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A Mixed Methods Analysis of School- and Student-Level Effects: Mathematics Course Completion and Achievement Beyond Algebra 2 Among Mexican American Female High School Students

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A MIXED METHODS ANALYSIS OF SCHOOL- AND STUDENT-LEVEL EFFECTS: MATHEMATICS COURSE COMPLETION AND ACHIEVEMENT BEYOND ALGEBRA 2 AMONG MEXICAN AMERICAN FEMALE HIGH SCHOOL STUDENTS

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At times like these, we must all stop to give thanks. First, thanks to the creator for providing life and sustaining me through the easy time and especially during the more difficult. Without You, I am not.

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ABSTRACT

In the United States, as the Hispanic population continues to grow, persistently low mathematics achievement among Mexican Americans continues to exist, particularly among girls. Low mathematics achievement places this group in a disadvantaged position. As such, a multistage mixed method study was implemented to investigate possible factors associated with mathematics achievement and the probability of taking mathematics courses beyond Algebra 2 among Mexican American female high school students.

The Educational Longitudinal Study (ELS:2002) database provided the quantitative sample (n = 710) of respondents who self-identified as Mexican American, female, and had a math IRT score. A parallel sample (n = 5), of college age women attending a public university in the southeast United States, provided qualitative data through face-to-face interviews. Inclusion criteria for the parallel sample was female, Mexican descendent self-identifying as first, second or third generation and completion of high school math credits beyond Algebra 2. Methods for analysis were the three-dimensional space narrative structure for the qualitative data and multilevel analysis for the quantitative data. Outcome variables were mathematics achievement and math credits beyond Algebra 2. Explanatory variables included in the model for the student level were social economic status, generational status, sense of belonging, parent expectation to earn at least a Bachelor's degree, homework rules, a measure of math self-efficacy, number of advanced placement math credits, and seeing school counselor for college advice. Explanatory variables for the school level included teacher encouragement, percentage of Hispanic teachers, and percentage of minority students.

Findings indicated significant student effects for math self-efficacy, seeing the school counselor, and advanced placement math credits, when using the imputed model with math

achievement as the outcome variable. Parental expectation to graduate college was significant when using math credits earned beyond Algebra 2 as the outcome variable. Qualitative data provided insights about participants enjoying opportunities for hands-on projects, working in groups, and solving math problems. Participants shared that teachers served as role models and that parents expected them to graduate from college. The qualitative data provides guidance for including sense of belonging and parental educational levels with further research relative to Mexican American female students.

CHAPTER 1 : INTRODUCTION

Immigrants come to the United States in pursuit of their American Dream. However, although the number of persons who migrate to the US continue to increase, and "we are a nation of immigrants," a CNN/Gallup poll found that 70 percent of Americans want less immigration (Coan, 2011, p. 25), and 59% say immigrants strengthen the country, while 33% describe immigrants as being a burden on the nation (Jones, 2016). These polls, ironically, suggest that we struggle to accept immigrants "as part of the fabric of American society who will comprise a growing proportion of the American population" (Bedolla, 2012, p. 38). The large proportion of opponents to immigration suggests a misunderstanding of the issues (Marrero 2012; Suro, 1998). The history of people coming to the United States, while seemingly a simple story to explain, suggests complicated and complex associations. The relationships of people associated with the Unites States included the brave, the enslaved, the free, as well as the incorporated. As such, American idealism belies a story of success, for all.

Before there was a United States, and prior to the nation/state of Mexico, the indigenous people of what we currently describe as the southwestern United States, travelled in and out of that territory (Duran, 2013). In 1821, Mexico gained its independence from Spain, and had entered war with the United States. Called the Mexican-American War (1846-1848; del Castillo, 1992), the Treaty of Guadalupe Hidalgo ceased war between these nations. With a payment of fifteen million dollars and the redrawing of its border, the United States government redefined the citizenship of many Mexicans (del Castillo, 1992). In fact, Article VIII and Article IX of the treaty solidified the choice of citizenship (del Castillo, 1992; US Library of Congress, 2015).

Spanish speaking families, regardless of primary language and ethnicity in the newly acquired lands, which included areas that we now call Arizona, California, New Mexico, and

Texas, suddenly became citizens of an English-speaking nation (US Library of Congress, 2015). This expansion afforded the United States to further lay claims to land from Florida to California. Although Florida was Spanish territory, Spain had lost total control of Florida in 1819, but Spain retained land west of the Sabine River (land we now call Texas) and land south of 42º Latitude, the land we generally call the southwestern states (Adams-Onis_Treaty, n.d.; Henderson, 2007). The Mexican-American War (1846-1848) redefined Mexicans. For instance, a century after the war, the use of language, particularly the privileging of English, became a contentious issue in Texas, which barred the speaking of Spanish by elementary school-age children (Hurtado & Gurin, 2004). Another contentious issue included the question of ethnicity.

Prior to the Mexican American War, the confluence of indigenous, African, and Spanish culture and ancestry added to the complexity of racial classification in Mexico (Duran, 2013). The emerging *mestizaje*, a term which defined Mexican culture, came about during the latter part of the nineteenth century. *Mestizaje*, signaled the wrestling of power from the g*auchupines* (persons born in Spain). Applied to persons of Spanish ancestry born in Mexico, the term *criollos* came about during the latter part of the nineteenth century (Duran). However, particularized in the latter part of the twentieth century, people of Mexican ancestry became Hispanic for U.S. Census enumeration. While research shows the efforts to enumerate the 'Hispanic' population which used subjective indicators of Spanish descent began in the late 1960s (Rumbaut, 2009), some posit that Hispanic is grounded in the historical nature for racial classification (Alcoff, 2005; Ramos, 2009; Rumbaut, 2009).

According to the 2010 census, approximately 50.5 millionRat Hispanics lived in the United States. Counted as "the nation's largest ethnic or racial minority," Hispanics comprised approximately 17 percent of the population, and, by 2060, will account for 31% of the nation's

population (US Census, 2011a). In Louisiana, according to the US Census Bureau, between 2010 and 2013, the Hispanic population increased from a count of approximately 192 thousand to 217 thousand, which represented an 11% growth. The largest proportion of the Hispanic population resides in California (14.7 million) followed by Texas (9.5 million) and New York (3.4 million), and New Mexico had the highest proportion of Hispanics within a state population at 47.3% (US Census, 2014).

Since 1995, the Hispanic population, at times referred to as Latinos, experienced significant growth in 9 out of 12 southeastern states. For example, in North Carolina the increase was almost 400% between 1990 and 2000, and in Georgia it grew by 300% (Bohon, Macpherson, & Atiles, 2005; Brown & Lopez, 2013; Chapa & De La Rosa, 2006). With respect to the population of Hispanic origin, more Mexicans live in the west and southwest regions (see Figure 1.1.). In proportion, more Mexicans live in Arizona (91%), California (83%), and Texas (88%); more Cubans are in Florida (30%), more Puerto Ricans are in New York (29%); and more Salvadorians and Guatemalans live in Washington, D.C. (40%, Brown & Lopez, 2013).

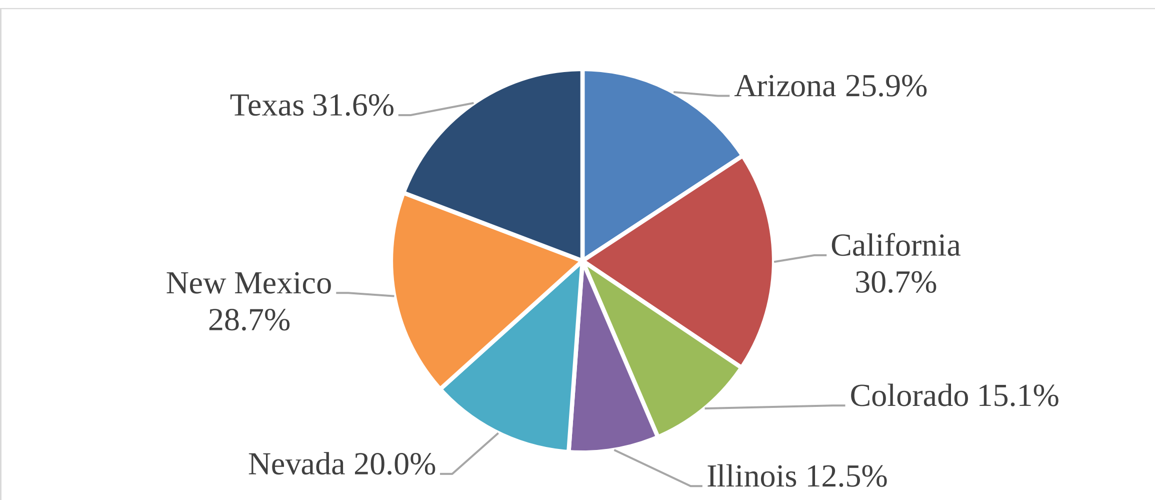

Figure 1.1. Distribution of the Mexican American population by top seven states. Source: U.S. Census Bureau 2010

As the Hispanic populations continues to grow, these concentrations make the understanding of the impact and education experiencies by region important (Coleman, 1967). Since ethnicity is not equal to language and culture, studies that disaggregate groups and consider diversity and adaptability to the wide range of contexts should be conducted (Arzubiaga, Noguerón, & Sullivan, 2009).

In the first decade at the turn of the twenty-first century, the overall U.S. population under the age of 18 grew at a rate of 2.6% (US Census, 2011b). In fact, the number of school-aged children under 18 years increased from 72.3 million to 74.2 million, which represented a 2.6% growth, and this increase may be related to the 57% percent Latino population growth from1990 to 2000 (Chapa & De La Rosa, 2006). The growth of the population of school age children, as a whole, suggests public and educational policy considerations (Gándara, 2010). In particular, given that a proportion of this growth includes children of Hispanic origin, the necessary educational policies as they relate to this segment of the population need to be clearly understood especially with considerations for gender (Gándara, 2010; Gándara, 2015). Figure 1.2 shows the percentage of Hispanic female school-age children enrolled in schools (2000-2014).

According to educational data, from fall 1995 through fall 2014, the distribution of Hispanic children enrolled in public elementary and secondary schools grew from 13.5 to 23.7% (NCES, 2014a). Despite the growing increase in the number of Hispanic school age children, in 2016, only a small percent of Hispanics was enrolled in college (NCES, 2016). Notwithstanding, the overall job market demands more education, and Hispanics will constitute a larger portion of the future workforce (Gándara, 2010; Mora, 2015), which makes it vital that all persons in our society be educated to their full potential (Chapa & De La Rosa, 2006; Gándara, 2015).

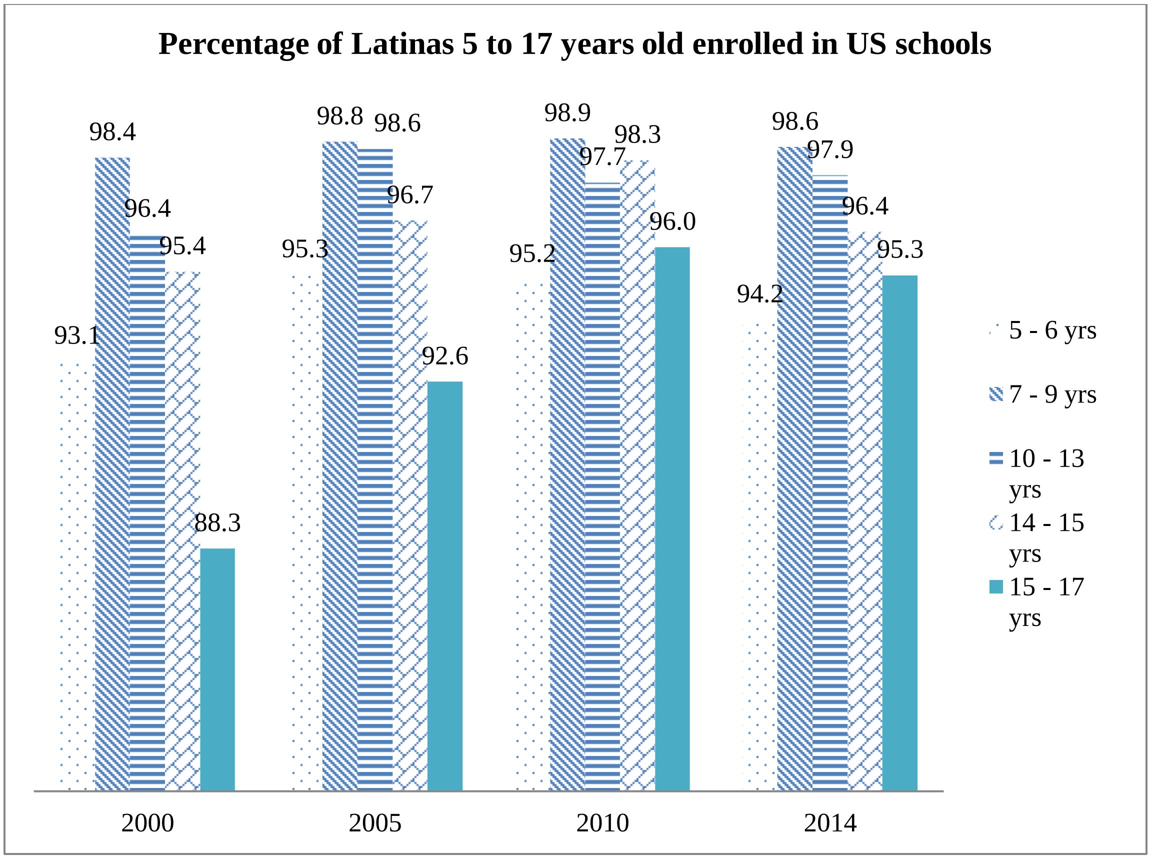

Figure 1.2. Percentage of Latinas 5 to 17 years old enrolled in US schools. Source: National Center for Education Statistics (2015b). Digest of education statistics, 2015, Table 103.10 prepared August 2015.

Statement of the Problem

In 2000, the overall Hispanic high school graduation rate stood at 57.0%, whereas in 2005, the rate increased slightly to 58.5%, and, in 2015, this rate jumped to 66.7% (NCES, 2016b). For similar years, the Latina high school graduation rate stood at 57.5% in 2000, whereas, in 2005, the rate increased slightly to 59.1%, and in 2015, there was a greater increase to 67.8% (NCES, 2016b). Notwithstanding, for high school and college, graduation rates for Latinas remain low (Covarrubias, 2011; Gándara, 2015), and Latinas are less likely to take the SAT (Zambrana & Zoppi, 2002); however, recently they accounted for 10% of female test takers (College Board, 2015, Table 9, p. 3).

Latino representation in all parts of the nation's education pipeline remains low (Chapa & De La Rosa, 2006, p. 221; Gándara, 2015). The educational outcomes for Latinas remains a concern, especially for Mexican Americans (Castellanos & Gloria, 2006; Gándara, et al., 2013).

At the university level, although the numbers remain low, according to the *Survey of Earned doctorates* published by the National Science Foundation, between 2005 and 2015, doctorates earned by Latinas increased from 1,089 to 1,665 which represent a 53% increase. This increase was much faster than their male counterparts whose awarded doctorates went from 1,193 to 1,758 which represents a 43% increase (NSF, 2016).

At the high school level, although Latinas' mean SAT mathematics scores were below the overall female scores (*M* = 496, *SD* = 115), Mexican or Mexican Americans scored higher (*M* = 444, *SD* = 93) than all other self-identified Hispanic groups (see Table 1.1).

