indicates that 42 percent of public 2-year students enrolled in at least one remedial reading, writing, or math course" (p. iv).

Changes in admission policies within 4-year institutions have contributed to a decreasing number of Latino enrollments. Policies such as Proposition 209 in California which passed under the auspice that too many unqualified minorities were gaining access to coveted spaces within higher education and therefore barred consideration of race and

ethnicity in the admissions process (Gndara, 2005). Gndara and Chavez (2003) reported that UC Berkeley admitted 53percent fewer Latinos and UCLA admitted 33percent fewer Latinos the exact year the proposition went into effect. Since the passage of Proposition 209 in California, Latino demographics have continued to experience increased growth, but admissions into 4-year universities have continued to decrease every year. When a student does not transfer out of a community college and into a 4-year institution, they are limiting their ability to have economic and social mobility. “The average annual median income for adults who have associate’s degrees is approximately \$13,000 less than per year than adults who have a bachelor’s degree (\$32,900 vs. \$45,700), or \$500,000 less in lifetime earnings” (U.S. Department of Labor, 2002).

Solrzano et al. (2005) admits “indeed, we are losing a tremendous resource in the community college student who fails to transfer to a 4-year college or university” (p. 283). Community colleges have failed to provide transfer opportunities to Latino students even though “71 percent of Latinos who enter a community college desire to transfer to a 4-year institution” (Solrzano et al., 2005, p. 282). Bailey, Jenkins and Leinbach (2005) found that “only 11 percent of low-income, minority students transfer to a 4-year institution compared with 48 percent of high income students” (p. 46). Solrzano et al. (2005) finds the poor academic guidance to blame for not providing an explicit method or structure to facilitate transferring to a 4-year university. Often times, Latino students receive misinformation about qualifying classes that can or cannot transfer to 4-year institutions which often leads to students taking additional courses.

How is this data relevant to Latina STEM students? Most college-aged Latinas are enrolling, attending, and ending their postsecondary education in community colleges

throughout the country. The community college transfer system is failing STEM students the most because STEM fields demand more stringent course requirements that most community colleges don't provide. Many STEM students struggle after transferring to a 4-year institution because curriculums didn't line up and they had to retake basic courses such as organic chemistry or calculus. Many engineering students at community colleges won't finish a Bachelor of Science degree if they take the wrong class in their first year. STEM fields work upon building blocks of mathematics and science courses, and if one of those building blocks is missing, the entire educational structure is at risk of crumbling.

Chapter Three – Methodology

This study was qualitative which allowed for a more thorough examination and understanding of the experiences of twelve Latinas involved in STEM as they navigated their academic training and/or careers. More importantly, the qualitative nature of this study provided an opportunity to capture the intersections and complexities of gender, race and socioeconomic status for these women involved in STEM.

I interviewed six Latinas in STEM careers and six Latinas currently enrolled in undergraduate STEM programs. In order to aggregate much needed data about the educational experiences of the few Latina students in STEM programs and careers, it was important to use *testimonios*, counter-stories, to accurately analyze how these women survive and succeed in higher education and what happens to them at each stage of the educational pipeline. The concept of testimonios is defined as the participant's recollection of significant accounts "of life events and experiences in their own voices" (Jasis & Ordonez-Jasis, 2012, p. 71). This methodological approach gives us a view of reality from the participant's perspective which can validate their educational experiences. Using *testimonios* allowed me to gain access and knowledge for a content analysis as opposed to a statistical analysis. CRT, the theoretical framework of this study, uses the idea of counter-storytelling as a way to examine intersections of gender, race and social class. CRT provides a way to transform the dominant ideology and thought to better reflect the participants' experiences within society with hopes to change social hierarchies and dominant master narratives regarding Latinas and education. Entering into the narrative space allowed me to explore how Latinas see themselves versus how society views and defines them. "Through these stories that tell of those who

survived and pursued their dream in spite of such conditions, we come to understand the factors that made it possible to succeed, to walk a path that few have walked” (Cantu, 2008, p. xvii). Social construction, which states that race is a product of social thought and relations, is one of the important themes of CRT (Delgado & Stefancic, 2001). Using this idea, I aim to see how we can “deconstruct” what has historically and socially been constructed through *testimonios* and counter-storytelling.

Sample Population

I interviewed six Latina professionals currently in STEM careers and six Latinas currently enrolled in undergraduate STEM programs. All participants were female and varied in age from 20 to 49. All student participants are currently enrolled as an undergraduate student in a STEM field program. All professional participants are currently employed in STEM fields. All participants qualify as Latina which is defined as those females who classify themselves in one of the specific Spanish, Hispanic, or Latino categories listed on the Census 2010 questionnaire - "Mexican," "Puerto Rican", or "Cuban"-as well as those who indicate that they are "another Hispanic, Latino, or Spanish origin." The terms "Hispanic," "Latino," and "Spanish" are used interchangeably in this study (U.S. Census, 2010).

Eleven of the twelve participants were born in the United States and all twelve participants are of Mexican descent. They all self-identified themselves as Mexican American. Spanish was the first language for eight of the twelve participants. One hundred percent of the *student* participants were bilingual and born in the state of California. Five out of the six *professional* participants were bilingual. The STEM majors represented among the student participants included Biology, Mechanical

Engineering, Applied Mathematics, and Computer Science. The participants in STEM professions represented among the professional participants included a math professor, civil engineer, molecular biologist, mechanical engineer, and biology professor. All six student participants were second generation Americans. Four professional participants were second generation Americans, one was third generation American and one was fifth generation American. Seventy-five percent of all participants grew up in a household that was categorized as lower socioeconomic status. All participants employed in a STEM field attended a four year university straight from high school. Two out of the six student participants attended a community college before entering a four year university. All but one participant took advance placement classes and/or honors classes in high school.

Procedure

Data was collected in two phases. The first phase involved identifying eligible participants for the study. Student participants needed to be currently enrolled in an undergraduate STEM program and be self-identified as Latina per the definition above. Participants in STEM careers needed to be currently employed in a STEM field and be self-identified as Latina per the definition above.

Once participants were deemed eligible, I emailed a short form consisting of 20 demographic questions, including age, major, college, GPA, ethnicity, parental educational levels, languages, and birthplace to name a few. The second phase involved collecting data through personal interviews. I personally conducted in-depth interviews with all participants using a set of open-ended questions (see Appendix A). Prior to the start of the interview I read the consent form to participants to inform them of their rights

as participants and to obtain their permission for use of their *testimonio* for my study (See Appendix B and C). Five out of the twelve interviews were done in person and all others were completed over the phone. Interviews were recorded and lasted one to two hours. Interviews were then transcribed and stored in a private file cabinet under lock and key.

Data Analysis

My guiding research questions were: What characteristics did their educational experiences have in common that *contributed* to their capacity to increase STEM degree completion? And what characteristics did they have in common that *limited* their capacity to increase STEM degree completion? A content analysis was conducted and recurring themes across the interviews were ascertained. Commonalities among the participants were examined to provide insight into the underrepresentation of Latinas in STEM fields. I looked for similarities in the participant's educational experiences in an attempt to understand the practices and policies that lead to successful educational outcomes.

Chapter Four – Findings/Results

Interview findings reveal support systems and challenges in the academic and/or professional experiences of Latinas in STEM. In particular, four common themes emerge: (1) Community Cultural Wealth, (2) Socioeconomic Circumstances, (3) Academic Preparation, and (4) Sexism.

Community Cultural Wealth

The *testimonios* provided by all twelve participants reveal a unique context to better understand community cultural wealth (Yosso, 2005) provided by families for their daughters pursuit of an education. The women in this study identified forms of aspirational capital, familial capital, and resistance capital in their educational journeys in STEM. Although some parents could only be involved in aspirational/motivational support, others were able to participate in a more substantial way; both approaches had a compounding effect on their child's educational trajectory.

Aspirational Capital. The most common theme I found among all participants was the strong emphasis parents placed on obtaining an education along with exposing them to the possibility that college was indeed an option. More importantly, parents consistently encouraged their daughters' pursuit of an education even though they themselves had a limited education.

Jessica is a Mexican American biology student who grew up in a low income neighborhood in Glendale, CA, her father graduated from high school and her mother's educational history was unknown. Jessica vividly remembers how her parents consistently talked about the importance of school and motivated her to do well in school.

My parents have always talked about college. They have never given us another option, it was always school, school, school. And so I didn't know any other option.

Brittany, a Computer Science major, grew up in a low income neighborhood in the Los Angeles area to parents whose highest level of education was middle school. Although her parents did not go far in their educational journey, she recalls how her parents motivated her to put education first.

Our whole lives, my parents have just been supportive. It's education or nothing to them. And they've really engraved that in me-in my head. It's just all about education and everything else comes after.

Victoria, a professional civil engineer, grew up poor in a neighborhood in Laredo, Texas and she recalls how her parents lectured her about doing well in school at an early age. These high expectations for her education influenced her to always do her best in school.

There was an expectation, it was funny because they would drill into us from very young 'You will get an education, you are going to college and you must and need and should always do your best.' That's all they ever said 'you should always do your best' whatever that is.

Familial Capital. Other parents were more hands on and were able to contribute by helping the participants with their homework or attending parent teacher conferences. These particular parents were able to share their funds of knowledge by providing instrumental support to their daughters at home and at school.

This support proved to be critical for Ana, a mechanical engineer, who recalls how her dad helped her with homework as often as she could even though he only had a 3rd grade education.

We quickly reached a point in math where they only were able to help out until the multiplication tables. And for me I always enjoyed math. It was funny because my dad-both my parents- but my dad was very strict. And when we were off in the summer he would give us assignments- he would say, you have to do this much before I get home today. I was in kindergarten and he made me memorize the times tables.