Table 1.1. Latina high school graduates 2015 Mean SAT Mathematics scores

Self-identified	*N*	Group Mean (*SD*)
Mexican or Mexican American	71,778 (4%)	444 (93)
Puerto Rican	16,517 (1%)	439 (100)
Other Hispanic, Latino, or Latin American	92,114 (5%)	442 (101)
All ethnicities (female)	903,719 (100%)	496 (115)

Note: Table produced by author using data compiled from *2015 College Bound Seniors Total Group Profile Report Total Group* (College Board, 2015).

AP math test scores for most Hispanic females continue to be in the lowest score categories. For instance, in 2016, the average score among Hispanic females on Calculus AB

was 2.17 and slightly higher (2.97) for Calculus BC; 13% scored 5 and 48% scored 1 (College Board, 2017).

In 2009, among eighteen to twenty-four year olds, as much as 65.0% of Mexican Americans completed at most a high school diploma, which was only lower than Central Americans (65.2%), and only 2.9% of Mexican Americans completed at least a Bachelor's degree—among the lowest of all Hispanic groups. In 2014, these numbers improved which showed that 55.9% of Mexican Americans completed only up to a high school diploma, and 3.9% completed at least a Bachelor's degree (NCES, 2015c). However, within the educational pipeline, Mexican Americans as a group do not complete university degrees at the same rate as their Latino counterparts (see Table 1.2).

Table 1.2. Percentage of Latinos educational attainment by age and ethnicity 2009-2014

	18 to 24 years old				25 years and over			
	Up through High School only		Bachelor's and beyond		Up through High School only		Bachelor's and beyond	
Ethnicity	2009	2014	2009	2014	2009	2014	2009	2014
Mexican	65.0	55.9	2.9	3.9	7.6	67.3	9.0	1.4
Puerto Rican	59.2	53.6	4.8	5.7	56.1	51.8	15.6	18.0
Cuban	44.8	45.3	9.3	9.2	51.8	49.5	23.8	25.5
Dominican	45.5	47.5	6.5	6.4	61.8	56.5	14.8	18.1
Central American	65.2	59.8	3.8	4.5	7.9	69.1	11.0	11.8
South American	42.5	35.0	8.2	11.1	43.7	39.3	29.0	32.4

Note: Table produced by author using data compiled from Table 104.40 *Percentage of persons 18 to 24 years old and age 25 and over, by educational attainment, race/ethnicity, and selected subgroups: 2009 and 2014* (NCES, 2015c)

Rationale for the study

Factors relating to Latino mathematics achievement have been studied, but, to date, few researchers examined Latinas by themselves (Fujimoto, 2014; Gutiérrez, 2008; Sayman, 2013; Zambrana & Zoppi, 2002). The need to understand what factors are associated with Latina achievement becomes important (Gándara, 2010; Gutiérrez, 2008). The dearth of research with a specific focus on Latina academic achievement begs the question: What are the individual factors and school factors that have on effect on mathematics course taking and mathematics achievement among Mexican American female students residing in the United States?

Latinos, during the latest US decennial census, comprise 16% of the population (Ennis, Ríos-Vargas, & Albert, 2011). Among Latinos, Mexican Americans account for 64.1% or 34.6 million persons (López, 2013). Figure 1.3 shows the distribution of US and foreign born Mexican Americans.

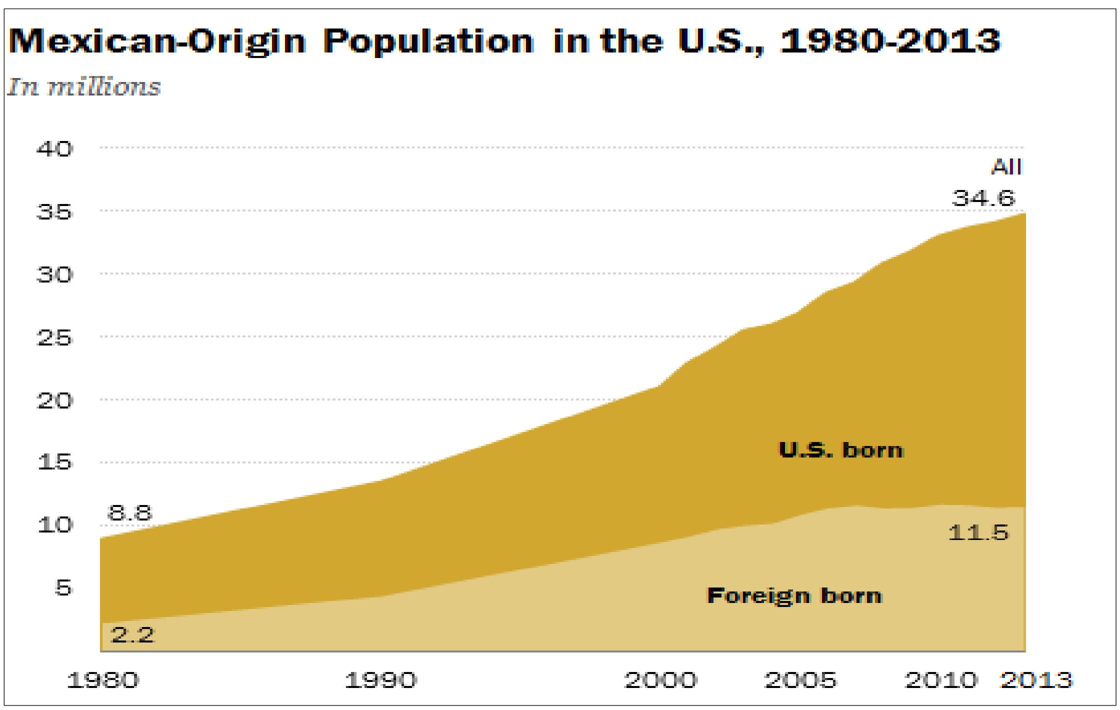

Figure 1.3. Mexican American population origins. Source: López, G. (September 2015). Hispanics of Mexican Origin in the United States, 2013

These numbers suggest that Mexican American growth patterns as well as Mexican migration will continue to make an impact on society from its cultural fabric to the economy (Pizzaro, 2006; Gándara, 2015). However, as noted earlier, in 2014, 55.9% of Mexican Americans completed at most a high school diploma, and only 3.9% completed at least a Bachelor's degree (NCES, 2015c). These numbers suggest that as the descendants of Mexican origin continues to grow, persistent factors that contribute to low representation in the educational pipeline need to be studied (Crosnoe, 2006; Duong, Badaly, Liu, & McCarty, 2015; Pizzaro, 2005).

In general, fewer women pursue STEM field education than men do, and environmental factors such as stereotypes and spatial ability play major roles, which can be mitigated (Corbett, Hill, & St. Rose, 2010). In fact, among all females, for 2013-2014, Hispanic females obtained 9.8% of Bachelor STEM degrees and 5.8% of Doctoral STEM degrees (NCES, 2015d). As such, the dynamics of home factors, individual factors, and school factors associated with the dearth of Latinas in STEM fields should be understood, and these factors should be understood not only between immigrant groups but within and across generations of immigrant groups.

Sayman (2013) noted that our understanding of the dynamics that create opportunities for underrepresented populations to pursue STEM careers will positively affect a diverse student population. Specifically, high school mathematical experiences among Latinas (Gutiérrez, 2008) is of interest, since mathematics, considered a gateway subject to higher education, remains privileged in our current technological world (Hersh & John-Steiner, 2010; National Research Council, 1998). Ruiz (2011) suggests that researchers and educational stakeholders "need to pay close attention to the mathematics education of Latinas/os students and the positive consequence of strengthening their education" (p. 305). The researcher identified family, individual, and

school level factors and proposes to test the strength of their effects as it relates to immigrant students across generational classification.

Purpose of the Study

The purpose of this study is to (a) test the strength of the relationships of individual level factors and school level factors associated with mathematics achievement and high school math course taking beyond Algebra 2 among Mexican American females and (b) to better understand how these factors impact their trajectories toward STEM careers.

Within the context of the study, the participants, all female and identifying as Mexican descent were selected from the Educational Longitudinal Study (ELS:2002) database. Similar to past research that used nationally representative sample of high school students, the present study relies exclusively on Latinas from one such database. This reliance is grounded in the notion that not only do nation-wide Latinos comprise the largest language minority group in the overall US population but also Latinos continue to underperform in mathematics (Mosqueda, 2010). The information in the database is anonymous and ethical issues are addressed since the data is secured and its intended use falls within the scope of the present study. In addition, since the study centers on mixed methods design, a component that included interviewing to capture the meaning of the participants' experiences was interpreted and reported. The focus of the interviews was to capture the mathematical experiences of the participants to inform the quantitative data.

This study informs theory and practice. From a theoretical perspective, this study tested the cultural-ecology theory of school performance as well as assimilation theory and from a practical perspective, the model informs educators, professionals, and policymakers who work with Latinas and related issues about the association among the identified variables (Gutiérrez, 2013).

The present study moves away from achievement-gap gazing (Gutiérrez, 2008, 2012a; Ladson-Billings, 2006) and the deficit thinking myth as applied to Mexican Americans (Valencia & Black, 2002). Achievement-gap gazing compares academic attainment between ethnic groups, especially on national test scores as opposed to within-group differences (Carpenter, Ramirez, & Severn, 2006). The extant literature provides insight on the persistent use of group comparative studies on mathematics achievement (Byrnes, 2003; Catsambis, 1994; Tate, IV, 1997; Wenglinsky, 2004; Riegle-Crumb & Grodsky, 2010).

The achievement-gap lens “perpetuates the myth of greater between-group than within-group variation” and also “accepts a static notion of student identity” which “sends an unintended message that marginalized students are not worth studying in their own right” then “places a group in opposition to each other,” and the term gap “serves as a safe proxy for discussing particular kinds of students without naming them” (Gutiérrez, 2008, p. 359). Take for instance Mexican American parents whose educational experiences were in Mexico. These parents asked how their children behaved in class as opposed to American parents who asked about academics and strategies for improvement (Ixa Plata-Potter & de Guzman, 2012). We note that parental perspectives differ and are not deficient. Deficit thinking is grounded in the notions of genetic disparity and cultural disadvantage (Ballón, 2015).

As it relates to mathematics education, achievement-gap gazing fails to account for inequities in schools (Flores, 2007; Gutiérrez, 2008), fails to identity the true causes of these gaps due to unaccounted variables, and fails to recognize the variance in factors between groups may not be able to account for within group variance (Gutiérrez, 2008). For example, Mantute-Bianchi (1991) found disparate educational achievement between recent Mexican immigrants and descendants of Mexicans, which suggests heterogeneity and that a more precise definition of

this group of students is needed. Issues relating to identity and power; culture and language; and learning contexts need to be better understood. Moving away from the achievement-gap gazing affords a research agenda focusing "on advancement, on excellence, and on gains within marginalized communities" (Gutiérrez 2008, p. 312; Gutiérrez 2012b).

Drawing from Gloria Anzaldúza's (1987) *Borderlands/la frontera: The new Mestiza*, a groundbreaking theoretical work on Chicana identity, Delgado Bernal (2001) identifies the "mestiza consciousness to include how a student balances, negotiates, and draws from her bilingualism, biculturalism, commitment to communities, and spiritualities" (p. 628). Carter (2006) suggests cultural mainstreamers, cultural straddlers, and noncompliant groups as ways to form in/out group identity and to draw from these identities as it relates to school success among Latinas to comfortably move beyond stereotypes.

The academic achievement of high school students from immigrant families has been studied as it relates to generational differences (Duong, Badaly, Liu, & McCarty, 2015; Fuligni, 1997; Kao & Tienda, 1995). Matute-Bianchi (1991) posited a typology of Mexican Americans which accounts for the complexity of immigration status and generational status. Matute-Bianchi noted that "distinctions between immigrant and nonimmigrant Mexican people in the United States are complex and multifaceted" (p. 207) and, based on dominant patterns of behaviors and ethnic identities, posited five categories: (1) recent Mexican immigrants, (2) Mexican oriented, (3) Mexican American, (4) Chicano, and (5) Cholo (see Appendix A.1).

The intent of this study is to use a multistage mixed method approach to explore for possible significant factors associated with high school math course taking beyond Algebra 2 as well as to add to the sparse literature in mathematics education that addresses only Latinas (Espino, 2016a; Fujimoto, 2014; Sayman, 2013; Zambrana & Zoppi, 2002). It is important to

study and to identify factors associated with mathematics achievement so as to prepare the next generation of women for the increasing technology related workforce (AAUW, 2013; Gándara, 2015; Sayman, 2013).

Research questions

1. What student-level factors (e.g., family SES, generation status, math self-efficacy, sense of belonging, parental expectation, rules for doing home-work, and having AP Math credits) and school-level factors (e.g., teacher student relationships, percentage of minority students, and percentage of Hispanic teachers) are associated with math achievement of Mexican American female high school students?
2. What is the likelihood that these student-level factors and school-level factors influence the likelihood of Mexican American female students to take advanced high school mathematics courses beyond Algebra 2?
3. What is the impact of these student-level factors on mathematics achievement while controlling for school-level factors?
4. How much of the variance in math achievement scores is attributable to Mexican American female students and to schools?
5. How do these factors differ among immigrant and nonimmigrant students?
6. What kinds of encouragement and experiences in mathematics classes influence the likelihood to study higher level mathematics?
7. How can the emerging qualitative data be used to provide a deeper understanding of the strength of the relationship of possible student-level factors and school-level factors that influence the likelihood of taking advanced high school mathematics courses?

Key terms

1. Chicana and Chicano—Cultural and political identities of resistance popularized during the1960s when the modern Chicano Movement emerged (Hurtado & Gurin, 2004).
2. Chicana—Singularized to identify and discuss women of Mexican origin and/or other Latinas who share a similar political consciousness. Note that not all Mexican origin women use or identify with the cultural and political identity of Chicana (Bernal, 2001).
3. Hispanic—Used in the context of population; most government data use this umbrella term as a catchphrase referring to a heterogeneous population of Mexican Americans, Puerto Ricans, Cuban Americans, Central Americans and South Americans who inhabit regional communities (Alcoff, 2005; Ruiz, 2009).
4. Latino/a—The “o” ending is a masculinized form to describe males of Hispanic descent, whereas, the “a” ending is a feminized form to describe females of Hispanic descent; Spanish language customarily references groups of males, (e.g., Latinos), and females (e.g., Latinas) to be written in the form that denotes only males, Latinos (Gutiérrez, 2013).
5. Newly immigrated (born in Puerto Rico or a non-US country) regardless of mother's birthplace). Will be considered generation 1.
6. First generation (born in the United States, but his/her mother was born in Puerto Rico or a non-US country). Will be considered generation 2.
7. Second or more generation (born in the US and his/her mother were born in the US). Will be considered generation 3 or more.
8. Dropout—any student who withdraws from high school for reasons except death, or expelled before graduation based on push, pull, or falling out (Doll, Eslami, & Walters, (2013).

Delimitations

- High school female students self-identified as Mexican American.
- National database of survey data (NELS:2002) as provided by the Institute of Educational Sciences.
- Informant accuracy in providing personal stories.