Judy, another mechanical engineer, remembers how her mother taught her math even though she only had a 2nd grade education herself.

Even though my mom only had a second grade education she was really sharp when it came to numbers and I remember at a very young age, she was always the one who taught me. She taught me my times tables, taught me how to count. Anytime we were in the car or had idle time she would quiz me on times tables.

Another participant working in a STEM field, Monica, whose father also had a 3rd grade education, recalled how her parents enrolled her in summer programs and attended many school functions.

Even though my dad has a 3rd grade education, I hate to say 3rd grade education, but he went up to only 3rd grade, umm and my mom high school, both of them have always been supportive and they attended open house when they used to

have them. They supported us to attend summer programs. We did a lot of reading and other art classes, and so I remember being actively involved because my parents would involve us.

There is much discussion in the literature pertaining to what constitutes “parental involvement” (Quicho & Daoud, 2006; Valencia & Black, 2002; Zarate, 2007). Studies have argued that we must develop significant collaborations between school and home in order to understand the meaning of “parental involvement” or “parental participation” (Jasis & Ordonez-Jasis, 2012; Quicho & Daoud, 2006). When parents do not understand the parameters of parental involvement, teachers often misinterpret that confusion as disinterest. As shown here in this study, not only did parents feel that they were significantly participating in their child’s educational journey, but the child felt supported as well. In fact, the participants gave many examples of how their parents navigated internal and external systems for the academic advancement of their child.

Resistance Capital. Resistance capital “refers to those knowledges and skills fostered through oppositional behavior that challenges inequality” (Yosso, 2005, p. 80). Latinas face many oppressive circumstances related to their educational journeys, one being gender discrimination within the home (Cammarota, 2004, p. 54). There were some participants who experienced traditional gender roles within their Latino families. Two students engaged in resistance by a desire to be seen as equally capable. Esmeralda, a mechanical engineering student, remembers how her brothers would discourage her studies and question her academic ambitions. However, she used the disapproval of her brothers as fuel for her ambition to do well in school.

My brothers- how do I say this? Like I love them to death, but they would say sometimes rude comments, like ‘why are you going to school? You’re not even going to get a job after you graduate.’ I didn’t really get motivation from my brothers, because I’m a girl. I grew up like in a Mexican, macho household. Like all of my brothers, like all their wives- well two of them- their wives or girlfriends, they have kids, they’re stay at home, that’s what they are.

Victoria had a similar experience, however, the definition of gender roles worked in her favor. She recalls how her father wanted a boy, but when she was born he was disappointed. In turn, he treated her like the son he never had and because of that she was exposed to his work in construction which lead to her becoming an engineer.

You know it’s funny because I always felt like they treated me like they were expecting a boy. It was weird, because when I was 2 years old, my dad got me a train set. I mean I got Barbie’s too, but my dad never treated me like a girl. So they kind of latched on to ‘She’s the smart one’ so he treated me like a boy. And when I was in middle school he started building out the house because we lived in a trailer. And he just started adding rooms one at a time, and he let me help him. And that’s unusual you know for a Hispanic man to let his daughter help him with physical labor.

Cammarota (2004) contends that “the theory of resistance through achievement may indeed shed light on the reasons why young Latinas are embarking on new directions in their life courses” (p. 53). This is proved by increasing high school and college graduation rates for Latinas since 1996 (NCES, 2010). Latinas are using resistance

capital to “overcome societal constructions that attempt to render them inferior to males” (Cammarota, 2004, p. 53). Solórzano and Bernal (2001) state that it is crucial that we understand how students engage in resistance to counteract social conditions that may affect their educational journey and acknowledge these resistance strategies as strengths that students use to reject cultural norms.

The *testimonios* provided in this study counter the master discourse that claim Latino parents do not participate in the school life of a child or that Latino parents do not have high academic expectations for their children (Quiocho & Daoud, 2006; Valencia & Black, 2002; Zarate, 2007). On the contrary, these *testimonios* illustrate that Latino parents contribute and support the structure of formal schooling as well as reinforce the importance of moral guidance and education taught in the home. These *testimonios* provide strong evidence that Mexican Americans do in fact value education and consider it key to the economic mobility of their child. Moreover, parents were able to provide their daughters with knowledge and skills that allowed them to navigate and resist the gender constraints experienced in some of their homes.

Socioeconomic Circumstances

It has been widely confirmed that there is a direct correlation between socioeconomic status and educational achievement (Crisp & Nora, 2012; Frankenberg & Lee, 2002; Gándara & Contreras, 2009; Ginorio & Huston, 2001; Moller & Stearns, 2012). In this study, two themes emerged with respect to finances: family financial woes and lack of monies for college tuition. When participants were asked about their childhood or neighborhood experiences growing up, most participants immediately had a memory of

their financial situation as a child. Many experiences shared were tied to the limitations placed on the family by lack of finances or resources.

For example, Jessica recalls how her family's financial troubles motivated her to get a job even though her parents forbade it because they wanted her to focus on her studies.

I saw how sometimes we would go without a meal and that really hurt me to see how much my parents worked and they just weren't going anywhere so I thought I have to do something. I thought okay well I have to help my mom and I wasn't allowed to get a job so this was all like. I took the bus afterschool and then I would go to my job and then I would go back home. I would tell her that I was at soccer practice but I would always I'd be oh at school we did this thing and I have money. So I'd give her money and she would be oh they are so nice.

Another participant, Bonnie identified her greatest obstacle in school was financial. Her parents divorced when she was six years old and her mother had to start working at the canning factories to support her children. Bonnie remembers how that was the only job her mother could get because she only had a 2nd grade education.

So basically like high school wasn't the best experience for me...Financial troubles were always in the back of my mind. When I was a sophomore I wanted to stop school because I felt I wasn't learning and I thought I could move ahead faster if I could work. We had a lot of personal problems. I remember when I was younger, around my house was a lot more dangerous. But around my school it wasn't that dangerous. There would be police around the school to make sure the kids were safe. So it was always nice around school.

Lastly, Judy shares how she never knew that her family was working class until she reached college. She remembers how her entire community faced the same financial obstacles which made her feel that these problems were not out of the norm.

I didn't know I grew up poor until I was in college. Then I realized how other people lived. I thought having ten people in a 2-bedroom home with one bathroom was normal! Our family experienced a lot from shut off water to shut off electricity. My parents were laid off after the company they worked for went bankrupt. There was a period of time when I was the only one working while I was in high school. And yet so many of my friends were experiencing the same things but it just didn't seem out of the ordinary.

According to Daniel Willingham (2012) children who grow up poor households suffer more stress than children who have wealthier parents. The stress is evident in the testimonios above. Many of the participants not only worried about how to pay for college but also worried about their family's finances such as mortgages, electric bills, and food. This added stress has been proven to affect a child's ability to learn and reach their full educational potential. Often times we do not factor into the equation the toll stress takes on these children and how that affects them at school. In some cases, the participants contemplated dropping out of high school or going straight into the workforce after high school instead of going to college.

In addition many of the *testimonios* about socioeconomic status related to college tuition. Most participants had no idea how they would find the money to go to college. Their testimonios reflect their resourcefulness and drive to attend college and how that

perseverance paid off. Jessica knew the financial struggles of her family and wouldn't dare ask them for money for college. Jessica was also the first person to go to college and had no one to guide her in the process.

I knew I wanted to go to college but I didn't know what I had to do to get there. I knew I would have to pay for it. I knew I had to do it myself. I never liked asking my parents for anything. So I worked, I worked full time in college. I took out a loan this last year and I did qualify for financial aid but not enough because supposedly we had made too much money and I am like 'Where? Where is all of that money?' I just knew I couldn't ask my parents for money.

A similar story emerged from Bonnie. After high school, Bonnie attended and graduated from a junior college. With her associate's degree in hand, she applied to a four year aerospace program in San Diego. She recalls the process of applying for a Pell grant and scholarships and how currently she is in her last year of college and may drop out due to financial troubles.

I got the Pell grant my first year and that covered everything and I applied for all scholarships. I got a couple. I've never taken out a student loan, I've avoided that at all costs. But the end of my second year they took away the Pell grant. They weren't going to cover my books and tuition and I ran out of my savings from paying my rent. So I wasn't going to make it another two years. I had to transfer out of the aerospace engineering program and transfer to CSUN because it was cheaper. They don't have aerospace here so I am a mechanical engineering student now. As of right now I am trying to figure out how I am going to pay for

my last year....my financial hardships are way more than schooling. Like my mom was in the hospital and then my grandpa was in the hospital and like we don't have medical insurance so now we are like in thousands of dollars in debt. All of our savings are pretty much gone. All we have for income now is my tutoring and research money.

Similarly, Ella recalls how her mother pushed her to find financial resources to go to college because she knew they couldn't afford it. Once Ella was accepted to MIT, the excitement of being accepted didn't last long as the worry began about how their family could afford such an expensive school.

I mean I knew I could not afford it and my parents could never afford it and then on another hand I didn't want loans because that's just a burden I didn't want to deal with later. So I started, my mom was really active in this. She would always tell me 'Have you applied for scholarships? Have you applied for grants? Have you called the financial aid office? What are other ways you can get funding?' So I was very proactive about getting scholarships. I think I applied for like maybe 15 or something scholarships. And so that was my plan.

Ana, another MIT graduate, recalls how her parents were happy she was going to college, but they didn't fully understand the benefit of going away to an expensive college when her brothers stayed close to home and went to a local college. Therefore, she had two obstacles at this time, one was to convince her parents she needed to attend MIT and the second was to figure out how to pay for it.