CHAPTER 2 : REVIEW OF THE LITERATURE

Introduction

In this chapter, factors relating to mathematics course taking and mathematics achievement among Mexican American females will be discussed. First, the attention is on student level factors, such as SES, engaging home-work, and sense of Belonging. Next, school level factors such as teacher cultural background and the percentage of minority students will be discussed. A treatment on stereotypes and a description of Algebra 2 follows.

Background and Setting

According to Rumbaut, in the U.S. Mexicans have been "legally and officially classified as 'white,' yet socially treated as 'non-white'" (p. 19). Various laws pertaining to immigration, such as 1849 the California State Constitutional Convention deemed Mexicans to be 'white' for legal purposes. The Naturalization Law of 1790 and the Chinese Exclusionary Act 1882, limited citizenship to 'white persons.' However, two US Supreme Court cases, *In re*: Rodríguez (1897) and *Hernández v. Texas* (1954), brought to bear the notion of persons of Mexican descent as it relates to whiteness, especially those with phenotypically darker features (Rumbaut, 2009). One of the most influential cases to challenge the notion of Mexican Americans as classified white yet subjected to school segregation included *Mendez v. Westminster (1947)* which highlighted the contradiction of unequal treatment (Stru, 2010; Tevis, 2013). Nevertheless, from 1850 to 1930 Mexicans were counted as "white" then "classified as a separate 'race' in the 1930 census, amid the Great Depression" (Rumbaut, p. 22). In 1940, Mexican Americans were reclassified as "white," and with the increasing numbers of Puerto Ricans coming to the U.S. (first counted in 1950), along with Cubans after the Cuban Revolution of 1959 (first counted in 1970), the tabulations based on ethnicity received more treatment by the Census Bureau (Rumbaut, 2009).

The increased focus on civil rights, coupled with the need to advance documentation of disadvantages of minority groups, and concerns over differential census undercounts, eventually lead to the enactment of Public Law 94-311—a joint resolution "relating to the publication of economic and social statistics for Americans of Spanish origin or descent," which, in June 1976, was signed by President Ford (Rumbaut). A year later, as mandated by Congress, Directive 15—Race and Ethnic Standards for Federal Statistics and Administrative Reporting—introduced and specified a minimal classification of four 'races' ('American Indian or Alaskan Native,' 'Asian or Pacific Islander,' 'Black,' and 'White') and two ethnic backgrounds ('of Hispanic origin' and 'not of Hispanic origin'). In addition, Directive 15 stated that there should be a standardize collection and reporting of 'racial' and 'ethnic' statistics and "to include data on persons of 'Hispanic origin' who may be of any race" (Rumbaut, p. 26).

In 1997, the Census Bureau revised Directive 15 with five racial categories (Rumbaut, 2009). Not only could respondents select one or more racial designations, but also they could select two 'ethnic' categories from 'Hispanic or Latino' and 'not Hispanic or Latino' with "Hispanic or Latino defined as 'a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race'" (p. 24).

With respect to race, the 2010 census provided "15 separate response categories and three areas where respondents could write-in detailed information about their race" (US Census, 2011b, p. 2). The Bureau suggested that "'Hispanic or Latino' refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race" (p. 2). In fact, the question on Hispanic origin included:

> five separate response categories and one area where respondents could write-in a specific Hispanic origin group. The first response category is intended for respondents who do not identify as Hispanic. The remaining response categories ('Mexican, Mexican Am., or Chicano'; 'Puerto Rican'; 'Cuban'; and 'Another Hispanic, Latino, or Spanish

> origin') and write-in answers can be combined to create the OMB category of Hispanic. (US Census, 2011b)

Therefore, as it relates to race, the Hispanic or Latino population taken as monolithic would be unwise (Ramos, 2009; Suro, 1998).

Context

The generational classification system to describe immigrant status can be challenging. The generation classification of students becomes problematized with respect to immigration status (Mantute-Bianchi, 1991). Traditional definitions have included an ordinal system such as first- and second-generation participants. There is reference to generation 1.5 and 2.5, which applies to those who came to the United States at an early age. There is a separation of immigrant students as foreign born (first-generation) or native born (second-generation, Duong, et at., 2015). Studies have combined first- and second-generation students into an "immigrant" category to compare a nonimmigrant or "native" category that includes third-generation and beyond.

Linear and non-linear explanations as it relates to immigrant generational status success have been theorized. The literature suggests two well-known theories—the *traditional assimilation theory* and the *segmented assimilation theory*. Also, *bumpy line assimilation theory* states that generations may differ how they assimilate and how they succeed based on marriage, phenotype, gender, and social position, but notably, the next generation may teach to the previous some lost cultural expressions (Vasquez, 2011).

The *traditional assimilation theory* posited by Gordon (as cited in Duong, et al., 2015) states that integration by immigrant groups into mainstream occurs linearly as later generations acquire greater academic and socioeconomic success and adopt Anglo-American cultural values. However, it has been found that especially among European and Filipino families with higher

SES backgrounds but not among Latinos, students from immigrant families attained higher grades in mathematics and English courses and later generations attained higher standardized test scores (Fuligni, 1997).

The *segmented assimilation theory* proposed by Portes and Zhou (as cited in Duong, et al., 2015) accounts for the disparate contextual factors on the trajectories of immigrants' modes of incorporation. These factors include family resources, the host country's economic climate, and the receiving community. A successful "ethic enclave" would likely extend opportunities to new immigrants, while a "disadvantaged subculture" would likely increase the likelihood of immigrant youth associating with marginalized youth (Duong, et al., 2015, p. 4).

Three hypotheses have been put forward to explain immigrant educational attainment. These include the *straight-line* assimilation hypothesis, the *accommodation-without-assimilation* hypothesis, and the *immigrant optimism* hypothesis (as cited in Kao & Tienda, 1995). The *straight-line* assimilation hypothesis predicts low educational achievement among immigrant youth, but increases with generational status. The *accommodation-without-assimilation* hypothesis predicts higher educational achievement among recent immigrant youth because they have not been influenced by native peer culture, in particular oppositional behaviors. The *immigrant optimism* hypothesis states that differences between immigrant and native parents are the essential ingredient to explaining differences in academic performance, and because foreign-born children may lack English skills, second generation will outperform their peers.

The home environment has been considered part of the ecological context of schooling (Smith, et al., 1997), its association with nursery school preparation (Baldwin, 1949), middle school mathematics achievement (Beaton, 1996), and even out of school factors (Berliner, 2009) suggest a wide interest in this relationship. Home environment may be put into a larger category

of family factors along with parent expectations and attributions, discipline, and parent involvement (Christenson, Rounds, & Gorney, 1992). In their development of Hispanic Academic Advancement theory, Jodry, Robles-Piña, and Nichter (2004) informed their conceptual framework with home sub-factors that include home-support, home-motivation, and home-education.

As it relates to individual factors, social cognitive theory suggests that among the mechanisms of personal agency, none is more important than people's beliefs to exercise control over events affecting their lives (Bandura, 1989, p. 1175) which operate on action through cognitive, motivational, and affective processes. McLeod (1992) suggested three facets of the affective experience of mathematics: 1) how students view themselves doing mathematics, 2) negative and positive emotions that accompany "interruptions and blockages" that inherently occur from time-to-time in learning mathematics, and 3) positive or negative attitudes as students encounter the same or similar mathematical situations. Adelman (1999) suggested the higher up the *math ladder* a student progresses the greater the odds of obtaining a college degree. Fennema and Sherman (1978) found significant attitudinal differences between high school males and females in their confidence in learning mathematics. However, for Shapiro and Williams (2012), performances and actions that are visible to others such as parents and teachers who endorse math-gender stereotypes put girls at risk for "other-as-source stereotype threats which can harm performance, confidence, self-efficacy, and interest" (p 180).

One level of interest with respect to learning relates to doing homework (Landers, 2013) and belonging in the context of school and neighborhood among Latino youth (Maurizi, Ceballo, Epstein-Ngo, & Cortina, 2013).

A wide array of concerns about school factors on academic achievement have ranged from quality of secondary school English teachers (Johns Jr., 1954) to differences between private and public schools (Finger, & Schlesser, 1963). Student body characteristics, instructional personnel characteristics, and types of programs and finances, have also been analyzed and correlated to student achievement among minority students (Dyer, 1968).

Jodry, Robles-Piña, and Nichter (2004) informed their framework with school sub-factors, one of which is school-education (faculty/staff had high expectations for achievement and behavior, school valued language and culture by providing role models in the faculty, using culturally and linguistically responsive pedagogy, and school viewed parents as assets).

Theoretical Framework

Two theories inform this study. These theories include the cultural-ecological theory of schooling (Ogbu, 1978, 1991, 1992, 1999, 2003) and segmented assimilation theory (Portes and Zhou, 1993; Zhou, 1997). Ogbu's cultural-ecological theory posits that minorities differ from one another with respect to *societal and school factors* (the system) and *community forces* as it relates to the degree to which groups experience social and economic discrimination, how they develop their attachment to minority cultural values, and how they utilize socialization practices related to culturally-specific values. Segmented assimilation theory posits that host societies offer disparate possibilities to different immigrant groups which may limit opportunities but "not necessarily constitute a complete denial of opportunity" (Zhou, 1997).

The first theory that grounds this study relied on the anthropological work and cultural-ecological model of Ogbu (1978, 1981, 1991, 1992, 1999). With respect to education, Ogbu developed a cultural-ecological theory of schooling which addresses *societal and school factors* and *community forces* that affect the school performance of minority students (Ogbu 2003; Ogbu & Simon,1998). For Ogbu, *societal and school factors* (the system) refer to those educational

policies and practices, the rewards for educational accomplishments, and the treatment of minorities in educational institutions and the larger society heaped upon perceived minorities (Ogbu 2003). Minorities, in turn, interpret and respond to the system with *community forces* that encompass relativistic cultural frames of reference (comparison of self with dominant society), build beliefs about the value of credentials, espouse relational interpretations of schooling, and develop symbolic beliefs about threats to identity, culture, language, and ability (Minh Phuong & Nieke, 2013; Ogbu, 2003; Ogbu & Simons, 1998). Figure 2.1 shows these two parts: *societal and school factors* (the system) and *community forces.*

Ogbu's cultural-ecological theory of schooling, grounded in cultural-ecology theory and a cultural-ecological model (Ogbu, 1978, 1991, 1992, 1999, 2003), seeks to explain and to make comparisons between two types of ethnic minorities: voluntary and involuntary immigrants. Ogbu and Simons (1998) delineated voluntary immigrants as those who migrated on their own volition to any other society for either economic opportunities or other forms of liberties. According to these theorists, involuntary immigrants are indigenous minorities brought to another country through slavery, such as in the United States, or, generally, through conquests or colonization, such as a result of the Mexican American War of 1848. In the American milieu, we can distinguish and identify minorities who fall within the immigrant status of 'voluntary' and 'involuntary' each having factors that influence behavior towards failure or success (Warikoo & Carter, 2009). Ogbu's cultural-ecological theory posits that minorities differ from one another with respect to *societal and school factors* (the system) and *community forces* as it relates to the degree to which groups experience social and economic discrimination, how they develop their attachment to minority cultural values, and how they utilize socialization practices related to culturally-specific values. Ogbu's theory encompasses the notion of a collective oppositional

identity premise. However, this oppositional position results from a status positionality and subsequent responses to treatment meted out from the perceived dominant group. For example, in relation to schooling, Ogbu argued that African-American students see little opportunity

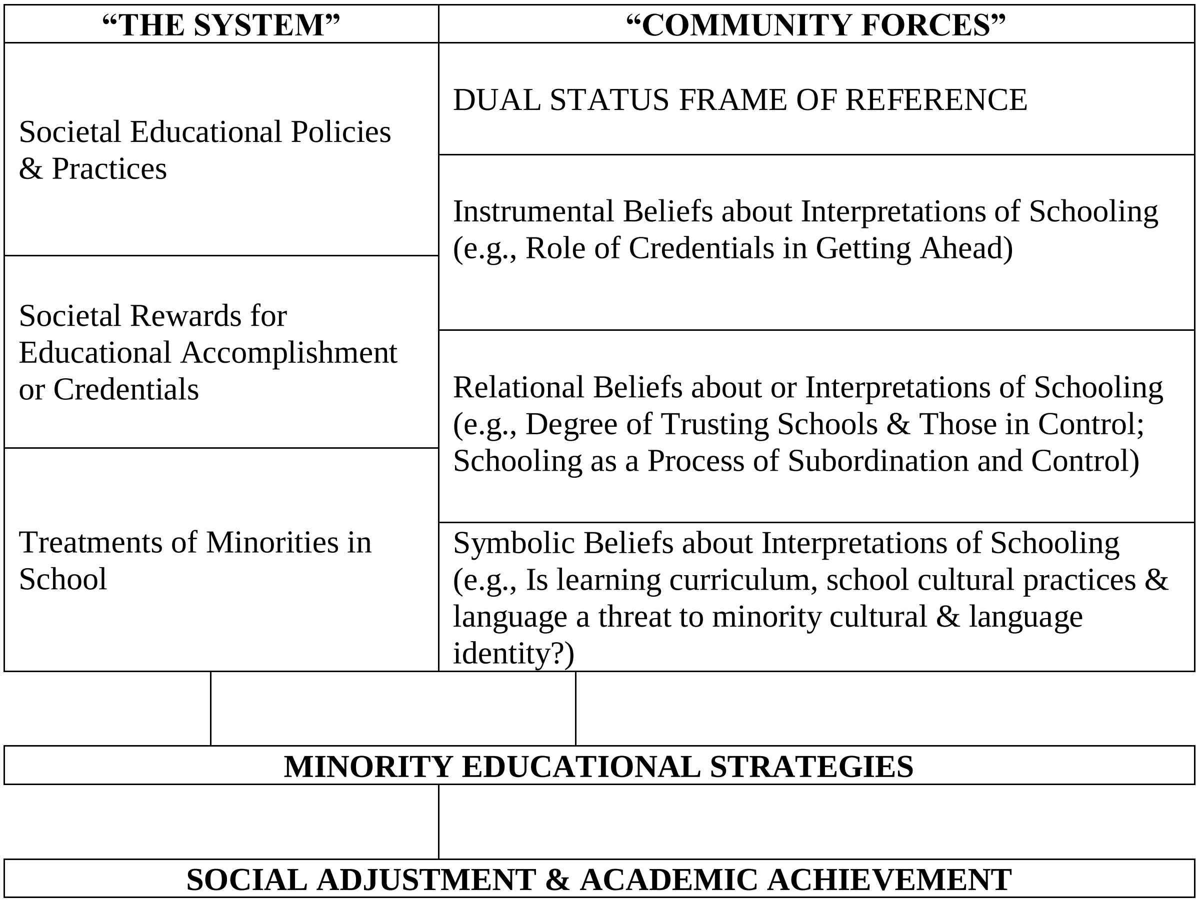

Figure 2.1. Two parts of the “problem of minority” schooling. Source: Ogbu, J. U., & Simons, H. D. (1998). Voluntary and involuntary minorities: a cultural—ecological theory of school performance with some implications for education. *Anthropology & Education Quarterly, 29*(2), 155-188.

through education since there is a lack of trust that credentialing affords equal opportunities, which makes students become disillusioned and un-involved in high school. Disengagement becomes associated with behavior problems and “as this identity is internalized, lower educational expectations and lower attainment are the result” (Trusty, 2004, p. 7).