When I was accepted to college my parents were happy about it. But when they found out it was MIT, then it was like ‘Why are you going to MIT when you can go to Mission college? Mission college is right there.’ Some of my teachers and counselors had to speak with them-to let them know what a big deal it was and how I couldn’t pass this opportunity up. So then I got the acceptance package, I think it came with a financial aid package. I think if I remember correctly it was \$35,000 a year. And my parents were like ‘There’s no way we are going to pay for that.’ And I was like ‘I get it, there’s no way you guys can pay for that.’ I think my dad was making around that much a year! And I just thought- I have to go for it. So I got some loans and scholarships. I would just apply for whatever I could. Internships- my summer internships, all that money I would save up. It was financially tough once I was there. I remember coming back during the winter breaks and I think I’d lost like 10 or 15 pounds, because I didn’t have that much to eat. So that was difficult.

Lastly, Judy recalls how her parents could not help her monetarily, but always supported her emotionally. So she did not encounter a cultural barrier but she definitely faced the financial barriers.

I knew my parents couldn’t help me and my dad told me all the time- anytime I told him I wanted to be part of an activity at school or any club at school or wanted to go to an outing, he would always say, ‘I support you, but I can only support you emotionally, I can’t support you financially.’ And they continue to say that to this day! That’s funny. ‘We’re here for you- we’re 100% behind you, but we can’t help you financially.’ So it was a big concern for me and I did get a

lot of scholarships so I was always online looking up scholarships. I was always in college counseling office trying to figure out what else I could do to raise my own money.

A common theme found among the participants was the fact that most parents did not have the financial resources needed to provide better access to educational opportunities, but they did provide cultural and social capital which proved to be beneficial and instrumental to the success of these students. The skills and knowledge acquired through their homes and communities afforded these participants the resourcefulness and ingenuity to overcome the financial barriers that were set before them. The findings suggest that although poor Latino parents are constrained by socioeconomic circumstances, their parenting style was highly supportive of educational attainment.

Academic Preparation

Academic preparation emerged as a major theme in this study. In particular, participants identified tracking and mentors/teachers as key elements in their academic success. Eleven out of the twelve participants I interviewed were enrolled in some sort of AP, honors, gifted or magnet program at one point in their educational journey. We can assume the exposure to a more rigorous curriculum and engaged teachers better prepared them for college and even more so to major in a STEM field.

Tracking. As we know through the research, tracking plays an active role in perpetuating social inequalities which lead to greater educational gaps for minorities (Burris et al., 2008; Moller & Stearns, 2012; Oakes, 1985). A common factor I found among the participants was the difficulty in entering into one of the enrichment programs. Whether the participants were denied access by a teacher, a parent, or the system of

testing, these women had to challenge the status quo to secure their seat in the higher tracked class.

For instance, Ella recalls how her lack of proficiency in English kept her from entering the gifted program in elementary school even though her math skills were above grade level. She was placed in remedial reading classes even though she thought she was smarter than the rest of the students. Being a young elementary student she did not contest the testing process or the placement into a low track. However, when she reached middle school, the testing happened again and this time she knew she wanted to be in the gifted program.

So in elementary, I remember there were like two of us taking the test. And I think actually, if I recall it was at the end of third grade that I took it. But I didn't do well enough to qualify but of course I think it may have had to do with me still learning English. So in middle school, I remember they also did similar to what they did in my elementary school where they tried to separate the gifted from the non-gifted or whatever you would call it. And I asked my teacher when was the testing. This time I guess I passed because I remember all my class was all gifted. This was in 6th grade. I always wondered what would have happened had I not asked to take the test.

Another participant, Ana also qualified to be in a gifted program and refused to accept the fact that she could not enter into a magnet program. Both of her brothers attended the magnet school and she was determined to be considered just as smart. Her continued persistence gained her access to the program.

Somehow at the end of 6th grade we learned about the magnet program. Since it's a lottery process I wasn't fortunate to get in and I kept bugging and bugging and bugging and I'd literally call every day to see , you know am I still on the waiting list? What number am I? Eventually either I just annoyed the hell out of them – they were just like let's just let her in. And I got in. I was so happy because I knew I could do well.

I asked Ana why she decided to be so persistent to get into the magnet school and she said she knew she would get a better education there. She saw the difference in schooling from her brothers and she knew she was capable of the same educational challenges. She also explains how she enjoyed being surrounded by advanced students because it motivated her to do her best.

There was a big difference. A lot more homework, I mean we actually had pretty good books – I mean the quality of material, even was at a whole other level. So the classwork, the type of projects that were given – it wasn't this whole, go make a volcano thing, or whatever the typical science projects are. It's a lot more advanced. And then the students, obviously. So there was not as many Hispanics, so now you've raised the bar right, because you're studying with other students that – it's normal for them to be challenged, it's normal for them to be getting good grades. So now you have to step up the game.

Likewise, Monica recalls how she never performed well on the gifted testing but she was capable of completing the curriculum and performed very well in class. She was frustrated that she wasn't allowed to join the honors classes without passing the "special"

test even though she could pass exams in class. With the support of her mother, Monica chose to question the system by talking with her high school counselor who eventually did place her in honors classes.

I got to high school and I didn't test well to get into the honors programs. I tested well when it came to tests, exams and you know knowledge of class, but when it came to testing to get into the program, I didn't do so well. For some reason I didn't get picked to be placed in honor courses. And you know I had classmates in there, my friends were in there, I just wasn't placed in there. And there were students in those classes who were placed but they didn't do well. So remember talking to the counselor and telling them look this isn't fair. I don't test well on this special entrance test, but I can do the work for you and get A's and you got students in the class that tested well to get in but they are not doing well once they are in. So the counselor looked at my grades and said you're right, I don't know why you are not being placed in these classes. So she then I ended up graduating with honor, like 3rd or 4th in my class.

In contrast, Judy faced a different challenge. When she was tested for the gifted and talented program it was her parents, not the school, that did not want her to participate in the program. Judy parents didn't understand or had never been exposed to a gifted program and didn't want her to be so far away from their home because the gifted school was located in a different community. Judy recalls how her father's lack of knowledge about the gifted and talented program could have prevented her from reaching her full educational potential.

So one of my most vivid memories of elementary school is that I started exhibiting an ability in math very early on. And I remember being tested for whether, I think it was the gifted exam and I think I did really well in it. My parents were called in. They, the school, suggested I attend a different school and there was a bus service and this would be great. And I remember my dad saying no. And uh I just remember the teachers I had around that time and he said no. That that's gonna be too hard I'm not gonna know where she is, this is close, she can walk here, if there's an emergency I can get here quickly and so logically it didn't make sense and I think that's my most vivid memory from elementary school and I didn't think a lot about it at the time, but in high school and college I always think back and I just remember that experience and I think about how much more diverse my high school experience could've been if I had had a different opportunity. I don't think he understood the value.

By 9th grade Judy was doing very well in school and heard about a high school magnet program. This time she was determined to get in and had a different type of motivation. Judy recalls performing extremely well in math, so well that when she saw other students who she considered “not as smart” entering the magnet program, she decided to apply.

I applied for the math science and technology magnet program at my high school and I did that because of a friend of mine, a Latino. And I met him in 8th grade when I wasn't doing too well. And everybody talked about him as being the smartest guy in the school. And I thought he's not that smart, I'm smarter than him. But I just, I just don't like it. Hearing everybody say that he's so smart and smarter than everybody else, I wanted to prove that I was as smart as he was. It

was, it was healthy competition. And he told me he was applying to the magnet and I said okay I am too. We helped each other a lot. He ended up being valedictorian and I was salutatorian at our high school. He made a big difference in my life just by being the smart guy I wanted to trump. We are still friends today. He went to Harvard and I went to MIT.

Eleven out of the twelve participants I interviewed were enrolled in some sort of AP, honors, gifted, or magnet program at one point in their educational journey. Each one of the participants faced obstacles in their schools within the system of tracking into AP and/or honors classes. Historically, minority students are less likely to have access to AP courses, specifically in math and science (Ginorio & Huston, 2001). There is no question that these participants were exposed to a more rigorous curriculum through AP classes and, therefore, better prepared for college courses. As stated before students who are in high ability groups are more likely to enroll in college, which is the case with all eleven participants that took AP or honors classes in this study. As their *testimonios* reveal, their persistence led them to partake in the enrichment programs.

Teachers. When asked whether or not there was a teacher or mentor in their educational journey that had a profound impact on their schooling, participants primarily identified positive experiences with teachers, but there were a few experiences that were negative. Each participant relished in the memory of a great teacher, counselor, family member, or mentor. Research has suggested that having an effective teacher can have a profound effect on a child's academic outcome (Gndara & Contreras, 2009; Ginorio & Huston, 2001; Ream, 2005). With regards to students of color, positive results are more likely when the teacher has a greater belief in the student's learning potential (Gndara &

Contreras, 2009). This proved to be true with this group of participants. For this sample, each teacher and mentor contributed in different ways. Some of the teachers and mentors gave small, motivational talks while others took time out of their own schedules to administer extra tutoring. Some teachers went above and beyond the classroom and involved themselves in the personal lives of the participants, helping them through pregnancies or walking them home at night because of dangerous situations. More importantly, participants shared the influence particular teachers had over their interest in math and science. When I asked how they first became interested in math and science, 10 of the 12 participants cited a great math or science teacher. This is especially relevant to STEM fields because if teachers can create an early interest in math and science, perhaps more Latinas will go into these fields as a profession as was the case with these participants.

Bonnie fondly remembers her 10th grade math teacher, Ms. Sherman who was responsible for sparking her interest in math. She remembers Ms. Sherman was young and energetic and considered her the engineering genius.

Ms. Sherman, we got along with her pretty well. She was pretty young for a teacher and she would give us engineering in math so that influenced me right away. She was working on her Master's degree in math but got her bachelor's degree in engineering. That was the first time I met a woman with an engineering degree or anyone with an engineering degree. I liked that she was a girl and she cared about us. You don't see many females in the science, math obviously because I don't know, I noticed growing up that girls weren't really interested in that as much and then she really cared about her students. She would always stay

after class after school to help you, whatever it was that you needed. She was always there.

Esmeralda also remembers two teachers that impacted her life and exposed her to challenging math courses. Esmeralda always considered herself smart but contributes her study ethics to one elementary teacher and one 8th grade math teacher.

I always thought school was easy- a lot of the stuff came easy to me. When we were learning the multiplication tables, I remember I had 2nd grade teacher, Ms. Fernandez, and she was really strict. She would scream at us like if we didn't get our multiplication tables right. She was just one of those teachers that just screamed, so I thought I don't want to be screamed at so I better learn all my multiplications. She was strict but I liked strict teachers. I like teachers that give you a lot of work to challenge you. I like those teachers because I feel like those teachers actually want you to learn.

She remembers her 8th grade math teacher instilling discipline into her homework regime. His name was Mr. Litt and he engaged the students before and after class on his own time. Esmeralda felt that Mr. Litt laid the groundwork for the building blocks needed to advance in math and considered him one of the greatest math teachers she ever had.

Well first time I was interested in math, well maybe the first time was in 8th grade. I had a math teacher in 8th grade- Mr. Litt. He gave us so much homework for Algebra 1. And I remember the first day of class he was like, 'you're going to thank me. Every math class after this is going to be easy to you.' And it was! We would have to go in before school at 7:15 and we would play math jeopardy

before we had to go to our regular classes, and we also would have to stay after school for tutoring. It was the coolest thing ever. He was the one who engaged me the most in math.

Similarly, Ana recalls a 1st grade teacher named Ms. Daygencoat who recognized Ana was excelling at math. Ms. Daygencoat pulled Ana out of first grade math and placed her with the second grade math students. Ana credits this teacher for positioning her for success in math.

A teacher I remember was Ms. Daygencoat. She was just someone that was very dedicated to her students and her teaching and she tried to cater to the different levels. So she saw that I was standing out and so she pulled me- although I was in first grade with her, she would send me to second grade for math.

Roselyn also recalls having many great teachers who left a lasting effect on her. She remembers an 8th grade science teacher who would hold science fairs at the school. Her name was Mrs. Wiseberg and her encouragement and support led Roselyn to spend more and more time with her which spurred her interest in science.

I had so many teachers that were instrumental in my life. And throughout my education. But in terms of science, in 8th grade I participated in this little science fair at the school and I had this teacher Mrs. Wiseberg who I always gravitated towards because she praised me and liked me and consequently I would do well in the class. I ended up winning that science fair, 1st place because of the help Mrs. Wiseberg gave me. She made me fall in love with science and biology.

Victoria remembers a vice principal who took an interest in her in elementary school because he recognized her potential in math. She didn't remember why he took a particular interest in her but she said his attention made her feel important and smart.

In elementary it would have been Mr. Ornelas. He was the vice principal there at the elementary school. And he is the one who told me to read a math book over the summer. And I was like 'what do you mean read a math book, you teach math, you have to show me how to do it.' And he said 'no, no, try reading this book.' And I was like well I'll be darned you can actually read a math book. Ever since then I basically self-taught myself math before I would take the classes, so I was always ahead.

Judy credits her high school history teacher for encouraging her to do her best in school and for exposing her to a creative curriculum. His name was Mr. Torres and he taught the AP history class where he encouraged people to be critical thinkers. However, what Judy remembers most about Mr. Torres was how he cared about her personal life and inspired her to continue school when she found out she was pregnant.

I had amazing teachers in high school. This was where my life really turned around. I had one teacher, Marco Torres, who was an AP history teacher. And he really pushed everybody to think outside the box. He brought in literature that we'd never been exposed to like Howard Ben. He had a very creative room and encouraged people to write to nonstandard prompts. So we weren't writing about the same boring topics every time. He would let us relate to current events. And I remember when I got pregnant, I wrote him a letter because he became an

important mentor to me. And I told him I can't believe I've done this. My life is over, I have let everybody down. And he called me and said, 'what are you talking about? It's not over. You can do anything you want to do.' And this has always stuck with me, even now.

Judy also had another teacher that made a difference in her life, both personal and academically. It was her high school calculus teacher who she says not only sparked her interest in engineering, but took an important interest in her life outside of school because he believed she had amazing potential.

The other person that was really critical in my high school career was my physics and calculus teacher, George Rhys. He was ethnically blind and he would encourage everybody and had a very grassroots spark in him and he would always present us with opportunities to learn. But I will never forget when I was having problems with my daughter's father, I experienced stalking and very threatening behavior with him and throughout high school, Mr. Rhys would walk me to my car every day after school to make sure that I was safe. And when I got into MIT he continued to mentor me to this day.

Brittany confessed that in high school, she was just going through the motions waiting to graduate. It wasn't until she joined the school newspaper that she met a very enthusiastic teacher named Mr. Blough. She praises Mr. Blough for persuading her to do her best in school and not just try to finish.

In high school I would just take the classes I got and just go with them. Then I joined the school newspaper and I met this enthusiastic teacher who taught us

how to write differently. He was very straightforward and so experienced. He was a writer for the New York Times for years and I was just so impressed. And he was impressed with my photography and I didn't know why. But he saw something in me that most teachers didn't see. That I was a person. And this changed the way I saw myself. I looked up to him mainly because he was so supportive and he knew I could do better. He sat me down and he taught me how to write correctly. He taught me there was so much more to writing than what I was learning in my classes.

Lastly, Ella remembers her college professor, Dr. Barbara Huey, as being enormously helpful with her physics classes. Ella claims that if it wasn't for Dr. Huey taking time out of her personal life to tutor her, she may not have survived at MIT.

Well I remember when I was in the program, I struggled to understand the physics class and that's because a lot of the other girls had already taken physics and I hadn't. And so they were teaching us physics that summer and it went pretty quickly because when they asked, 'Oh who's taken physics?' The majority raised their hand, and so they just went at a faster pace and I didn't understand it and I was doing terribly in all of the assignments. And I remember, and I always remember this, she sat down with me on a Saturday for an hour and just taught me physics. And that was the most valuable time I have ever had with a professor.

There are numerous examples in the *testimonios* above on how teachers who genuinely cared about their students really left a lasting impression on their students. Interestingly, the majority of the participants did not feel that it was vital to have a Latina teacher. As

long as the teachers were engaged and encouraging, the participants felt race was irrelevant. Some of the participants said it was comforting at times to have a reflected ethnicity in the faculty but not necessary. What the participants did say was that they wanted more female teachers at the high school and college level. The participants seemed to identify more with female professors than male professors. Many of the women claimed that they were inspired just to be in the presence of a successful woman in the field of math and science. All participants acknowledged that it was rare to see women in the sciences.

Not all of the participant's experiences with teachers were positive ones. There were some environments in which teachers were dismissive of the students, held a low expectation for them or just didn't believe in their learning potential. These negative experiences proved to be just as impactful as the positive ones. However, in some cases, many used the negative experience as motivation to excel.

A case in point, Roselyn. She recalls a homework assignment in 3rd grade that required her to write a paragraph about where you were from. The directions given by the teacher stated that your parents must edit and correct your paragraph. Roselyn received help from her father, who didn't have the greatest writing skills, but still she felt like she executed the assignment well. Once she turned in the paper, the teacher ridiculed her efforts and embarrassed her in front her classmates.

Yes, I remember Mrs. Mueller, was white was an older woman and we had to write a paragraph and we were supposed to go home, it was about where we were from, but my dad was from Peru so he helped me edit. I must have been like in

second or third grade because it wasn't the best writing at the time and there was errors in it and it was because my dad. Until this day my dad doesn't write very well at all umm and he was the one helping me with this assignment and so then the next day in class she made fun of it. She looked at it and said. "Did your parents really help you?" I mean she was really rude to me and she put me down. She embarrassed me. And I remember that was the first time I realized my dad, you know, didn't have the greatest skills. It was the first time I noticed that my dad, you know, really couldn't help me with my work. So it just made feel a little...my dad we are buds, we're best friends but you know it sort of umm...let's just say it was—I really went to him for help. And she made fun of it. That's probably one of the reasons I liked math more after that.

Lisa remembers a high school counselor that discouraged her from applying to college. She knew she did not want to attend community college and started investigating how to apply to a four year college. During this time she went to receive advice from the high school counselor who she says didn't seem interested or invested in her desire to go to college.

I knew I was smarter than most of the kids in my class and there were some real rocks there who were going to four year colleges so I said if they can do it, I can do it. Right? And in high school I had this bad male counselor and unfortunately when I was ready to apply to colleges he was not encouraging. He actually wasn't my counselor, my counselor was sick that day so I had to see him. In any case, he just looked at me and he said, 'you should just apply wherever.' I walked out and

the secretary was Chicana and she gave me some scholarship information that might help me and I walked away. So I applied in spite of him.

These Latina participants experienced educational conditions that challenged their resiliency but they managed to succeed despite these circumstances. They were able to negotiate the social forces that affected their academic aspirations. Ceja's (2004) study on Chicana students concluded that the concept of resiliency allows students to "develop a certain consciousness or mental outlook that allows them to form a critical perspective of their surroundings and lived experiences that, in turn, allows them to cope, survive, and in many cases thrive within those realities" (p. 342).

Sexism

An unexpected finding was that most participants claimed to have experienced more sexism than racism in both college institutions and the professional environment. This is not to say that racist attitudes were not present in their experiences, only that discrimination based on gender within the STEM fields seemed to take precedence over discrimination based on race. When asked if they had ever been academically judged in college due to their race, participants overwhelming said that gender bias was a larger factor in which they were academically judged. Participants identified sexism as part of their college experience conveyed via male classmates and professors.