According to Ogbu and Simons (1998), dominant behaviors of disengagement among minorities have resulted from historical treatment and the interpretation of such treatment (see

Figure 2.2). These treatments include an involuntary incorporation into the society, instrumental discrimination, social subordination, and expressive mistreatment that collectively mark the people as a distinct segment of society, which result in an almost impossible situation to be solved. For involuntary immigrants, no homeland exists to return; hence, the notion of escaping these permanent conditions can never be realized. However, voluntary immigrants withstand these treatments because they sense possibilities of escape, especially through education. For Ogbu and Simons, voluntary minorities come with a *primary culture* model that formed prior to living in the dominant society, whereas, involuntary minorities have a *secondary culture* model that formed after incorporation. These models of culture aid these groups as they negotiate within the space. For example, learning the dominant language within the *primary cultural* model would be seen as a challenge to overcome and to translate into an advantage to advance economic, social, and educational interests within the society. In the *secondary cultural* model, language is seen as a border to maintain and to preserve minority culture vis-à-vis the dominant group.

Ogbu's theory seeks to explain coping strategies associated with perceptions of behavior associated with dominant cultures such as *acting white*, in the US case. Ogbu (2004) posited that after emancipation African-Americans did not abandon oppositional cultural and dialect frames of reference. For Ogbu, the stride for upward social mobility, acceptance, and equality created a dilemma between acting toward White or Black frames of reference in situations controlled by Whites. As it relates to society, Ogbu argues that out of this dilemma emerged five coping strategies from which to choose. These coping strategies include: (1) cultural and linguistic assimilation which means abandonment of Black frames of reference, (2) accommodation without assimilation which requires the use of a Black frames of reference in the Black

1. History: How a Group Acquired Minority Status & Subsequent Treatment by White Americans

2. Cultural Model of the U.S. / U. S. Society

3. Cultural Model of Minority Status

DUAL FRAME OF REFERENCE	**INSTRUMENTAL ADAPTATION**			**RELATIONAL ADAPTATION**	**SYMBOLIC ADAPTATION**		
How well they think they are doing by comparison with others; and who the "others" are	How they think they can get ahead/ "make it" as minorities & beliefs about school credentials	Survival strategies e.g., "A man has got to do what he has to do" to "survive"/ "make it"	Role models or people one would like to be like	Accommodation; collective struggle; degree of trust/ distrust of Whites & "The System"	Cultural/ Language differences & behavior	Cultural frame of reference: Group identity & behavior	Cultural frame of reference: Group membership & behavior

COMMUNITY FORCES	CULTURAL MODEL OF SCHOOLING i.e., BELIEFS ABOUT OR INTERPRETATIONS OF -Instrumental value of schooling -Relationship With Schools & Authorities -Cultural/Language Identity & Schooling	COMMUNITY FORCES

EDUCATIONAL STRATEGIES

Figure 2.2. Minorities' sociocultural adaptations or "collective solutions" to "collective problems." Source: Ogbu, J. U., & Simons, H. D. (1998). Voluntary and involuntary minorities: a cultural-ecological theory of school performance with some implications for education. *Anthropology & Education Quarterly*, *29*(2), 155-188.

community and White frames of reference in the White community, (3) ambivalence which involves the use of standard English and recognition that obstacles existed to prevent Black upward mobility notwithstanding engaging White frames of reference, (4) resistance which requires full acceptance and use of Black frames of reference without apology, and (5) encapsulation which occurs because there is use of a full Black frame of reference without knowing how to use White cultural or dialectical frames of reference (Ogbu, 2004). With respect to school, one coping strategy involves acting as the jester. Acting as the class-clown masks the true interest in academics. Another strategy includes camouflage by joining sports teams, avoiding homework, shunning *white activities*, and succumbing to peer pressure.

The larger implications with respect to disengagement among and voluntary and involuntary immigrants is warranted. It has been found that higher absenteeism among students born in the US than those not born in the US, and for every additional day students missed there was found a 6% decrease in the odds of graduating high school. Trusty (2004), found that attendance had a significant positive effect on college degree completion "with a one-standard-deviation increase in good attendance behavior in high school resulting in a 25% increase in the odds of bachelor's degree completion versus non-completion, given all other background and high-school variables" (p. 19).

Researches continue to test Ogbu's cultural-ecological theory of schooling. For example, Minh Phuong and Nieke (2013) used this theory to examine school experiences among Hmong students in Vietnam. Lim (2012) studied Korean-American elementary parental involvement with their student's school, Williamson (2010) examined African-American males in STEM, and Mindnich (2008) used the cultural-ecology theory of schooling to inform that study about low

income Latino grade nine students. Ogbu's theory was tested with students of Pakistani, Indian, and Bangladeshi descent in Britain along with Muslim communities in Europe (Bhatti, 2006).

For the present study, the cultural-ecological theory of schooling should be able to be tested among Mexican Americans since this theory suggests a "plasticity of development and learning as a function of the multiple contexts—within and outside the family—in which Latino children participate and confront social groups that press particular cognitive, linguistic, and social-participatory demands" (Fuller & García Coll, 2010). Although some scholars have critiqued Ogbu's theory as support for deficit thinking and "majoritarian story" (Solórzano & Yosso, 2002, p. 31), others have attempted to extricate Ogbu from such notions (Foley, 2004, 2005).

Segmented assimilation theory suggests that disparities in human capital and methods of incorporation will translate into patterned differences in adaptation patterns by immigrant offspring. As it relates to immigrant status and generational status, educational improvement among Mexican Americans seems to stagnate, although second generation does better the first and third. Segmented assimilation theory seeks to answer, among others, the question as it relates to what sector of society particular immigrant groups assimilate, in particular, the theory seeks to explain possibilities of a downward trend. In other words, there are distinct forms of adaptation: acculturation and parallel integration into the middle-class, a path to assimilation and into the underclass, or rapid economic advancement with "deliberate preservation of the immigrant community's values and tight solidarity" (Portes & Zhou, 1993, p. 83).

Telles and Ortez (2008) found no improvement along a straight line from first generation to third and beyond in that mostly the next generation status stayed the same from the previous, but parental economic status was associated with their offspring economic status. These

researchers found that a low level of education kept “Mexican Americans concentrated in working class or low-level white collar occupations well into third and fourth generations” (p. 267). These researchers advanced the notion that a sense of racial hierarchy may have an effect on stagnation. Haller, Portes, and Lynch (2011) noted this as a “stubborn effect of a negative mode of incorporation.” These resesrchers constructed the Downward Assimilation Index (DAI) from high pregancy rates, incareration, single parent household, and high school grades. They found that among the second generation a low DAI had an effect on the third generation. In their sample drawn from the Children of Immigrants Longitudinal Study, it was found that Mexican American students had a 47% greater likelihood of downward assimilation. Even within schools of high- and low-SES, Mexican Americans still had a greater likelihood of downward assimilation. However, among middle class Mexican Americans, second generation parents who experienced racial discrimination were found to be cautious yet encouraging of their offspring to obtain college degrees (Vasquez, 2011). Galindo (2013) showed that from the Early Childhood Longitudinal Study-Kindergarten cohort, among elementary school age Mexican Americans, although across all generations persistent, math achievement scores were below White students, third generation outperformed first and second generation, but these gaps narrowed by the fifth grade. In this study, SES was not sufficient to overcome these gaps.

What other factors across generations of Mexican Americans can explain the generational gap as it relates to mathematics achievement? Do agency and school organization make a difference?

Student Level Factors

The home environment has been considered part of the ecological context of schooling (Smith, et al., 1997). Four approaches to studying home environment and school success include socioeconomic (SES) measures; family-constellation studies; the ‘British school’ that

emphasizes parental experiences and aspirations for the child and status variables; and the ‘Chicago school’ that empahsizes specific social-psychological or behavioral processes conducive to learning (Iverson & Walberg, 1982). Home enviroment and its association with nursery school preparation (Baldwin, 1949), middle school mathematics achievement (Beaton, 1996), and even out of school factors (Berliner, 2009) suggest a wide interest in this relationship. Home environment, which excludes socioeconomic status (SES), may be put into a larger category of family factors along with parent expectations and attributions, structure for learning, discipline, and parent involvement, all of which are important for student learning (Christenson, Rounds, & Gorney, 1992). Eight home environmental variables, which include parents’ aspirations for the child, concern for the use of language, knowledge of educational progress, and family involvement in educational activities, were found to be significantly related to children’s academic intrinsic motivation (Badiozamani, 1995; Douglas, 1964).

In their development of Hispanic Academic Advancement theory, Jodry, Robles-Piña, and Nichter (2004) informed their conceptual framework with home sub-factors. These sub-factors include home-support (positive communication, positive adult relationships, caring home environment, and parent’s interest in their student’s school), home-motivation (value academic goals, making important contributions, provided good role models, advocacy in their interest, and provided a safe home environment), and home-education (high expectations for behavior and achievement, taught children how to advocate, and value of language and heritage).

Watson, Brown, and Swick (1983) in a sample of 362 homes in South Carolina used path analysis to test the theories of the effects of neighborhood support, home support, household income, and educational level of the home upon achievement of children. The dependent variable was the “Cognitive Skills Assessment Battery (CSAB) from the Teachers College

Press" (p. 176). The findings revealed that, for first graders, there existed a significant relationship between "the support a parent receives from the environment and the support given by that parent to the child" and a significant relationship "between the amount of support given a child by the home and the achievement of that child" (p. 177). These researchers found that regardless of the income levels of the home, it was the home that had the greatest effect on the achievement of the child. In addition, these researchers found that some parental differences between active parents and those classified as inactive support or not providing support contributed to higher achievement. The researchers concluded that some parents fail to connect the importance of schooling to their children's lives. Among the conclusions in this study, the researchers suggested that teachers must recognize their vital role, parents must recognize that learning is essential, and parents must have ecological supports from which they draw upon to carry out their roles.

Notwithstanding, parents and teachers as ecological factors, other factors may affect parental support. For example, parental support for Latino students is affected because they "tend to be poor and less educated than other groups and reside in areas where there is less parent leadership and civic engagement around improving schools," and it is poverty that "erodes cultural assets as it depletes the sense of self-identity and cultural identity" (Zambrana & Zoppi, 2002, p. 46). These researchers argue that the intersection of economic factors with parental and institutional factors "contribute to high rates of educational failure among Latino girls" (p. 46). In this fray, Ixa Plata-Potter and de Guzman (2012) noted that, for Mexican immigrant parents, disparities in understanding differences in school procedures between the United States and Mexico, as well as language barriers and other challenges, contributed to parents feeling discouraged and unable to support their children. Given these possibilities, Latino parents seem

to lean on other cultural factors to lend support to their children. For instance, Espino (2016a) examined the role of stories of *educación* told by parents in shaping the educational aspirations of Mexican Americans who hold PhD degrees.

Walker (2006) noted that in their study with Latino students, several mentioned that although their parents did not explicitly help them with mathematics home-work, they were supported in other ways through encouragement to complete their home-work and school-work and by telling them to take advantage of opportunities. Ixa Plata-Potter and de Guzman (2012) as well as Espino (2016b) suggest that Mexican American parents give *consejos* [homilies] by providing an ongoing conversation about the importance of school and, through these expressions, parents felt that they were meeting their responsibility to help their child. These studies suggest that parental involvement seems to be a factor of importance as it relates to educational achievement. For instance, Trusty (2004) found that one-standard-deviation increase in parental involvement resulted in a 13% increase in the odds of degree completion, and a one-standard-deviation increase in parental expectation resulted in approximately a 19% increase in the odds of degree completion.

Hill and Torres (2011) argue that, in the extant literature, there exists a lack of understanding about the culturally embedded strategies or beliefs about parental involvement as it relates to Latinos. They noted that Latino parents hold teachers in high regard and find it disrespectful to challenge teachers, so parents fail to express their opinions to teachers, especially with disagreements. In addition, they suggested that Latino parents' silence leads to less relationship building and feelings of alienation in their interactions with teachers. These actions tie in with the notion that Latino parents' strategies are misunderstood and that their cultural beliefs are challenged or devalued which in turn create barriers to home-school partnerships. The

consequence here is that parental involvement is misunderstood (p. 100). In fact, Hill and Torres (2011) conclude that “the extant empirical literature on the relation between family practices and academic achievement is not large or robust enough to draw firm conclusions about whether existing theories of family—school relations are generalizable to U.S. Latino families” (p. 107). This assertion suggests that researchers need to identify additional factors grounded in perspectives as they relate to Latina parents.

SES

It has been found among Mexican youth that when immigrant status was correlated with low SES, lack of parental and counselor guidance support existed (Perez-Brena, Delgado, De Jesús, Updegraff, & Umaña-Taylor, 2017). However, while SES was associated with differences in initial expectations, it did not interact with nativity to create a higher risk context that may adversely impact youth adjustment. The interest in SES and its relationship to academic achievement among Hispanic has an historical grounding.

Carpenter, Ramirez, and Severn (2006) examined factors that best predict grade 12 student achievement in math. Using NELS:88 data, this study utilized multiple regression enter method on a sample of 15,618 grade 12 students, which equals a weighted sample size of 3,156,664 among which there were 2,170 Hispanic students (weighted n = 361,143). It was found that the most significant predictors of mathematics achievement within-groups appear to be rooted in the home, including SES, parental involvement (for Hispanics), language, and even homework. In fact, these findings suggest that as SES increases, so too does math achievement and learning English as a second language.

Mosqueda and Maldonado (2013) in their quantitative study that examined the relationship between Latina/o secondary school students’ degree of English-language

proficiency, mathematics course-taking, and 12th grade mathematics achievement. Although it was found a significant relationship between math achievement and SES, these researchers found that "course-taking resulted as the most important predictor of mathematics achievement" (p. 212). These researchers used the first follow-up data of the Educational Longitudinal Study (ELS) data set and a subsample of 2,005 first-, second-, and third plus-generation Latinas/os clustered in 506 schools. Using HLM modeling on two levels (clustering of students and within schools) and twelfth grade mathematics achievement scaled score, the researchers examined four models. The second model suggested "statistically significant relationships between 12th grade mathematics achievement and SES, gender, teacher preparation, and school SES" (p. 212). In fact, parameter estimates showed that the effect of one unit positive difference in SES was associated with almost two points higher difference on the mathematics score.

In a longitudinal study, it was found that among Mexican and Central American immigrants, regardless of SES, the length of time since the family immigrated to the United States is related to less educational attainment, via lower expectations and GPAs (Roche, Calzada, Ghazarian, Little, Lambert, 2017).

LeFevre and Shaw (2012), in their investigation as it relates to Latina/o formal parental involvement, used a sample of students from the NELS:88 dataset. In their longitudinal study, it was found that the odds of students graduating high school on time in the highest income quartile were seven times the odds of students in the lowest quartile, and for those in the second quartile were twice those in the lowest quartile.

Trusty (2004), in support of LeFevre and Shaw (2012), used logistic regression on the similar dataset to predict bachelor's degree completion. This researcher examined the effects of high-school behavior variables, parenting variables, locus of control, and high-school course-

taking on completion or non-completion of a bachelor's degree. Among a sample of 5,257 participants (9% Latino), it was found that the odds of degree completion was 30% higher for women than the odds for men, "a one-standard-deviation increase in SES increased the odds of degree completion by 62% " and no SES by course-taking interaction (Trusty, 2004, p. 19).

At times, SES seems to contribute less to academic attainment. Catsambis (1994) used the NELS:88 database and logistic regression on a sample of only public school students. This study was to explore the drop in women's participation in mathematics during adolescence by tracing mathematics-related learning opportunities, attitudes, and achievements from middle school. Among the multivariate analyses, it was found that, as early as eight grade, fewer female students than male students decided to pursue mathematics and science careers. In fact, it was found that Latinas were most likely to be afraid to ask questions in math class which put Latinas to be the most disadvantaged group. This researcher concluded that within each racial-ethnic group, socioeconomic status was not related to gender differences in mathematics achievement. Notwithstanding, SES and other factors such as the high school program and parental decisions do play a role in educational success.

Byrnes (2003) used the 3C model and relied on the 1992 National Assessment of Educational Progress that included a sample of 318 participating high schools (N = 9,499) with girls (49.6%) and boys (5.4%), and an ethnic composition of 69% White, 17% were Black, and 11% were Hispanic. Using hierarchical modeling, it was found that only 40% of Black and Hispanic students took classes beyond Algebra 1. This researcher found that far more predictive of math performance than ethnicity was parent education (as an SES indicator), high school program, coursework, calculator use, worksheet frequency, ability and liking of math, and beliefs about the nature of math.

Worthy (2006) used qualitative analysis from interviews conducted with 16 parents who resided in a low-income community in Texas and whose primary language was Spanish. This researcher was examining the consequences for Latina/o children and their parents' lives as recent immigrants and their native language. Among the findings was that many of the parents shared that a major reason to emigrate was to provide opportunites for their children. However, it was found that many of these parents had low incomes and did not own a car, which resulted in the decision against sending their children for opportunities to learn in the after school science program.

Riegle-Crumb and Grodsky (2010) investigated whether racial/ethnic gaps in math achievement was more prominent between high school seniors who took advanced mathematics classes and those who had not taken a mathematics course beyond Algebra 2. This study did not differentiate among Hispanic groups. In fact, these researchers examined whether the racial/ethnic composition of a school had any contributing factors that could explain gaps between minority and majority students math course taking beyond Algebra 2. The researchers used a representative sample of high school seniors drawn from the ELS:02 data set as well as high school transcript data. It was found that although 37 percent of Hispanic students completed an advanced mathematics course, multivariate regression analysis on the scaled mathematics scores and dichotomous variable, math course taking above or below Algebra 2, revealed that, at one standard deviation above the mean for family income, Hispanic students' predicted test scores were approximately half a point higher than for White students. In fact, it was noted that "differences in family income between white students and their black and Hispanic course-taking peers are significant, but among those in the non-advanced stratum, majority-minority

differences in parental education level are significant only between white and Hispanic students" (p. 256).

Parents Support of Gender Stereotypes

Fujimoto (2014) examined how college age Latinas use stories to counter, respond, and resist gender stereotype. In this study, the researcher deployed narrative inquiry to gain insights from the participants about pervasiveness of dominant and deficit narratives that present limitations toward achieving academically. Relying on a snowball sample, the first eight Latinas who participated in a pilot study, provided common themes such as academic preparation, college experience, culture, and family, which were then used to form the basis of interviews with twenty-seven alumnae from a major university. It was found that among these participants, parents expected their daughters to graduate from college since this was seen as a pathway to a better life. Many of the participants reported that gender differences existed around dating and social activities; however, parents maintained the same academic expectations similar to their brothers. For this researcher, the narratives presented illustrated a disruption in the stories about educational underachievement. The researcher concluded that the stories from these participants and how they thought about race modeled resiliency and reminded them that they "are part of a larger family, community, and legacy that is far beyond their individual selves, and taught about the reality of struggle and hard work and that this is part of what life is and much more" (p. 43). Notwithstanding, the researcher suggested that Latinas understand these stories in particular ways since girls, more than boys, are often expected to assist with household chores and perhaps childrearing responsibilities. In fact, engaging in these activities situates Latinas "in close, consistent contact with family members and the opportunity to hear the family stories and their

interpretation and reinterpretation" (p. 43). To what extent do the effects of stereotypical activities generalizable?

Sayman (2013), in a recent qualitative method study among Latinas attending state-supported residential schools for science and mathematics, found that gender stereotypes by parents affect feelings of support for studying mathematics. This researcher quoted one participant who stated that even though studying mathematics was important, one father insited that the student knew "how to iron, cook, and clean the house" (p. 222). This finding seems to exemplify the relationship between gender stereotypes and parental beliefs, which has been investigated (Jacobs, 1991).

In a study that investigated the influence of parents' gender stereotypes on their beliefs about their child's ability, belief, and performance on mathematics that included grade 6 through grade 11 students and their parents, the reseacher used path analysis and found that parents of girls held more stereotypical beliefs about boys being more talented at math (Jacobs, 1991). It was also found a Sex by Stereotype interaction that acted as a significant predictor in all four models used by the researcher. This study suggested that gender-differentiated messages from parents may account for beliefs of their children. A limitation of this study was the sample of predominantly White, middle-class participants. Nothwithstanding, among the conclusions of this study is that "children of the sex not favored by the stereotype….whose parents hold stereotyped views may receive less favorable messages about their abilities than children of the other sex" (p. 526).

Tomasetto, Alparone, and Cadinu (2011) tested whether parents' gender stereotypes regarding mathematics would moderate the negative effects of stereotype threat on girls' math performance. These researchers hypothesize that girls whose parents endorse gender stereotypes

of math are more vulnerable to the negative effects of stereotype threat when gender identity is made salient. In their sample of twenty-four White female kindergarteners, first graders, and second graders attending different urban and suburban public schools serving predominantly middle-class families, using hierarchical regression, it was found that prior math achievement significantly predicted performance. In addition, in the stereotype threat condition—gender identity made salient—math performance of girls whose mothers endorsed gender stereotypes was lower than for girls whose mothers strongly rejected gender stereotypes. Although this study was limited in its sample and did not include Latinas, the findings suggest that gender stereotypes about math can disrupt girls' performance as early as elementary school.

Gunderson, Ramirez, Levine, and Beilock (2012), in their review of research that used primarily US samples, concluded that parents and teachers, as major environmental factors, hold gender-biased attitudes that can influence children's math attitudes and performance. In fact, these researchers noted that even though achievement test scores for girls and boys have narrowed recently, the dearth of girls who choose to pursue math coursework remains. For these researchers, adults' math-gender expectations and attributions affect children's math attitudes and achievement. These researchers proposed that the development of negative math attitudes in girls sets in motion math anxiety and math avoidance, which lead to lower levels STEM course-taking. In addition, these researchers posit that children may likely internalize math-gender stereotypes in elementary school which is the peak stage of gender rigidity, where they believe that certain activities are appropriate only for girls or for boys. These researchers propose a causal model in which parents' gender stereotypes bias their beliefs which then affect their child's own self-perceptions about math, which then affects the child's math achievement. For these researchers, differential treatment which can be either cognitive or social result from

parents and teachers who may treat girls and boys differently, as it relates to math-gender stereotypes and gender-biased expectancies. Gunderson, Ramirez, Levine, and Beilock concluded that any “effect of adults’ attitudes on children’s attitudes and behaviors must be mediated through adults’ behaviors and interactions with children” (p. 162).

Understanding adults’ behaviors becomes critical for advancing theoretical knowledge of the environmental transmission of gendered math attitudes (Gunderson, Ramirez, Levine, & Beilock, 2012). Notwithstanding gender-rigidity, is environmental transmission of gender specific roles reinforced in high school? How do parental academic expectations about their girls and mathematics relate?

Homework

Homework has its detractors (Kohn, 2007; Kralovec and Buell, 2001), supporters (Cooper, Robinson, & Patall, 2006; Mau & Lynn, 2000), and those who support homework use but cautiously interpret its use (Cushman, 2010; Landers, 2013; Marzano & Pickering, 2007). Kralovec & Buell (2001) suggest that “homework wars” exist (p. 39) and oppose its practice. In fact, they looked at homework in the context of students’ lives, and using interviews of 45 at-risk students residing in Maine, they found that the inability to complete homework was a factor significantly associated with dropping out of high school. Alfie Kohn (2007) suggests that homework has negative effects, the positive effects are mythical, and piling on more homework occurs in the absence of evidence of its value towards learning. Kohn posited that homework is “a curious fact when you stop to think about it, but not as curious as the fact that few people ever stop to think about it.” Notwithstanding, using meta-analysis, home-work has been found to be related to math self-concept (Xu, Yuan, Xu, & Xu, 2016).

Torres and Hurtado-Vivas (2011), using participatory action research found that homework is a burden for parents because of shift jobs, for some students there exists a lack of economic resources for additional supplies, and increased amounts of homework completed at home burden parents with assiting. For these rearchers, parents assistance with homework becomes problematic for students. Wilson and Rhodes (2010), posited that the use of homework is little understood by students and even by teachers who are unaware of students' levels of progress because they are unable to scaffold new knowledge. In their study of attitudes towards homework among high school students comprising of 577 freshmen (263 males and 314 females), it was found that 39% completed homework frequently; 69% thought homework was meaningful; 64% noted that homework served no purpose; 73% did not like doing homework; 84% found homework boring; and 86% believed that they were more likely to complete it if started in class. Wilson and Rhodes concluded that these statistics "could play an important role in the probability of homework being completed" (p. 364). In addition, these researchers found that 43% of participants failed to complete HW because they did not understand it and lack of understanding occurred for 65% more math HW than any other core subject. There was no delineation of these results by gender.

Mau & Lynn (2000) in their study of gender differences in the amount of time spent on homework relied on NELS:88 data and a sample of 1,406 Asians, 14,024 whites, 2,922 Hispanics and 2,260 African-Americans. They found that for males and females, math, reading, and science scores were positively related with homework. In fact, these researchers found that girls do more out of school homework than boys and the correlations between doing homework and math scores were higher for girls, yet the girls' math scores were lower. In addition, using multiple regression analysis, they found that homework and gender are independent and

statistically significantly associated with test scores. Notwithstanding the results, gender by race effects were not analyzed.

Landers (2013) in developing a theory of homework as a social practice, relied on grounded theory, and used Experience Sampling Modeling with 14 students followed by extreme case studies with two high school freshmen to propose that instead of abolishing homework educators should consider what “opportunities students are provided in schools and classrooms to buy into meaningful homework tasks” (p. 387). In fact, this researcher posited that teachers use their own school experiences, professional training, and assessment of students’ needs to shape how homework becomes incorporated into their teaching. This researcher found that students connect doing homework on a regular basis to future academic opportunities, ergo, going to college. Landers theorizes that, as it relates to homework, students “buy in or check out” and this depends on experiences they are offered in schools and classrooms, their developing identities, and the meanings that they are negotiating. This study did not take into consideration race, nor did it examine parents’ perspectives.

According to Marzano and Pickering (2007), one of the two most comprehensive meta-analyses on homework was conducted by Cooper and colleagues. Cooper, Robinson, and Patall (2006) examined the extant literature relating to homework from 1987 to 2003. These researchers created three sets of types of homework studies (1) exogenous manipulation studies, (2) studies that focused on naturalistic, cross-sectional measures of the amount of time spent on homework (no intervention) related to an achievement-related measure, and (3) simple bivariate correlations between time spent on homework and some measure of achievement. They found that, although “each set of studies is flawed, in general the studies tend not to share the same flaws” (p. 48), there is a positive and statistically significant relationship between the amount of

homework students do and achievement outcomes especially for secondary school students, and between 1.5 to 2.5 hours of homework were optimum for high school students. Cooper, Robinson, and Patall suggest that the effects of homework on outcomes other than achievement have not been empirical tested and that "variations in the amount of homework assigned" need examination. In this extensive study of homework neither race, gender, nor class were given any treatment.

Maltese, Tai, and Fan (2012) support Cooper, Robinson, and Patall (2006) in that their research of NELS (1990) and ELS (2002) data with a sample of 14,930 students using multiple linear regression models found that time on homework did not have a significant association with final grades, but with achievement scores. They did find that time on math homework had diminishing returns, nonetheless, "students who reported spending 61 to 120 minutes on homework each day scored 2.9 – 3.0 points higher than their peers who reported doing no homework, on average" (p. 61).

More recently, Fan, Xu, Cai, He, and Fan (2017) extend Cooper and colleagues to examine homework achievement in math and science and to include studied beyond US populations. In their meta-analysis of homework, it was found that a small and positive relationship existed between homework and math and science achievement. These researchers reported that "homework completion," "homework grade," and "homework effort" had larger effect sizes, studies that looked at homework frequency and time spent on homework.

Time spent on homework may have a relationship with achievement for Hispanic students. Wenglinsky (2004), using hierarchical linear modeling and NAEP 2000 data, found that homework was not a significant predictor of math achievement for Hispanic students. And this finding seems consistent with (Carpenter, Ramirez, & Severn, 2006) who investigated

factors that best predicted grade 12 mathematics achievement using the NELS:88 data and multiple linear regression modeling. They found that although homework appears not to be a significant predictor of math achievement for Hispanic students, spending 7 to 20 hours on homework
per week increased math achievement among other students. The difference between Hispanic males and Hispanic females was not investigated.

Martinez (2011) using interviews of 22 participants (13 females, 9 males) in grades 10-12 of mostly Mexican American students residing in a large Midwestern city found that time spent on homework averaged about an hour, only 3 female students and 3 male students said they completed homework all the time. In fact, among the reasons students mentioned with respect to difficulty completing homework included an underestimation of the time it will take to complete homework and overt laziness. Martinez posited that students fail to understand the importance of doing homework as a serious issue; consequently, they fail to make connections between what is being presented in class and its relevance to academic success. Interestingly, this study found that 41% of these students stated that they do not ask parents for help with homework because parents were not familiar with the material, did not have a strong grasp of the English language, or did not have the level of education to know the material, and these may relate to the academic outcomes. Three students mentioned that they do not seek help from their parents because their parents are “busy working” which strains the relationship between home, school, and Latina/o parents and disadvantages these parents (Torres & Hurtado-Vivas, 2011). Does the degree to which parents of Hispanic students place on homework and check on homework completion may relate to academic achievement?

Parents of Hispanic students noted higher rates of homework for children in grade 2, 3, and grade 12 (Pressman, Sugarman, Nemon, Desjarlais, Owens, & Schettini-Evans, 2015). In this study, it was found that among parents who reported less self-efficacy to assist with homework reported higher family stress, yet parents who reported a greater need to be more involved in homework, reported higher family stress.

Belonging

According to Landers (2013), identity development is our investment in the myriad of forms of belonging to communities, and these forms develop within communities through practice of relationship building and gaining a sense of self through creating bonds or distinctions. For Landers, the "meanings people make out of their experiences shape their participation" and, importantly, their practice (p. 377).

Gándara (2010) conjectures that the Latino high school student dropout rate is related, in part, to their sense of not belonging and lack of attachment to school. For second generation Latinas, a decline in school bonds was found (Bondy, Peguero, & Johnson, 2016). Among Mexican adolescents, gender was negatively related to belonging and positively predicted GPA, and belonging was negatively associated to lower peer GPA (Delgado, Ettekal, Simpkins, & Schaefer, 2016). Gándara asserts that extracurricular activities afford friendship groups, and since Latino students fail to join these groups because of perceptions of exclusivity, family obligations, or transportation difficulties, a sense of school belonging fails to develop. In this line of reasoning, Gillen-O'Neel and Fuligni (2013) posited that "the extent to which students maintain a sense of belonging at school may predict whether or not they leave high school prematurely" (p. 678).