Esmeralda experienced sexism from both professors and classmates. She remembers how she was assigned to a predominantly male group for a project and how the male students in the group tried to allocate simple, gender defined tasks to her.

Let's see, one of my friends I started off with him, like we started off at the same time, when we were both mechanical – we're both graduating this year, but he would always be like, well you got a better grade because you're a girl, or stuff like that. And I'm like really, maybe it's because I study more? But no, it's because I'm a girl, type of thing. And for my junior design project we had to – it's a lot of labor because in my project, it was a lot of standing, a lot of drilling, a lot of stuff like that. And of course, I mean it was my senior design project too, so I wanted to put in a lot of work, as well as everybody else. And they were like, oh no you don't have to do that, you can do like the paperwork and stuff. Kind of girl thing, and I'm like really, we're all supposed to work on it. And I'm not the kind of person that will go off on them and tell them. But a few times they did – and just because it was my senior project and it was so time consuming – I guess it just got me frustrated sometimes, but yeah. I do hear like gender stuff, from other guys – oh you got a better grade because you're a girl.

Esmeralda had a similar experience with an engineering professor. She did her best to block out the sexism and continue with her studies during the semester she took his class. She mentioned it was difficult to endure, but she needed the credit in this class and had no other choice.

There was this one crazy engineering professor that all the girls try to avoid. He always pick on the girls and I don't know - I feel like because he says he hates girls and I've heard he's come down on his criticisms towards girls. I mean, I would go up on the board to do problems but I'm kinda skinny. And every time I would go up to the board to do problems, he would comment on how skinny I

was. And it would embarrass me a little, because, you know why does he have to comment on my body in front of everybody? He doesn't do that with anyone else.

Bonnie was another participant who experienced sexism from both a professor and classmates. She remembers how her classmates at UC San Diego use to question her presence in their science classes in the aerospace program.

Uh yeah at UC San Diego, it was a lot worse over there to be female. They would say, you're a girl, what are you doing here? And shouldn't I be pursuing a more female oriented profession like nursing or teaching or secretary. I say oh well look at what test I beat you at now? So umm some of them joked around but others don't joke around like they would get upset that I beat them and they think that there is one guy that he is like an automobile pro like he knew the inside and outside of cars, and we took this class called thermo dynamics together, which some of the components of cars is in that class. I got an A in the test and he got a B and he was like, 'That is not fair I know more of this than you do, you don't actually know this, you're a girl, you can't know this.' Always these kinds of comments.

Bonnie then recalled an engineering professor whose class she tried to avoid. This professor had a reputation for sexism against female students. She had not experienced a professor discriminating against women previously, having received only positive encouragement from teachers and professors who supported her efforts.

Yeah there is one specific engineering professor I won't say his name but umm he does make comments in his classes, he makes jokes, he picks on girls in his class.

There is another one but he is the worst. He is hard on girls especially. He will he will pick on them in class, like make fun if they don't know the answer and he doesn't do that with the boys. There will be one or two girls in the class and he is always picking on them to go to the board and he will be like, 'Oh I would tell you this joke but there is a female in here.' Like he's annoyed there is a female in the class so he can't tell it or something. He's just always making small remarks about girls.

Growing up in Texas, Victoria didn't have any female role models in STEM professions and therefore had to blaze her own educational path. She recalls how math and science teachers treated girls differently in class.

Yeah, but one of the things that affected me was really the girl thing. I saw that as limiting because the teachers treated girls good in science or math differently. Plus, I didn't know any engineers, I did not know a single one you know, I didn't have any relatives who were in any kind of STEM, no doctors, no anything in my family. So it was like the teachers knew girls wouldn't become engineers so why bother in the classroom.

Alina experienced sexist attitudes from her male classmates. However, she also felt that the discrimination against her was also rooted in her being Mexican.

It's not professors because I feel like they are more understanding. They see everyone—maybe they don't see everyone as an equal but they try to treat everyone the same. But like students or my peers I feel like they treat me differently. I feel it's because I am a Mexican girl because there is not a lot of

them at CSUN that are biology majors yeah so and most of them are guys that are not Mexican so I feel like they think I'm dumb even though I am in the same classes as them.

Brittany experienced the same sexism from her middle school math teacher, however, his sexist attitude was meant to be a compliment but still came off derogatory.

It was Algebra – in middle school. And I finished one problem very quickly, and the teacher was very – okay if you finish it shoot up your hand, right away. So as soon as I was finished, he looked at me very surprised, like wow, a student finished it in a few seconds and she's a girl. And he was just like well, 'Miss Muniz, you finished it?' And I was like yeah! And he read it and he looked through it and he was like, 'wow, yes this young lady here finished it.' and he looked over at the boys who are always ganged together in that class and pretended to be smarter than the rest of the students and he was like you see, she finished before you. And that's the only that I remember in regards to me being a girl. I never really had an experience where it was oh it's because you're Mexican.

Lisa experienced sexism when she was completing her requirements for her PhD at Berkeley. According to Lisa, the department chair, and college as a whole, held sexist attitudes towards female professors. She remembered how they would produce female graduates but never hire them.

One of the professors I had a really nice fellowship but one of the requirements was that everyone had to teach something. It was part of your degree part of your

education as a graduate student and so I went, I went and I talked to the professor, the guy in charge, the department chair. I said you know I need to complete this requirement for my PhD and he looked at me and said well you know you really are just going want to be with your children once you have them. This was in 1976, so hopefully things have changed.

I asked Lisa if she felt she had experienced more racism or sexism in her professional career and she stated she has experienced both.

A little bit of each yeah. You can't say, we live in a race blind society, that's for damn sure. When I first came here somebody asked me, I took my kid over to the day care, I mean to the child care center the experimental one, and I would come in about the same time every day. And umm and this woman would come in and she had her children, her children had fragility syndrome and so finally she asked me, 'You know you come here about the same time I do, what do you do?' Cause she was a housewife, 'Oh I said I work at the University' and she looked at me and said, 'Which buildings do you clean?' And I said, 'Oh I—I don't clean any buildings sometimes my lab gets really dirty students and I will clean it up.' And she said 'your lab?' And I said, "Yeah I'm a professor here.

The underrepresentation of women in STEM fields can possibly be contributed to situations like the ones described above. The sexism experienced by these women, be it serious or minor, motivated these women to challenge the belief that women cannot be scientists or engineers. In fact, these experiences provided moments of resistance in the classroom and workplace against limitations placed on women due to gender stereotypes.

Chapter Five – Conclusion

“This is not just a Latino problem, this is an American problem. We’ve got to solve it, because if we allow these trends to continue, it won’t just be one community that falls behind- we will all fall behind together.” –President Obama (2010)

Using qualitative data, this study critically examines the barriers to educational attainment for Latinas currently in STEM (Science, Technology, Engineering and Mathematics) majors or Latinas currently working in STEM fields. It also documents how they successfully navigated the educational system and coped with the barriers. The findings further our understanding of why Latinas are underrepresented in STEM programs across the country despite demographic growth. Based on the findings, the study proposes recommendations for change and emphasizes the need for increasing the number of ethnically diverse students, primarily Latinas, entering STEM programs in the United States.

These findings are based on in depth interviews with twelve high achieving Latinas pursuing STEM careers and therefore, is not reflective of all Latina students. They have persevered and achieved success by reaching their full educational potential and it is my hope that these *testimonios* can help shed some light on how we can eradicate the inequitable education practices which result in unequal outcomes for Latinas in STEM fields. Four common themes were identified as relevant to the persistence of the Latina participants in STEM fields. These are (a) cultural community wealth (b) socioeconomic status (c) academic preparations, and (d) sexism.

Community Cultural Wealth

This study found that parental involvement was vital to the ability of the child to prosper and thrive in school. Most of the participants in this study mentioned parental support as one of the most important contributing factors to their academic success. The majority of the parents in this study had uniformly high aspirations for their child's education and championed their child's academic achievements. The parents, many having low educational attainment themselves, may have been at a disadvantage but they used their cultural capital to help enhance the academic outcomes for their child. The parents who did not understand how to manage the school system, conveyed to their children the importance of education and gave support in other ways. For example, the parents suggested that their children were capable of great achievements or set standards for academic success. These *testimonios* contested the notion that minority cultures do not value education and documents the important role that parents played in the development of the child's educational aspirations. These findings are consistent with researchers who have consistently found that Latino parents hold educational attainment in high regard (Jasis & Ordonez-Jasis, 2012; Quiocho & Daoud, 2006; Zarate, 2007). Given that Latinas have low levels of higher education participation, it is vital to recognize the positive influence that parents have over the college aspirations of these women.

Socioeconomic Status

The participants used their financial woes to motivate them to do well in school as opposed to letting them deter them. As mentioned before, the effects of poverty go beyond the ability to pay for material possessions. The stress that most poor children are

subjected to can be damaging to their cognitive abilities. These participants used this stress as provocation to succeed in school as they recognized education as an important factor in economic mobility. The participants were also extremely resourceful in the search for financial aid for college. They utilized counselors, faculty, teachers, and community resources to seek out funds for college. Many other students may not be knowledgeable that these resources even exist and therefore think that college is not a viable or realistic option. Because socioeconomic status has a stronger relationship with college access than race/ethnicity, the lack of access to financial resources can leave Latinas with a sense of education apathy. These participants were highly resilient against the economic forces that affected their college aspirations and they developed a positive mental attitude that allowed them to survive and thrive within their economic realities. In addition, poor Latino parents were able to be highly supportive of their child's educational attainment regardless of the socioeconomic circumstances.

Academic Preparation

Eleven of the twelve participants were determined to be placed in honors or AP classes and their persistence paid off. By resisting to be tracked into the lower classes, they were exposed to a more rigorous curriculum which led to being better prepared for college. Having access to an honors curriculum leads to higher achievement levels which fosters a college-going attitude among students. These Latinas negotiated their worth and knew that they deserved more from their school and their teachers. Compared to other fields of study, academic preparation is even more important in STEM professions as STEM fields work upon building blocks of math and science courses.

The debate about ability grouping continues to plague our school administrators and faculty. What is known about a higher tracked student is that once placed in the classroom, their learning potential is expanded. Being enrolled in special programs does produce substantial gains in educational achievement because the student is subjected to engaged teachers who are teaching engaged students (Feldhusen & Moon, 1992). Burris et al. (2008) make a strong point that “detracking itself cannot ameliorate social inequities....yet schools can do a great deal to provide all students with fair access to the best curricula, teachers and instruction that they have to offer” (p. 601). So the question becomes how can lower tracked Latinas receive the same quality instruction and access the same curriculum as higher tracked students. The Latinas that participated in this study are success stories because they were academically prepared for college and STEM programs. But what happens to Latinas who do not question the educational system or to those Latinas who don't understand how to navigate their own school system in order to reach their full educational potential?

Another strong conclusion in regards to academic preparation was the fact that each of the twelve participants identified valuable role models and effective teachers as contributing to their college aspirations. Well prepared and engaged teachers seemed to be one of the most essential resources for these Latinas. As the literature shows, there is a clear relationship between quality teachers and high achieving students. The quality instruction had a great impact on these participants along with high expectations from the teachers. Contrary to the academic literature, years of qualifications and educational levels of teachers were not as important to the students as the affirmations and the fact that teachers “cared” about their students. In the findings, it was the teacher's nurturing

qualities that qualified them as effective teachers. Their teachers exhibited beliefs that the students were highly capable of doing well in school which enhanced their school performance. The *testimonios* showed examples of how teachers contributed to making the students feel competent and able which spurred the student's belief in their own ability. This psychological support increased the participant's motivation to try and succeed in school.

Sexism

The participants overwhelming agreed that sexism in the STEM field is more prevalent than is racism both academically and professionally. According to the *testimonios*, STEM fields commonly create a culture that excludes women. According to the participants, negative stereotypes persist about women's abilities in math and science even though the number of women in science and engineering is growing.

The women that participated in this study are outliers and therefore resisted the conditions and behaviors that continue to perpetuate the myth that women are not good at math or science. Women have historically been encouraged to major in fields deemed more appropriate or acceptable for women; however, once a woman decides to pursue a STEM field, little is done to support them. A study on women in STEM by the AAUW (2001) found that the gender bias "not only affects individuals' attitudes toward others but may also influence girl's and women's likelihood of cultivating their own interest in math and science" (Ginorio & Huston, 2001, p. xvi). The study also found that people tend to associate math and science fields with "male" jobs and when women occupy one of these "masculine" jobs, there is a negative view towards them (Ginorio & Huston,

2001). And while we want to applaud these women on how they were able to tolerate, resist, and defy these sexist attitudes, the fact is discrimination based on gender continues to exist in the classroom today. The AAUW (2001) study claims that “in order to diversify the STEM fields we must take a hard look at the stereotypes and biases that still pervade our culture” (Ginorio & Huston, 2001, p. xvi). I believe further research is needed in this area as it was not the focus of my questioning. However, due to the obvious sexism experienced by these women, we must analyze gender bias in colleges and the workplace.

Limitations

One of the limitations of this study was the fact that it relied on a small, select sample of high achieving students. I have no comparison interviews of low-achieving students and therefore cannot conclude that the themes identified would be common to all Latinas. Another caution regarding the findings, is the use of *testimonios* which rely on the memories of each participant. While some may argue with their memories and perceptions of what occurred, the intent of the study was to gain insights from the point of view of a group of successful Latinas in STEM fields. And lastly, the Latino population is diverse whereas the sample in this study consisted solely of Mexican American females. Solórzano and Bernal (2001) state that “Chicana and Chicano students live between and within layers of subordination based on race, gender, language, immigration status, accent, and phenotype” which means their resistance must be analyzed at each of these intersections (p. 335). There are many more internal and external resistance strategies that Latinas use to navigate the educational systems; in this study, I have just named a few.

Recommendations

Although the findings are based on a small sample, they are consistent with much of the literature on Latinas and educational attainment. There is an obvious need for a national policy agenda to include effective intervention strategies in our educational system in order to attract and retain Latinas in STEM fields.

Recognize Cultural and Community Wealth and Partnership with Parents

Both communities and schools need to create better partnerships between parent, student, and educator in order to further a student's academic success. Educators should avoid notions of cultural deficiency. These programs need to create a space where parents and educators can collaborate so that all children can achieve their greatest academic potential. The parents of the participants in this study, most of whom attained low levels of education, were involved the best way they knew how. Imagine if they had the right tools to navigate the system and how much more effective their support could have been.

Implement Early Preparation Programs and Encouragement in STEM

Programs that expose Latinas to math and science early and spark or foster an interest in the STEM fields are critically needed at the K-12 school level. The majority of Latinas in this study had an early interest in math which was nurtured and cultivated. Crisp and Nora (2012) claim that "mathematical and science training at the elementary and secondary levels has been shown to influence the academic preparation of students as well as their interest in high school mathematics and science coursework and in pursuing

a STEM career” (p. 3). Recognize and reward the positive influence of engaged and caring teachers who encouraged students to succeed.

Recognize and Eliminate Sexism in STEM

We should also advocate for colleges and universities to implement programs that hire more female faculty within the STEM fields which can help neutralize the gender bias against women and minorities. Colleges can and should create effective mentoring programs that encourage Latina’s achievements and interest in math and science. The participants demonstrated that having mentors and effective teachers that encouraged and supported them had considerable benefits socially, psychologically and academically. Cammarota (2004) states that “faith in achievement, in part, has fostered a significant shift in Latina’s historical patterns of educational attainment” (p. 55).

This study, like many other studies, found that Latinas confront multiple barriers in realizing their educational dreams and we have found a number of factors that separate high achievers from their peers. “Although Latinas are reversing a historical trend of academic failure, the slow pace of their advancement still places them at a social and educational disadvantage” (Cammarota, 2004, p. 55). As the Latino population continues to grow, their experience in the United States from education to employment will have greater implications on the nation as a whole. We need to impress upon Latinas that our future depends on them to be the agents of change because the economic and social consequences for the nation as a whole is dependent upon their success. Preparing this pool of high potential students will extend our ability as a nation to compete in a global market. The graduation gap between Latinas in STEM and other groups is a growing

threat to the well-being of the entire country and, just as a diploma is a ticket to upward mobility, the lack of one guarantees the opposite.

References

- Adelman, C. (2005). Executive summary: The toolbox revisited--paths to degree completion from high school through college. *Journal for Vocational Special Needs Education*, 28(1), 23-30.
- Anderson, E. L., & Kim, D. (2006). *Increasing the success of minority students in science and technology* (No. 4). Washington, DC: American Council on Education.
- Anzaldua, G. (1987). *Borderlands*. San Francisco: Aunt Lute Books.
- Bailey, T., Leinbach, D. T., & Jenkins, D. (2005). Graduation rates, student goals and measuring community college effectiveness. *CCRC Brief*, 28, 1-4.
- Bedolla, Lisa G. (2005). *Fluid borders: Latino power, identity, and politics in los angeles*. California: University of California Press.
- Bernal, D. (2002). Critical race theory, latino critical theory, and critical raced-gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative Inquiry*, 8(1), 105-126.
- Burris, C., Wiley, E., Welner, K., & Murphy, J. (2008). Accountability, rigor, and detracking: Achievement effects of embracing a challenging curriculum as a universal good for all students. *Teachers College Record*, 110(3), 571-607.
- Camacho, M., & Lord, S. (2013). Latinos and the exclusionary space of engineering education. *Latino Studies*, 11(1), 103.
- Cammarota, J. (2004). The gendered and racialized pathways of latina and latino youth: Different struggles, different resistances in the urban context. *Anthropology & Education Quarterly*, 35(1), 53-74.

Cantu, N. E. (2008). *Paths to discovery: Autobiographies from Chicanas with careers in science, mathematics and engineering*. California: UCLA Chicano Studies Research Center.

Carnevale, A. P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of job and education requirements through 2018*. Lumina Foundation.

Cataldi, E. F., & KewalRamani, A. (2009). High school dropout and completion rates in the united states: 2007 compendium report. NCES 2009-064. *National Center for Education Statistics*.

Ceballo, R. (2004). From barrios to yale: The role of parenting strategies in latino families. *Hispanic Journal of Behavioral Sciences*, 26(2), 171-186.

Ceja, M. (2004). Chicana college aspirations and the role of parents: Developing educational resiliency. *Journal of Hispanic Higher Education*, 3(4), 338-362.

Cole, D., & Espinoza, A. (2008). Examining the academic success of latino students in science technology engineering and mathematics (stem) majors. *Journal of College Student Development*, 49(4), 285-300.