Walshaw and Brown (2012) corroborated Landers when, in their investigation of the interrelationship between the affect and cognitive among underachieving high school students in New Zealand of low SES, found a math teacher, Mr. Polson, in his affective-evaluative schema made effective efforts to developed relationships among all students which developed a sense of Belonging. In fact, these researchers noted that when a new student joined the class, Mr. Polson allowed her to read aloud the class the day's answers to the problem set for the class. This act suggested that this math teacher provided mentorship by creating an environment such that this student could build a sense of self, which in turn affects a sense of Belonging. Else-Quest, Mineo, and Higgins (2013) posited that improving women and ethnic minority representation in STEM fields is "anchored in the influence of role models and mentors" and that these role models have the "greater potential to recruit students into particular academic majors when they convey a sense of Belonging" and shape attitudes and beliefs about abilities (p. 305).

Chun and Dickson (2011) examined mediation effects of sense of school belonging and academic self-efficacy. These researchers looked at how sense of school belonging and self-efficacy mediated the relationships among proximal processes (parental involvement and culturally responsive teaching) and academic performance with positive psychological and academic grades (math and English). In this study, the researchers proposed and tested these mediation effects based on the ecological systems model of human development developed by Bronfenbrenner and Morris. The sample of seventh-grade students enrolled in a school district near the United States-Mexico border self-identified as Hispanic (*n* = 478; 51.5% female) and with 89.2% as second generation or greater. Structural Equation Modeling results indicated that a sense of school belonging had only indirect effects on academic performance. The researchers concluded that "through experiences with parents who helped with homework, communicated

with teachers, and attended school activities that Hispanic students developed a sense of self-efficacy and a sense of school Belonging" (p. 1590). In addition, it was concluded that students' perceptions of their teachers was also a contributor to sense of school Belonging. Although this sample comprised all Hispanic students, they were all middle school students.

Cooper (2013) used case study methodology with five 10th grade Latinas residing in Los Angeles to investigate how they perceived their learning environments in classes and how these perceptions influenced emotional disengagement or engagement. Participants ranked math as low to moderate in level of emotional engagement. Classroom dimensions that influenced emotional engagement were safe spaces, affirming spaces, and productive spaces. This researcher found that among this sample of Latinas, they engaged more in class when the teacher showed a sense of caring. Cooper reported that "cultural differences also influenced perceptions of care, as some students perceived that white teachers did not understand them" (p. 506). This study also found that, emotional engagement was highest in classrooms in which students' positive conceptions of identity were salient and reinforced, and it was lowest in those in which students' idealized identities were threatened or in which negative aspects of their identities were fore-fronted (p. 507). For example, Ana, one of only three Latina/o students in Honors English class, felt that the Latina teacher's affirmation that she was a positive representative of her ethnic group underscored her high emotional engagement in this class.

Gillen-O'Neel and Fuligni (2013) argue that little is known about the long-term effects of school belonging over the course of high school and the extent of its association with academic achievement and value of school. These researchers examined school belonging focusing on social and emotional connections developed mainly with teachers and peers. This longitudinal study tracked a sample of grade 9 students (n = 572) from three high schools located in Los

Angeles. Almost 40% of the participants were Hispanic. Hierarchical Linear Modeling analysis revealed that, controlling for SES, 9th grade females indicated higher school Belonging, but their sense of belonging declined over the years. With respect to ethnicity, students of Asian, White, and Hispanic backgrounds reported similar levels of school belonging in 9th grade, and this remained the same over the course of high school. Analysis of interaction between gender and ethnicity revealed a significant slope (b = -.17, p = .032) for Latin Americans. This result suggests that for the Latinas in this study, their sense of school belonging declined significantly when compared to White students. These researchers found, for any particular year, there was no association between students' school belonging with their GPA, but they found a positive and significant association between school belonging and utility value of school for males and females. Gender and ethnicity interaction showed no association between school belonging and intrinsic value of school. However, after controlling for GPA in any school year, these researchers found a positive association between students' school belonging in that year and higher intrinsic and utility value, which suggest an association between belonging and academic motivation. In this study, the researchers did not report the number of Latinas in the sample.

Walker (2006) suggests that "students' peer groups may provide support that goes unnoticed by parents or school adults but can be useful in improving achievement among underserved students" (p. 51) since they work together to achieve a common goal connected with school. In this study that sought to examine how peer, family, and school relationships contribute to mathematics success, the researcher relied on hour long semi-structured interviews from a sample of 21 high school students from a large high school in New York City with a majority (56%) Latina/o population and predominately (60%) female. It was found that mathematics success was due to interrelated factors; neither peers, parents, nor teachers appeared solely

responsible. As it relates to peers, it was found the presence of a little teasing and accusations of acting like a nerd but not as acting White. Of interest is that many of the participants connected with school since they resisted peer pressure to engage in disruptive classroom behaviors.

Mathematics self-efficacy

Bandura argues that the construct of self-efficacy, a specific task performance capability, is a construct embedded in a theoretical system and differs from confidence which refers to strength of belief. Perceived self-efficacy refers to belief that one can attain designated goals (Zimmerman, 2000). As such, the agent holds a sense in a capability level and strength of that belief. This sense influences the choices people make and their courses of action which suggests that individuals engage in tasks they feel competent and confident and avoid those which they do not. Self-efficacy judgments refer to future functioning and is assessed through a *level* (the difficulty of a particular task), *generality* (ability to transfer self-efficacy beliefs), and *strength* which is the amount of certainty to perform a task (Zimmerman, 2000).

Four experiences readily influence self-efficacy beliefs: enactive attainment, vicarious experience, verbal persuasion, and physiological reactions (Zimmerman, 2000; Usher & Pajares, 2009). *Enactive attainment* are those that depend on prior outcomes of personal experiences. *Vicarious experience* depends on self-comparison with and those outcomes attained by a model. *Verbal persuasion* in which outcomes are described “and thus depend on the credibility of the persuader” (p. 88). *Physiological reactions* include fatigue and stress which are interpreted as incapability.

Social cognitive theory suggests that among the “mechanisms of personal agency, none is more central or pervasive than people’s beliefs about their capabilities to exercise control over events that affect their lives” (Bandura, 1989, p. 1175) which operate on action through

cognitive, motivational, and affective processes. Bandura suggests that the quality of analytic thinking in a person affects performance accomplishments. Bandura noted that we avoid potentially threatening situations and activities because of our belief that we will be unable to cope with situations we may regard as risky. Coping efficiency acts as a cognitive mediator of anxiety (Bandura, 1989).

McLeod (1992) suggest that students show little enthusiasm for math as they move through school, and posits “three facets of the affective experience of mathematics” (p. 578). The first facet encompasses how students view themselves doing mathematics. The second facet involves negative and positive emotions that accompany “interruptions and blockages” that inherently occur from time-to-time in learning mathematics. The third facet relates to positive or negative attitudes as students encounter the same “or similar mathematical situations repeatedly” (p. 578).

Schiefele & Csikszentmihalyi (1995), in their study of interest in mathematics and achievement motivation, hypothesized that these are better predictors of quality of experience in math class and achievement idependent of ability. Interest was the strongest predictor of quality in-class math experience and course level, ability was a strong predictor of grades and course level, and the data suggested that past achievement “is not a strong predictor of subsequent interest” (p. 175). Additionally, quality of experience was not correlated to course level. Adelman (1999) suggested the higher up the *math ladder* a student progresses the greater the odds of obtaining a college degree. In fact, Adelman noted that moving beyond Algebra 2 is truly a gateway to university degree completion and posed a conditional hypothesis—the higher the percentage of high school graduates who take higher levels of mathematics *and* attend a 4-year college at any time, the higher their overall college graduation rate.

As it relates to mathematics, Fennema & Sherman (1978) used their 'Mathematics Attitudinal Scales' and found significant attitudinal differences between high school males and females in their confidence in learning mathematics. For Shapiro and Williams (2012), performances and actions that are visible to others such as parents and teachers who endorse math-gender stereotypes put girls at risk for "other-as-source stereotype threats which can harm performance, confidence, self-efficacy, and interest" (p 180). Other-as-source stereotype threats emerge when in a stereotype-relevant situation, one's performance has the possibility of confirming to others "that the stereotype is true about one's own, or one's group's abilities" (p. 180). In fact, this argument may relate to Baxter, Bates, and Al-Bataineh (2016) who found that not only do males have higher levels of mathematics self-efficacy and math confidence than females but also those students who enroll in lower level math courses have lower levels of mathematics self-efficacy.

Zimmerman (2000) argues that measures of self-efficacy has discriminant validity in predicting multiple academic outcomes. Pajares and Kranzler (1995) studied the relationship between students' self-efficacy and anxiety reactions regarding mathematics and found them negatively correlated, and only self-efficacy was predictive of mathematics performance (as cited in Zimmerman, 2000). Galassi, and Ware (1985) found that self-efficacy beliefs rather than math anxiety are more predictive of math performance (as cited in Zimmerman, 2000).

Betz and Hackett (1983) defined self-efficacy expectations regarding mathematics as perceptions of performance capability in relationship to math problems, everyday math tasks, and mathematics-related college coursework. They later distinguished mathematics self-efficacy from other measures of attitudes toward mathematics because it is a situational or problem specific assessment of an individual's confidence in her or his ability to successfully perform a

task (Hackett & Betz, 1989). These researchers found mathematics self-efficacy of college males stronger than those of college females, which contradict the findings of Hall and Ponton (2005) comparing Calculus I and Developmental Math students. Mathematics self-efficacy importantly related to career decision making especially for science-based majors, and math related careers (Hackett, & Betz, 1989). Those with stronger mathematics self-efficacy expectations reported lower levels of math anxiety, more years of high school math, higher levels of confidence, and a greater tendency to view math as useful. Mathematics/science self-efficacy contributed significantly above measures of prior achievement and mathematics aptitude and shown to contribute to academic persistence 4 to 8 years later (Larson, et al., 2014).

Pajares and Miller (1995) hypothesized that “individuals’ judgments to solve math problems, to perform math-related tasks, or to succeed in math-related courses entail substantively different judgments of mathematics” (p. 192). It was found that confidence to solve mathematics problems was a powerful predictor of ability to solve those problems than was confidence to perform math-related tasks or confidence to earn high grades in math-related courses. Pampaka, Kleanthous, Hutcheson, and Wake (2011) constructed a measure of mathematics self-efficacy (MSE) based on seven competences: costing a project, handling experimental data graphically, interpreting large data sets, using mathematical diagrams, using models of direct proportion, using formulae and symbolic mathematical. The findings indicate higher mathematics grades with higher scores in the MSE scales. Statistically significant positive correlations were also found, suggesting that the MSE score of the students can predict their achieved grade.

Math self-efficacy has been studied among middle school students to develop instruments and found mastery experience as the most powerful source (Usher and Pajares, 2009).

Interestingly, among college and non-college Latinas, all with low mathematics trajectories and negative recollections of math, the college girls mentioned math and their lack of mastery of the content, and one college-going girl developed a strategy to improve her math grades by relying on a family member as a vicarious source (Zaragoza-Petty, & Zarate 2014).

School Level Factors

Historically, a wide array of concerns about school factors on academic achievement have ranged from quality of secondary school English teachers (Johns Jr., 1954) to differences between private and public schools (Finger, & Schlesser, 1963). Student body characteristics, instructional personnel characteristics, and types of programs and finances, have also been analyzed and correlated to student achievement among minority students (Dyer, 1968).

One level of interest with respect to learning relates to doing homework (Landers, 2013). However, the effects of homework on outcomes other than achievement should be further studied (Cooper, Robinson, & Patall, 2006). Peer relationships and friendships as they relate to achievement have been studied (Ryabov, 2013; Schwartz, Kelly, Duong, 2013) as well as belonging in the context of school and neighborhood among Latino youth (Maurizi, Ceballo, Epstein-Ngo, & Cortina, 2013). A growing body of research continues to focus on teacher-student relationships as it relates to student academic success (Bernstein-Yamashiro, & Noam, 2013) and teacher mathematics knowledge and skill with respect to time on the job (Schmitt, 2013). Even teachers' perceptions of school climate have received treatment (Bear, Yang, Pell, & Gaskins, 2014).

In their development of Hispanic Academic Advancement theory, Jodry, Robles-Piña, and Nichter (2004) informed their conceptual framework with school sub-factors, viz., school-support (caring faculty/staff, caring school environment, and collaboration initiated by school with families and communities), school-motivation (faculty/staff valued students; students seen

as assets, students provided good role models, faculty/staff advocated for students and made students feel safe at school), and school-education (faculty/staff had high expectations for achievement and behavior, school provided programs addressing students' needs, school valued language and culture by providing role models in the faculty, using culturally and linguistically responsive pedagogy, and school viewed parents as assets).

del Carmen Salazar (2013) relied on qualitative research to suggest that a humanizing pedagogy promotes liberation for educators and students. "The application of Freire's ideas in the context of education in the United States and other countries has been a challenge for educators" (p. 127). Rodriguez (2012) proposes a *praxis of recognition* framework for educational theory and practice for policy makers interested in the well-being of Latina/o youth. This proposed framework is far more than just advocating for individual teacher activism. The well-being of Latina/o youth seemingly would relate to dropout prevention, sense of self, and cultural sensitivity.

Dropout

The National Center for Educational Statistics defines dropouts as students who no longer attend school and have not attained a high school level of education. Since the 1990s, although the overall dropout rate continues to fall, Hispanics continue to register the highest among all groups (U.S. Census Bureau, 2013). As it relates to Latinas, in 2012, the dropout rate was above 11percent. Notwithstanding, the number of high school graduates for Hispanics continue to rise the fastest among all groups.

The dropout issues among Chicana/os remain. Yosso and Solórzano (2006) used census data to estimate that out of 100 elementary school age Chicana/o students, 54 will drop out of high school. Of the 46 who graduate, 26 will continue on toward postsecondary education, and 8

will earn a baccalaureate degree. Of these, “less than 1” will earn the doctorate degree. For Yosso and Solórzano, they suggested that schools continue to ignore the needs of Chicana/o students, and even at the graduate school level, these students feel ignored and isolated. For Valenzuela (1999), she argues that schools have a subtractive effect on students which may factor in to school leaving. Valenzuela described subtractive schooling as the negative impact felt by students as they experience, for example, a loss of culture which includes use of language and generalized cultural references.

Covarrubias (2011), argues that Chicanos and Chicanas in the pipeline needs to be fully understood. For Covarrubias, the “educational pipeline obscures differences in educational outcomes associated with the intersection of race, gender, and noncitizenship status” (p. 95). As such, this research goes further than Yosso and Solórzano and disaggregates the data. Using the March 2009 Supplement of the Current Population Survey, an additional factor of wealth was added. Chicanas were found to dropout of high school at lower rates than Chicanos, but they dropped out of college at a higher rate (46%) than Chicanos (45%). In fact, native Chicana’s push-out rates decreases as family income rises (first, 41% and fourth, 7%). And foreign-born naturalized and U.S.-born Mexican origin women from the third quartile are pushed out at rates of 41% and 11%, respectively.

The effects of dropout have far reaching consequences, such as less effective parenting, lower earnings, and less democratic participation, which make it clear the need for dropout prevention (Tyler & Lofstrom, 2009). Tyler and Lofstrom identified two categories of prevention intervention. In one category, dropout prevention is the primary goal and targets specific students or groups. In the other category, the broader goals go beyond at-risk students. According to Tyler and Lofstrom, four mechanisms are deployed to lower dropout rates: increasing school

attendance, increasing student school engagement and learning, building student self-esteem, and helping students cope with the challenges and problems that contribute to the likelihood of dropping out (p. 89). Of significance is the high school model that includes a “reorganization into smaller learning communities that feature a curriculum designed to prepare all students for high-level English and math courses, along with measures to increase parent and community involvement in the school” (Tyler & Lofstrom, p. 91).