Crisp, G., & Nora, A. (2012, July). Overview of hispanics in science, mathematics, engineering and technology (STEM): K-16 representation, preparation and participation. Retrieved from
http://www.hacu.net/images/hacu/OPAI/H3ERC/2012_papers/Crisp%20nora%20-%20hispanics%20in%20stem%20-%20updated%202012.pdf

- Cuádriz, G. H. (2005). Chicanas and higher education: Three decades of literature and thought. *Journal of Hispanic Higher Education*, 4(3), 215-234.
- Cuádriz, G. H. (2006). Myths and the “politics of exceptionality”: Interpreting Chicana/o narratives of achievement. *Oral History Review*, 33(1), 83-105.
- Delgado, R., & Stefancic, J. (2001). *Critical race theory: An introduction*. New York: New York University Press.
- Feldhusen, J. F., & Moon, S. M. (1992). Grouping gifted students: Issues and concerns. *Gifted Child Quarterly*, 36(2), 63-67.
- Frankenberg, E., & Lee, C. (2002). *Race in American Public Schools: Rapidly Resegregating School Districts*. n.p.: Civil Rights Project, Harvard University.
- Fuller, B., Eggers-Pierola, C., Liang, X., & Holloway, S. (1996). Rich culture, poor markets: why do Latino parents forgo preschooling? *Teachers College Record*, 97, 400-418.
- Gándara, P. (1982). Passing through the eye of the needle: High-achieving Chicanas. *Hispanic Journal of Behavioral Sciences*, 4(2), 167-179.
- Gándara, P. (1995). *Over the ivy walls: The educational mobility of low income Chicanos*. Albany: State University of New York Press.
- Gándara, P. (2005). Addressing educational inequities for latino students: The politics of "forgetting". *Journal of Hispanic Higher Education*, 4(3), 295-313.
- Gándara, P. (2006). Strengthening the academic pipeline leading to careers in math, science, and technology for latino students. *Journal of Hispanic Higher Education*, 5(3), 222-237.

Gándara, P., & Chavez, L. (2003). Putting the cart before the horse: Latinos and higher education. *Latinos and Public Policy in California, An Agenda for Opportunity*, 87-120.

Gándara, P., & Contreras, F. (2009). *The latino education crisis*. Cambridge, Massachusetts: Harvard University Press.

Gándara, P., Alvarado, E., Driscoll, A., & Orfield, G. (2012). *Building Pathways to Transfer: Community Colleges That Break the Chain of Failure for Students of Color*. n.p.:

Garcia, F. C., & Sanchez, G. R. (2008). *Hispanics and the U.S. political system: Moving into the mainstream*. New Jersey: Pearson Prentice Hall.

Gay, G., & Howard, T. (2000). Multicultural teacher education for the 21st century. *Teacher Educator*, 36(1), 1-16.

Ginorio, A., & Huston, M. (2001). *¡Sí, se puede! Yes, we can*. American Association of University Women Educational Foundation.

González, J. (2006). Academic socialization experiences of latina doctoral students: A qualitative understanding of support systems that aid and challenges that hinder the process. *Journal of Hispanic Higher Education*, 5(4), 347-365.

Gonzalez, N., Moll, L.C., Tenary, M.F., Rivera, A., Rendon, P., Gonzales, R., & Amanti, C. (1995). Funds of knowledge for teaching in latino households. *Urban Education*, 29(4), 443-470.

Hill, C., Corbett, C., & St Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics*. American Association of University Women. 1111 Sixteenth Street NW, Washington, DC 20036.

- Hurtado, A. (1997). Understanding multiple group identities: Inserting women into cultural transformations. *Journal of Social Issues*, 53(2), 299-327.
- Jasis, P., & Ordoñez-Jasis, R. (2012). Latino parent involvement: Examining commitment and empowerment in schools. *Urban Education*, 47(1), 65-89.
- KewalRamani, A., Gilbertson, L., Fox, M. A., & Provasnik, S. (2007). Status and Trends in the Education of Racial and Ethnic Minorities. NCES 2007-039. *National Center for Education Statistics*.
- Latino Educational Opportunity Report 2007. (2007, November). *UCLA Institute for Democracy, Education, and Access*. Retrieved from <http://idea.gseis.ucla.edu/>
- Limon, J. (2007). Latino education, or lack of!. *La Prensa*, 42(15), 12-13.
- López, G. (2003). The (racially neutral) politics of education: A critical race theory perspective. *Educational Administration Quarterly*, 39(1), 68-94.
- Lopez, M. H., and D'Vera, C. (2011). Hispanic poverty rate highest in new supplemental census measure. *Pew Hispanic Center*.
- Mansnerus, L. (1992). Should tracking be derailed. *Education Life, New York Times*, 14-16.
- McGlynn, A. (2011). Reports on latinos coming of age in america. *The Hispanic Outlook in Higher Education*, 21(9), 17-18.
- Mellander, G. (2001). A capitol view: Latinas; their education and future. *The Hispanic Outlook in Higher Education*, 11(19), 5.
- Moller, S., & Stearns, E. (2012). Tracking success: High school curricula and labor market outcomes by race and gender. *Urban Education*, 47(6), 1025-1054.
- Montejano, D. (1999). *Chicano Politics and Society*. Austin: University of Texas Press.

- Moreno, J. F. (1999). *The elusive quest for equality: 150 years of chicano/chicana education*. Cambridge, MA: Harvard Educational Review.
- Munoz, M., Trowbridge, S., & Loffredo, D. (2002). Hispanics and higher education: more questions than answers. *The Hispanic Outlook in Higher Education*, 12(21), 23.
- National Center for Education Statistics. (2010). *Status and Trends in the Education of Racial and Ethnic Groups*. Washington, DC: U.S. Department of Education.
- National Center for Education Statistics. (2011). *The Condition of Education 2011*. Washington, DC: U.S. Department of Education.
- National Center for Education Statistics. (2007). Washington, DC: U.S. Department of Education.
- National Science Foundation. (2011). *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011*. Arlington, VA. Special Report NSF 11-309. Retrieved from <http://www.nsf.gov/statistics/wmpd/>
- Oakes, J. (1985). *Keeping track: How schools structure inequality*. New Haven: Yale University Press. Print.
- Oakes, J. (1986). Keeping track, Part 1: The policy and practice of curriculum inequality. *Phi delta kappan*, 68(1), 12-17.
- Oakes, J. (1990). Multiplying inequalities: The effects of race, social class, and tracking on opportunities to learn mathematics and science. n.p.: Rand Corp.
- Obama, B. (2010, October 19). *Obama signs executive order to boost hispanic educational achievement*. Retrieved from

- <http://www.cbn.com/cbnnews/politics/2010/October/Obama-Seeks-to-Boost-Hispanic-Achievement-/>
- Packard, B. W. (2012, October 9). Community colleges cannot be overlooked in America's quest for new scientists. *New York Times*. Retrieved from <http://www.nytimes.com>
- Parker, L., Deyhle, D., & Villenas, S. (Eds.). (1999). *Race is...race isn't: Critical race theory and qualitative studies in education*. Bolder, CO: West View Press.
- Parsad, B., Lewis, L., & Greene, B. (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000*. National Center for Education Statistics, U.S. Department of Education, Institute of Education Sciences.
- Passel, J. S., Cohn, D., & Lopez, M. H. (2011). Hispanics account for more than half of nation's growth in past decade. *Pew Hispanic Center* <http://pewhispanic.org/files/reports/140.pdf>.
- Quirocho, A., & Daoud, A. (2006). Dispelling myths about latino parent participation in schools. *The Educational Forum*, 70(3), 255-267.
- Ream, R. (2005). *Uprooting children: Mobility, social capital, and Mexican American underachievement*. New York: LFB Scholarly Publishing.
- Ryan, C.L., & Siebens, J. (2012, February). *Educational attainment in the United States: 2009*. Retrieved from <http://www.census.gov/prod/2012pubs/p20-566.pdf>.
- Snyder, T. D., & Dillow, S. A. (2011). Digest of education statistics, 2010. NCES 2011-015. *National Center for Education Statistics*.

- Solórzano, D., & Bernal, D. (2001). Examining transformational resistance through a critical race and latcrit theory framework: Chicana and chicano students in an urban context. *Urban Education*, 36(3), 308-342.
- Solórzano, D., & Yosso, T. (2001). From racial stereotyping and deficit discourse toward a critical race theory in teacher education. *Multicultural Education*, 9(1), 2-8.
- Solórzano, D., Villalpando, O., & Oseguera, L. (2005). Educational inequities and latina/o undergraduate students in the united states: A critical race analysis of their educational progress. *Journal of Hispanic Higher Education*, 4(3), 272-294.
- Tribune Review*. (2011, March 13). Helping young latinos climb the education ladder.
- U.S. Census Bureau. *Current population survey, October 1967 - October 2009*. Washington, DC: U.S. Department of Commerce.
- Valencia, R., & Black, M. (2002). "mexican americans don't value education!"-- the basis of the myth, mythmaking, and debunking. *Journal of Latinos and Education*, 1(2), 81-103.
- Villar, M. (2001). The educational status of latinas: si, se puede! yes we can. *The Hispanic Outlook in Higher Education*, 11(20), 21.
- Wheelock, A. (1992). *Crossing the Tracks: How “Untracking” Can Save America’s Schools*. New York, NY: The New Press.
- White, K. (1982). The relation between socioeconomic status and academic achievement. *Psychological Bulletin*, 91(3), 461-481.
- Willingham, D. (2012). Ask the cognitive scientist: Why does family wealth affect learning?. *American Educator*, 36(1), 33-39.

- Yosso, T. (2005). Whose culture has capital? a critical race theory discussion of community cultural wealth. *Race Ethnicity and Education*, 8(1), 69-91.
- Zarate, M. (2007). Understanding latino parental involvement in education: Perceptions, expectations, and recommendations. *Tomas Rivera Policy Institute*, 1-19.