Doll (2010) teased apart national longitudinal studies such as NELS:88 and ELS:2002 to identify dropout antecedents. The researcher accounted for a plethora of nationally representative studies on dropout antecedents not amassed previously. It was found that employment and pregnancy ranked highest among the factors along with the notion of students not liking school. With respect to ethnic groups, Hispanics had much higher rankings in factors such as pregnancy and getting married as well as having to work and home responsibilities. Within the NELS:88 data, it was found that Hispanics were more likely to indicate that they did not feel as safe in school. Of interest to Doll, was that English Language Learners reported higher rates of dropout antecedents. These antecedents related to absenteeism, pregnancy, and thinking they could not complete course requirements or would fail competency tests.

Teacher Cultural Background

Some researchers suggest that “school systems should recruit and retain teachers from the Latino community who are aware and knowledgeable of Latino culture, history and literature” (Zambrana & Zoppi, 2002, p. 49). However, other researchers suggest that teachers need to engage more culturally responsive teaching which is defined as “using the cultural charactersitics, experiences, and perspoectives of ethnically diverse students as conduits for teaching them more effectively” (Gay, 2002, p. 106). Here, the basic assumption includes the

notion that “when academic knowledge and skills are situated within the lived experiences and frames of reference of students, they are more personally meaningful, have higher interest appeal, and are learned more easily” (p. 106).

Cuturally responsive teachers not only match instructional techniques to their diverse students’ learning styles, but also incorporate autobiographical case studies, motion and movement, and develop “rich repertoires of multicultural instuctional examples” (Gay, 2002, p. 113). Science teachers can be encouraged to reflect on their actions as it relates to becoming a culturally responsive teacher, and they can reflect about developing culturally responsive practices (Bottoms, Ciechanowski, Jones, de la Hoz, & Fonseca, 2017). However, teachers may hold beliefs about culturally proficient teaching, and at the same time they may hold deficit thinking beliefs (Guerra & Wubbena, 2017). However, it was found that using a visual intervention program, *Yo Veo*, teachers in two schools with large portions of Latina/o students were able to improve classroom management strategies and multicultural teaching practices (Chapman & Hall, 2016).

Using surveys and classroom observations of teachers in a mostly minority schools, it was found that while teachers expressed the need to have strong student-teacher relationships, the need to adjust their instruction to meet the needs of students, and the need to have parental involvement which contributes to academic success, these teachers were observed to practice minimal amounts of culturally proficient teaching (Guerra & Wubbena, 2017).

For some researchers, culturally responsive teaching does not problematize race and racism “as they relate to the sociopolitical pattern of schooling in the U.S.” (Brown-Jeffy & Cooper, 2011, p. 66). These sociopolitical patters have factored into the treatment of “status-oppressed minority groups” who, “sensitive to their treatment in school by teachers,

administrators, and peers will look for answers in these social relationships" (p. 67). This "cultural incongruence," within culturally responsive teaching, is addressed with the critical race theory framework. For these theorists, culturally responsive teaching may be conceptualized within five principles: (1) identity and achievement, (2) equity and excellence, (3) developmental appropriateness, (4) teaching the whole child, and (5) student-teacher relationships. These theorists argue that a goal of educational research "is to find a way to teach all students regardless of their ethnicity, race, cultural background, or community of origin," which makes culturally relevant pedagogy "a promising area of research in determining the actual effects of the mismatch of the culture of particular populations within the educational system and the effects of schooling on the learning outcomes" (p. 57).

Cooper (2013) used case study methodology with five 10th grade Latinas residing in Los Angeles to investigate how they perceived their learning environments in classes and how these perceptions influenced emotional disengagement or engagement. Cooper reported that cultural differences influenced perceptions of care which made students perceive that "white teachers did not understand them" (p. 506). Torres and Hurtado-Vivas (2011), used participatory action research and found that the lack of understanding by school personnel of the real roots of marginalization of Latino students and their parents from schools becomes problematic. These researchers posited that this lack of understanding leads to socially and culturally irresponsive teaching. Bohon, Macpherson, & Atiles, (2005) noted that those in authority need to be better educated on issues of cultural sensitivity and have a better understanding of cultural differences. For instance, there should be awareness among educators about the social and family hierarchy present within Hispanic culture.

Norton and Bentley (2006) used multicultural feminist critical narrative inquiry to investigate cultural responsive teaching and to argue that not only race and ethnicity should be the focus of classroom spaces, but teachers need to enact and to recognize that "spirituality as an aspect of culture is also significant because increasingly diverse spiritualties are being represented in public schools" (p. 53). These researchers used the narratives of an elementary school Latina teachers as well as several Puerto Rican and Dominican parents to advance the notion that home(land) pedagogies, as spiritual practice, are part of the lives of students, and these practices help Latina youth and children identify with (un)seen forces, engage in collectives, assert their cultures, affirm positive student identities, and manifest knowledge to sustain themselves and others. Norton and Bentley posited that teachers are part of a spiritual practice, *educación*, which involves relationships that necessitate teaching and learning oppression. These researchers argue that the process of *educación*, conceptualizes Latina/o youth and children as active, knowing, spiritual recipients of lessons within adult-child dyads. They found that one teacher, Jesse, affirmed the multiple identities of Latina students by maintaining a close connection though speaking Spanish and working with students to create multicultural events. For these researchers, such actions bridge school and cultural worlds that lie outside of school. The implications here are seen in research conducted by Gutierrez, Willey, and Khisty (2011) with elementary school students that found students in their mathematics discussion included the use of Spanish to make sense of difficult tasks. In this study, the researcher concluded that students skillfully used their bilingualism as untapped and underutilized resources.

In a sample of middle school Hispanic students, Chun and Dickson (2011) examined mediation effects of sense of school belonging and academic self-efficacy with a sample of

seventh-grade students enrolled in a school district near the United States-Mexico border self-identified as Hispanic (*n* = 478; 51.5% female) and with 89.2% as second generation or greater. It was found that "teachers' practices of using various instruction methods, incorporating the importance of cultural diversity and pluralism during instruction, and affirming the value for languages other than English contributed to Hispanic students' feeling connected with others and feeling capable of performing better in their school settings" (p. 1590).

In their development of an innovation configuration matrix, Aceves and Orosco (2014) noted that cultural responsive teaching practices should be part of the curriculum. These researchers reviewed studies that included at least 50% of linguistic different learners. They concluded that culturally responsive methods assist teachers in their understanding of students' identities develop and impact learning. In addition, they found that culturally responsive teachers have high expectations and engage students in critical thinking. These researchers noted that collaborative learning methods; heterogeneous learning teams; responsive feedback (e.g., ongoing and immediate feedback); modeling while providing examples based on cultural, linguistic, and lived experiences; and instructional scaffolding are key instructional techniques with cultural responsive teaching. These researchers, building on the cultural responsive teaching literature, argue that problem solving should include cultural and linguistic issues that students need to improve their lives, which include how to self-regulate learning. For Aceves and Orosco (2014), cultural responsive teaching is not just good teaching, but practices that teachers consciously make to connect students' cultures, everyday experiences, and languages to academic achievement while preserving cultural and linguistic identities (p. 22). Relating to these arguments, it was found that teachers who report cultural responsive behaviors, their behaviors were positive and significantly related to reading outcomes (Lopez, 2016).

Although many of these studies address the issues of culturally responsive teaching with different population samples, high school Latinas have not been sufficiently sampled. Neither is there robust examinations of specific Latino cultures.

Perceptions of minority students as it relates to minority and non-minority teacher favorability has been studied (Cherng & Halpin, 2016). Although the sample was from among middle school and grade 9 students, it was found that students have more favorable perceptions of Black and Latino teachers than White teachers and that Black students have favorable perceptions of Black teachers, but this was not the same for Latino students and Latino teachers (Cherng & Halpin). From the perspectives of teachers, among low-income Black and Hispanic students, their high school teacher perceptions of students' connectedness, regardless of how a student viewed connectedness, were associated with teachers having higher perceptions of future educational attainment. However, Hispanic students' teachers reported lower perceptions of educational attainment (Mahatmya, Lohman, Brown, & Conway-Turner, 2016).

Percent of Minority Students

The literature suggests that despite efforts to desegregate schools, the problem of segregation exists and the effects must be understood. Gándara (2014) suggest that segregation has a broader impact on English Language Learner than other factors such as school resources and structure. Researchers continue to examine the effects of test scores not only by economic composition but also by ethnic composition of schools (Mickelson, Bottia, & Lambert, 2013; Munk, McMillian, & Lewis, 2014). For instance, a statistically significant negative relationship to mathematics achievement was found using two-level hierarchical linear modeling that analyzed 98 regression effects nested within 25 primary studies (Mickelson, Bottia, & Lambert, 2013). Along these lines, Newton (2010) found that for the only school-level predictor that was

statistically significant—percent minority students in a school—a 1-unit increase in the percent of minority students resulted in a 5.92-point drop in math achievement controlling for all student background variables and other school-level variables. Orfield and Frankenberg (2014) found that the effects of segregation on Latino students are of concern. They found that using descriptive data, schools that are predominantly Black or Latino (81% to 100%), more than 75% of the students are also enrolled in schools with 70% or more students live in poverty. In fact, Orfield and Frankenberg (2014) noted that 43% of all Latinos in the United States are in 90% to 100% minority schools in 2011 which represents a 20% increase since 1968. High levels of segregation and math course taking have been found to be related; however, Black students have a better chance of enrollment in high level high school math courses when the proportion of White students decrease (Kelly, 2009).

These studies suggest that the effects of segregation on academic achievement should be studied and further understood especially taking SES into consideration.

Girls and Math Course Taking

Catsambis (1994) in a study to explore the drop-in women's participation in mathematics during adolescence by tracing mathematics-related learning opportunities, attitudes, and achievements from middle school used the NELS:88 database and logistic regression on a sample of only public school students. The sample was drawn from among 24,500 students in the representative dataset. It was found that especially at grade eight, differences in mathematics achievement occur among racial-ethnic groups rather than between male and female students. It was also found that higher proportion of girls rather than boys were placed in different ability groups and in higher ability mathematics classes. However, in general, Latino students were overrepresented in the low-ability math classes. This researcher noted that by the eighth grade, "fewer female students than male students have decided to pursue mathematics and science

careers" and that a statistically significant number of Latinas agreed that they were afraid to ask questions in math class. Latinas, when asked whether mathematics was one of their best subjects and whether they had always done well in mathematics indicated more negatively than did other groups. The researcher concluded, that Latinas "tend to be the most disadvantaged group, since they face barriers in all three domains: opportunity, achievement, and choice" (p. 211), which suggests that seemingly gender equity may be due to school placements and course requirements rather than to young women's interest in mathematics.

Martinez and Guzman (2013) examined racial/ethnic differences across gender groups in self-reported levels of challenge in high school math and science courses. The cohort sample of approximately 1000 students from grades 6, 8, 10, or 12 from 13 high schools in the Study of Youth and Social Development provided data. The researchers used the Experience Sampling Method (ESM). The ESM data collection occurred over the course of a week. A one-way ANOVA was used to test gender differences across racial/ethnic groups in the level of challenge reported in math and science classes. No statistically significant differences were found between boys and girls across the racial/ethnic groups. However, Latinas reported the highest level of challenge. The researchers conducted multivariate regression analysis to predict students' perceived levels of challenge while in school, math, and science classes. It was found that when girls are in school, they report higher levels of challenge when they are school than not in school. When female students are in math class, they reported a higher level of increase in their level of challenge than in science class and generally even more than in the school context. These researchers noted that from their data, larger percentages of Hispanic and Black female students reported never taking courses in calculus, precalculus, or trigonometry in comparison to Asian and White students (p. 422).

Archbald and Farley-Ripple (2012) in their study of who gets access to and choose college preparatory course sequences examined whether race or SES has an influence on course placements. In their sample of 9th grade cohorts from high school students (n = 707) located in a large midwestern city, logistic regression was used to estimate models in which dichotomous classifications were either "lower" mathematics courses versus "higher" mathematics courses (p. 42). A threshold was set to distinguishing lower from higher, in that each successive dichotomous classification raises the threshold such that "categories become progressively more advanced" (p. 42). The independent variables were demograpic and prior 8th grade achievement. The former included race, gender, SES as free-lunch eligibility, and Special Education classification, while the latter included prior standardized test, scores, prior mathematics grade, level of prior mathematics course attained. Without controlling for previous achievement, at the first threshold, it was found that Hispanics were 70% less likely to move onto higher level mathematics and 63% lower for these students to be at math Integrated 2. This study found that minority students (African America and Hispanic) and those eligible for free lunch had lower probabilities of being in upper category of courses; however, when prior achievement variables are accounted for, demographic differences disappear. These researchers concluded that "grades have the largest effect: rising one letter grade roughly triples a student's odds of being in the upper versus the lower category" and further noted, that given a higher course placement in 8th grade "generally leads to a higher course placement in 10th grade, while low course placement in 8th grade makes it extraordinarily unlikely to end up in higher level mathematics by 10th grade" (p. 47). This study did not distinguish Latina students.

Byrnes (2003) investigated math achievement between Black, Hispanic, and White students using 1992 NAEP data and found that 56% of White students and 40% of the minority

students took courses beyond 1st year algebra. In addition, while 73% of White students took courses in geometry, trigonometry, or both, only about 60% of minority students did.

Riegle-Crumb (2006) noted that when students fail only one semester, this may function to discourage them from continuing. At the opposite end of performance, students who receive high grades clearly meet the prerequisites for progress on to the next course in the sequence, and teachers, counselors, and parents may encourage such students more in the presence of this tangible record of academic achievement. Deploying hierarchical linear modeling, it was found that Hispanic students begin high school at lower levels of the *math ladder* and remain at lower rungs at the end of high school. In a sample of high school Latinas (n = 598) only 32% took courses beyond Algebra 2. Among this sample of students, the researcher concluded that taking Algebra I or higher in the first year of high school seems to influence the level of math attained by students' in their senior year.

Mosqueda and Maldonado (2013) in their quantitative study that examined the relationship between Latina/o secondary school students' degree of English-language proficiency, mathematics course-taking, and 12th grade mathematics achievement. Although it was found a significant relationship between math achievement and SES, these researchers found that "course-taking resulted as the most important predictor of mathematics achievement" (p. 212). These researchers used the the first follow-up data of the Educational Longitudinal Study (ELS) data set and a subsample of 2,005 first-, second-, and third plus-generation Latinas/os clustered in 506 schools. These researchers used HLM modeling on two levels (clustering of students and within schools) and twelfth grade mathematics achievement scaled score to examine four models. One of the models showed a "statistically significant relationships between 12th grade mathematics achievement and SES, gender, teacher preparation, and school SES" (p. 212).

In fact, the third model showed that taking higher-level mathematics courses by the end of high school had a positive and large effect on mathematics achievement. Although it was found that every additional higher-level mathematics was associated with a 3-point positive difference in mathematics scores, females' scores were 1.5 points lower than of males.