Appendix A
Questions for Study

Questionnaire to be filled out via email by students:

Name:
Age:
Year in college:
Major:
Full Time or Part Time Student:
GPA:
Generational Status:
Nationality:
Language: Primary/Secondary
Race/Ethnicity:
High School GPA:
High School AP Classes? Honors?
Childhood SocioEconomic Status (Lower/Middle/Upper Class)
Mother's Occupation:
Mother's Highest Education Level:
Mother's Nationality:
Father's Occupation:
Father's Highest Education Level:
Father's Nationality:
Sibling's Highest Education Level:

Questionnaire to be filled out via email by professionals:

Name:
Age:
Year in college:
Major:
Full Time or Part Time Student:
GPA:
Generational Status:
Nationality:
Language: Primary/Secondary
Race/Ethnicity:
High School GPA:
High School AP Classes? Honors?
Childhood SocioEconomic Status (Lower/Middle/Upper Class)
Mother's Occupation:
Mother's Highest Education Level:
Mother's Nationality:
Father's Occupation:
Father's Highest Education Level:
Father's Nationality:

Sibling's Highest Education Level:

What Degree/s Attained:

College Attended:

GPA:

Current Occupation:

Current Salary:

In person Interview Questions:

Part One: Early Education/High School Experience

1. Describe your elementary/middle school/high school? Neighborhood, teachers, peers, etc?
2. What classes and/or programs were you enrolled in high school?
 - a. Any high school programs/classes help guide you in your academic journey?
 - b. Did you take any STEM classes in high school?
 - c. Did you feel included/excluded socially and academically in these classes? If so, why and how?
 - d. How would you rate your high school academic preparation for college? Scale of 1-10, 10 being the highest?
3. Anyone inspire/motivate/mentor you to perform well in high school?
 - a. Teacher?
 - b. Family member?
4. Do you remember feeling academically judged by your race positively or negatively in high school? If so, how and why?
5. Has your culture/ethnicity/race helped or hindered you academically? If so, how and why?
 - a. Did your family support your academic endeavors?
6. When did you first become aware/interested in STEM?
 - a. How old and where?

Part Two: College Experience

7. Describe your college enrollment process/application?
 - a. Were you academically prepared for college?
 - b. Did anyone or any organization help you with this process? Did you find it or them useful/invaluable?
 - c. Did you attend a community college prior to entering a four-year?
8. How did your parents react to your decision to go to college?
 - a. How did they react to your decision to go into a STEM field?

9. How do you currently pay for college?
 - a. Do you have any financial concerns with regards to finishing school?
 - b. Do your parents have financial concerns regarding your tuition, books, etc?
10. Do any faculty/administrators support/guide you or hinder/deter you in current STEM program?
11. In your current STEM program, do you feel included or excluded academically?
12. Have you currently felt academically judged because of your race/ethnic/culture?
 - a. By Peers? By faculty/advisors?
13. Who or what inspires/motivates you to stay/pursue in STEM field?
14. What is your greatest challenge in your STEM program?

Part Three: Professionals Only

15. How did you find your current job?
16. How do you navigate the system?
17. Do you feel accepted in the profession by your colleagues?
18. Do you feel accepted as a woman by your colleagues?
19. Do you feel accepted as a Latina by your colleagues?
20. What advice would you give young Latinas wanting to pursue a STEM professions?
 - a. Why is it important to have Latinas in STEM occupations?
 - b. What are some tools for success in STEM occupations?

Appendix B
Oral Consent Form

Hello, I am a graduate student at California State University, Northridge conducting a study for my thesis project, called “Success Stems from Diversity: The Value of Latinas in STEM Careers.” Your participation in the interview portion of this study is voluntary and refusing or discontinuing participation involves no penalty to you or your campus. This study will also allow us to identify if there is an uneven distribution of opportunities and knowledge in schools that result in unequal outcomes for Latinas in STEM fields and how to use your experience to better understand how to successfully recruit more Latinas in the STEM profession. If you agree to participate in this study, we will ask you to take part in a 5 minute questionnaire and a two hour-long oral interview in person or via telephone. The interview will be audio recorded (with your permission) and will be transcribed and analyzed.

Do you agree to participate in this study and to allow data collected from this interview to be stored for future use by the Principal Investigator (PI) and/or research team?

If you have any questions you may contact PI Eva Longoria, CSUN Graduate Student at (323) 308-1127. Thank you for your time and contribution to this study.

Appendix C
Adult Consent Form

**California State University, Northridge
CONSENT TO ACT AS A HUMAN RESEARCH PARTICIPANT**

Success STEMS From Diversity: The Value of Latinas in STEM Careers

You are being asked to participate in a research study. Participation in this study is completely voluntary. Please read the information below and ask questions about anything that you do not understand before deciding if you want to participate. A researcher listed below will be available to answer your questions.

RESEARCH TEAM

Researcher:

Eva Longoria

Department of Chicana/o Studies

323-308-1127

ceo@evalongoria.com

Faculty Advisor:

Theresa Montano

Department of Chicana/o Studies

18111 Nordhoff St.

Northridge, CA 91330-8246

818-677-2734

theresa.montano@csun.edu

PURPOSE OF STUDY

The purpose of the study is to understand why Latinas lag behind their white and Asian-American counterparts in graduation rates in STEM fields and to understand what deters their persistence towards degree completion. The purpose of the study is not only to find and examine barriers to educational attainment among Latinas in STEM, but to study how Latinas cope with and overcome these barriers. This is a qualitative study that addresses the issues beyond the statistics and examines the lives of Latinas wanting to pursue a career in STEM fields and those who are currently employed in STEM jobs. The data collected from the study should allow us to create effective intervention components to address common factors impeding STEM degree completion for Latinas and to identify and replicate the common factors that lead to success for Latinas in STEM fields.

SUBJECTS

Inclusion Requirements

You are eligible to participate in this study if you:

- Are female and enrolled as a student in a STEM field program.
- Qualify as Latina which is defined as those females who classify themselves in one of the specific Spanish, Hispanic, or Latino categories listed on the Census 2010 questionnaire - "Mexican," "Puerto Rican", or "Cuban"-as well as those who indicate that they are "another Hispanic, Latino, or Spanish origin." People who do not identify with one of the specific origins listed on the questionnaire but indicate that they are "another Hispanic, Latino, or Spanish origin" are those whose origins are from Spain, the Spanish-speaking countries of Central or South America, or the Dominican Republic. The terms "Hispanic," "Latino," and "Spanish" are used interchangeably (US Census, 2010).
- Are Latina currently employed in STEM professions.
- Are over the age of 18.

Time Commitment

This study will involve approximately 2 hours and 10 minutes of your time.

PROCEDURES

The following procedures will occur: I will speak to you on the phone to receive oral consent of participation in the study (Oral Consent Script attached). Once oral consent is received, I will email you a questionnaire consisting of 20-25 questions of basic information. Once questionnaire is completed and returned, I will arrange for an in person interview on campus or off site at your convenience. At time of the interview I will begin with a few minutes of explaining the study. I will provide you a general overview of the topics we will be covering and remind you that the interview will be audio recorded and will be transcribed and analyzed at a later date. You will review and complete the written consent form and we will begin interview.

RISKS AND DISCOMFORTS

This study involves no more than minimal risk. Due to the nature of certain questions of race or ethnicity, you may become emotionally uncomfortable at a minimum. I will minimize this risk by allowing you to skip the questions or stop the interview at anytime.

BENEFITS

Subject Benefits

You will not directly benefit from participation in this study.

Benefits to Others or Society

The subjects will not benefit directly from this project; however, the results may influence changes in how colleges and universities recruit Latinas into STEM programs.

ALTERNATIVES TO PARTICIPATION

The only alternative to participation in this study is not to participate.

COMPENSATION, COSTS AND REIMBURSEMENT

Compensation for Participation

You will not be paid for your participation in this research study.

Costs

There is no cost to you for participation in this study.

Reimbursement

You will not be reimbursed for any out of pocket expenses, such as parking or transportation fees.

WITHDRAWAL OR TERMINATION FROM THE STUDY AND CONSEQUENCES

You are free to withdraw from this study at any time. **If you decide to withdraw from this study you should notify the research team immediately.** The research team may also end your participation in this study if you do not follow instructions, miss scheduled visits, or if your safety and welfare are at risk.

CONFIDENTIALITY

Subject Identifiable Data

Participants in the project will have a pseudonym as an identifier. Any information that is obtained in connection with this study and that can identify you will remain confidential. It will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of securing all electronic files in a password protected computer and paper files in a locked filing cabinet. In the event that you identify a specific person in the interview, that person's name will be replaced with a pseudonym.

Data Storage

All electronic files will be stored in a password protected computer and paper files will be stored in a locked filing cabinet at my office. Office entry is only permitted by me with a key. No one else will have access. I will keep the lists of names and aliases

separate from actual transcripts. The transcripts will have the alias/pseudonyms written on them and will be kept in one place; the list of identifiable names will be kept in another space. Again, no one will have access to this information.

Data Access

The researcher named on the first page of this form will have access to your study records. Any information derived from this research project that personally identifies you will not be voluntarily released or disclosed without your separate consent, except as specifically required by law. Publications and/or presentations that result from this study will not include identifiable information about you.

Data Retention

The data will be maintained for 3 years after completing data collection and then destroyed.

IF YOU HAVE QUESTIONS

If you have any comments, concerns, or questions regarding the conduct of this research please contact the research team listed on the first page of this form.

If you have concerns or complaints about the research study, research team, or questions about your rights as a research participant, please contact Research and Sponsored Projects, 18111 Nordhoff Street, California State University, Northridge, Northridge, CA 91330-8232, or phone 818-677-2901.

VOLUNTARY PARTICIPATION STATEMENT

You should not sign this form unless you have read it and been given a copy of it to keep. **Participation in this study is voluntary.** You may refuse to answer any question or discontinue your involvement at any time without penalty or loss of benefits to which you might otherwise be entitled. Your decision will not affect your relationship with California State University, Northridge. Your signature below indicates that you have read the information in this consent form and have had a chance to ask any questions that you have about the study.

I agree to participate in the study.

Participant Signature

Date

Printed Name of Participant

Researcher Signature

Date

Printed Name of Researcher