Gender Stereotype

Attitudes and stereotypes about math as they relate to mathematics and gender differences have had an historical grounding in the literature (Hyde et al., 1990; Jacobs, 1991; Else-Quest, & Peterca, 2015). However, since people have been known to be reluctant to report stereotypes, or may not knowingly express stereotypes, implicit measures have been developed to examine math stereotypes (Flore & Wicherts, 2015; Ganley, et al., 2013; Nosek & Smyth, 2011;). Some researchers suggest that implicit stereotypes "associating men with STEM fields contribute to the unequal representation of men and women through a number of mechanisms" (O'Brien, Blodorn, Adams, Garcia, & Hammer, 2015, p. 177). Notwithstanding, studies continue to examine and reveal the presence of explicit and implicit stereotypes.

Flore and Wicherts (2015) noted that Steele (1997) brought to the forefront the notion of the effects of stereotype threat which refers to the behaviors associated with activated negative stereotypes. The behaviors express as a worst performance by members of a stigmatized group when the negative stereotype is confronted. Flore and Wicherts (2015) noted the seminal paper written by Steele and Aronson (1995) that focused on ethnic minorities as a group that experienced a confrontation with negative stereotypes and the resulting worse performance. The resulting line of research included gender as a group using age grouping as well as the intersection of gender and ethnicity.

In their meta-analysis of over 15 years of stereotype threat literature, Flore and Wicherts (2015) examined four moderators and an exploratory moderator of age that may have an influence on the effect of stereotype threat. These moderators included test difficulty, the absence or presence of boys during test-taking, the degree women are deemed equal in several nations, and a control condition assigned to participants in which they received no gender related information. These researchers found a lower albeit small average standardized mean difference on math, science, and spatial skills tests for girls exposed to a stereotype threat. For the moderators, none were found to moderate the effect of stereotype threat. These researchers, however, found indications of publication bias. Stereotypes as it relates to women in mathematics, continue to be researched.

Nagging questions about whether women in STEM, despite exposure to gender stereotypes about math and science, would show weaker implicit stereotyping of math as male than men and women in non-STEM fields (Nosek, & Smyth, 2011). Using implicit association tests, women with stronger implicit stereotypes participated less in math, reported more negative attitudes toward math, had less identification with math, expressed higher anxiety about math, ascribed less skill in math, performed worse on college admission tests, and participated less in pursuing a STEM degree (Nosek, & Smyth, 2011; Sadler, Sonnert, Hazari, & Tai, 2012). A stratified national random sample of undergraduate students found female interest in science shifted from 12.1% at the start of high school to 7.6% at the end of high school. However, only 9% beginning high school females not interested in STEM beginning high school become interested as compared with 21% of their males. But, beginning females who showed an interest in STEM, 45% as opposed to 70% of the males maintained a STEM interest. Is there an age

where girls become more aware of math stereotypes? The question of age as a factor in the development of math stereotype has been explored.

Kurtz-Costes, Rowley, Harris-Britt, and Woods, (2008) examined the role of gender stereotypes in the development of children's self-perceptions. They found that while fourth-grade boys reported that adults hold traditional mathematics stereotypes, for girls, the better they perceived that adults viewed girls, the higher were their own ratings of girls' abilities. Sixth- and eighth-grade boys' beliefs about adult stereotypes were associated with their assessments of boys. In sixth grade, girls who believed that adults viewed boys as better in mathematics tended to have poorer mathematics self-concepts.

Martinot, Bagès, and Désert, (2012) used direct and indirect stereotype awareness measures among French school age children. Among the goals of their study was to examine whether there are two gender math ability favorable stereotypes regarding girls which applies to children and young adolescents and another favorable to men applicable to young adults and adults. It was found that a clear gender stereotype existed regarding math ability favorable to men, and when the stereotyped targets are children and young adolescents, the stereotype is less clear favorable to boys as girls. Does math stereotype begin in young adolescence? Among Italian school age children, Passolunghi, Ferreira, and Tomasetto (2014) investigated the explicit stereotypes and automatic associations among middle childhood through early adolescence. These researchers found that 5th and 8th grade girls manifested neutral beliefs, whereas 8th grade boys favored math over girls. However, an implicit measure of automatic associations found that girls across all grades associated math with males and language with females.

Middle- and high-performing eighth-grade students, high-achieving seventh and eighth-grade students, and fourth-, eighth-, and 12th-grade students, were assigned to a stereotype or

null effect in a series of studies (Gangley, et al., 2013). In all three studies, the researchers found no stereotype threat effect. However, in Study 1 and Study 3, there was a main effect of gender where girls underperformed compared to boys, regardless of condition. While studies as they relate to gender implicit stereotypes, the intersection with ethnicity needs more exploration. O'Brien, et al., (2015) posited that there are advantages to using intersectional approaches to studying gender-STEM stereotypes and STEM participation.

Else-Quest, Mineo, and Higgins (2013) used Eccles' expectancy-value model to examine the intersection of gender and ethnicity in math and science attitudes among urban adolescents who identified as White, African American, Latino, or Asian American. They found that males reported higher self-concept and greater expectations for success in math and science. Also, gender and ethnicity interaction effects had slight variations in the magnitude of effect sizes across ethnic groups. Ethnic similarities in math and science attitudes were found, but rooted in the effects of significant ethnic group differences only when SES and years living in the United States were not included as covariates.

However, in a study to determine if negative stereotypes about the intellectual ability of Latinos and women interact to have an effect on performance, it was found that gender-based stereotype threat was significant in the sample of Latinos but not Whites. Although the researchers were unable to explain this finding, they suggested that socialization in Latino families may focus greater attention on gender which could lead to gender stereotype threat effects (Gonzales, Blanton, & Williams, 2002). Are minority women more subject to the stereotype threat?

O'Brien, et al., (2015) used a sample of women in college STEM majors across African Americans and European Americans. These researchers examined participation in STEM majors

as a function of gender and ethnicity, tested for ethnic variation in women's gender-STEM stereotypes and STEM participation, examined ethnic differences in gender-STEM stereotypes among only STEM majors and examined gender-STEM stereotypes and STEM participation among a sample of women and men. It was found that African American women were significantly more likely to be STEM majors. Consistent with the intersectionality hypothesis, African American women held weaker implicit gender-STEM stereotypes but did not differ in perceptions of the gendered nature of STEM fields.

Algebra 2

In the United States, the *Secondary School Course Classification System* defines Algebra II as a course in which topics typically include "in-depth study of linear equations and inequalities; quadratic equations; solving systems of linear and quadratic equations; graphing of constant, linear, and quadratic equations; properties of higher degree equations; and operations with rational and irrational exponents" (Bradby, Pedroso & Rogers, 2007, p. iii). The 5-digit course description code for Algebra II, 02056, carries no meaning except to distinguish it from other courses. However, Algebra II is commonly situated in a hierarchy of math courses such that Prealgebra, Algebra I, and Geometry precede and Trigonometry, Precalculus, Calculus, and Statistics proceed (Bozick & Ingels, 2007; Nord, 2011). Using the ELS:2002 dataset, Bozick and Ingels (2007) found that a common mathematics sequence of Algebra II–no mathematics was followed by 13 percent of students, the Geometry–Geometry/no mathematics sequence was followed by 8 percent of students, and the Algebra II–Precalculus sequence was followed by 7 percent of students. In addition, they found that students who take Precalculus paired with another course had the largest gains in math achievement, and those who followed the geometry–Algebra II sequence had gains in skills which included problem solving. In fact, students who took algebra II during their junior year followed by Precalculus had more correct math answers

than those who took Algebra II-no math during their senior year. How do students end up in higher level mathematics courses?

Adelman (1999) coined *math ladder*, a five-rung ladder that comprises less-than-Algebra 2, Calculus, Algebra 2, Pre-calculus, and Trigonometry, as a term that describes the progression of mathematics courses that a student experiences during the high school years. Using hierarchical logistic regression analyses using two blocks, Adelman found that for each rung climbed the odds of completing a university first degree increased by a factor of 2.59 to 1. In fact, Adelman concluded that Algebra 2 seems to be the threshold that affords students the strongest influence on obtaining a bachelor's degree (Adelman, 1999).

Unfortunately, although there has been an increase in the overall trend of students taking Algebra 2, the course content does not align across all school districts. For instance, in Michigan, a study of high school transcripts to examine the implantation of the law requiring high schools to teach Algebra 2, it was found that although courses were labeled as such the level of course work did not increase, and the course content varied across districts (Kim, et al., 2015).

Summary

The extant literature that addresses the variables of interest suggests diverse methods of investigations. The body of literature as it relates to Mexican American and high school mathematics course taking continues to grow. For those studies that exist as it relates Mexican American females, they include the use of a wide demographic and have ranged from national datasets to localized samples. Of those studies that have identified Latinos, the researchers failed to tease apart Mexican American females; hence, a need to understand these students and their success in high school mathematics exists, and this focus should not deploy deficit models.

The extant literature suggests that quantitative methods have been the main focus of the research as it relates to Latino students and have included path analysis, multiple linear regression analysis, and hierarchical linear modeling. Studies have included variables such as ethnicity, gender, SES, and measures of stereotypes. Some qualitative methods have been used, but few to no studies exist that have used mixed methods. Most of these studies do examine the effects of race and gender; however, specific ethnicity or generational status as it relates to advanced high school math course taking need to be studied using advanced mixed methods studies.

CHAPTER 3 : METHODOLOGY

Introduction

This chapter details the multistage mixed methodology (Creswell, 2015) selected by the researcher. First, a brief description of the characteristics of this method is discussed followed by a description of the population of interest. The variables of interest are then described followed by a short discussion about the study design and the sampling procedures. The variables are then discussed followed by the statistical models. The present study attempts to fill the gap in the literature by implementing qualitative and quantitative data analysis for a multistage mixed methods design, by providing an empirical study of factors relating to mathematics achievement and to completing high school mathematics beyond Algebra 2 among Mexican American high school students.

The researcher used a multistage mixed methods study since this design builds on the combination of quantitative and qualitative approaches and provides a more complete understanding of a research problem that either approach alone may not highlight as well as the notion that each stage can be its own study (Creswell & Plano Clark, 2011; Creswell, 2014; Creswell, 2015). Mixed methods can be traced to the 1950s, but during the late 1980s and early 1990s a firmer foothold and emergence of major works propelled its form as a new methodology (Creswell, 2014).

According to Creswell, mixed methods research appeals to versatility at the general, practical, and procedural levels. At a general level, it draws on qualitative and quantitative research while lessening the limitations of either. At a practical level, it appeals to researchers as a novel procedure. At a procedural level, mixed methods research strategy provides underpinnings for: 1) comparing perspectives drawn from quantitative and qualitative data analysis, 2) explaining quantitative results with qualitative data, 3) exploring qualitative data to

inform quantitative data collection instruments, 4) understanding experimental results by including the perspectives of participant, 5) having a broader perspective for the need of an intervention, and 6) developing a more comprehensive view of changes needed for marginalized groups (Creswell, 2014).

Mixed methods research collects quantitative and qualitative data, integrates the data, and uses unique designs: parallel, sequential, and embedded (Creswell, 2014). The overarching research designs for this study combines qualitative and quantitative research data with parallel sampling.

Design

Stage 1

The multistage mixed methods exploratory design (see Figure 3.1 and Appendix B.1) began with an inspection of the quantitative database. This was an assessment to determine if the variables of interest were present in the database as well as to inspect how they would inform the building of an interview protocol. The researcher determined that there existed variables of interest present in the database that would afford a possible analysis. As a result, during this initial stage, the preliminary inspection of this data included analysis of descriptive data as well as the viability of variables. No advanced or sophisticated statistical analysis was conducted. The preliminary results lent support for the structuring of the interview questions. The semi-structured interview protocol was designed, and IRB approval was submitted. IRB approval was granted (Appendix C.1). The researcher prepared for and entered into the next stage.

Stage 2

During this stage, participants engaged in face-to-face interviews. In this stage, after all the interviews were concluded and transcribed, the first step was to organize the data (Creswell, 2012). An initial exploration of the data was to get a “general sense of the data, memoing ideas,

thinking about the organization of the data," and consideration was given whether more data was needed (Creswell, 2012, p. 243). The qualitative data was examined for themes. Also, in this stage the researcher was able to modify the conceptual framework as it relates to the population of interest.

Using face-to-face interviews, the researcher gathered additional information from these students as they shared their thoughts, feelings, and beliefs about their schooling experiences. In addition, these interview data were used to disclose experiences which may confirm or disconfirm the quantitative findings.

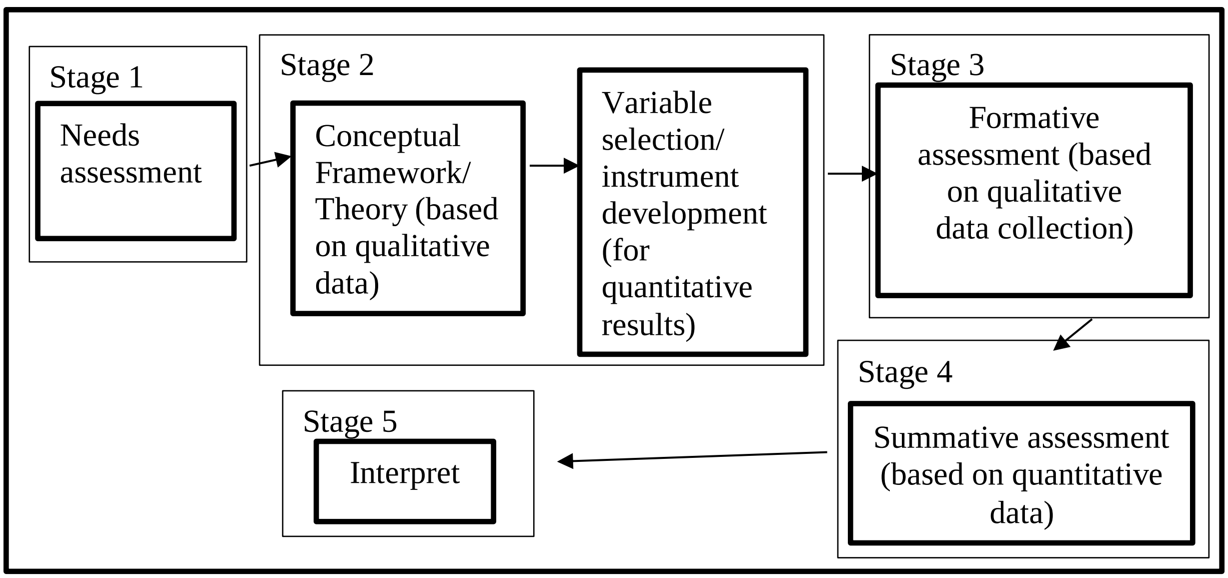

Figure 3.1. Multistage exploratory design. Adapted from Creswell, J. W. (2015). *A concise introduction to mixed methods research*, p. 58. Thousand Oaks, CA: SAGE.

I relied on a narrative three-dimension approach as an analytical tool to uncover additional information about schooling experiences it relates to mathematics. Kim (2016) notes that "narrative inquiry is a process of collaboration involving mutual storytelling between the researcher and the participants, in which both voices are heard" (p. 112). Connelly and Clandinin (1990) note that "the use of narrative in educational research is that humans are storytelling

organisms who, individually and socially, lead storied lives" and narrative is "phenomenon and method" (p. 2).

Kim (2016) posits that "education researchers realize that they need to be good storytellers and listeners to make sense of what goes on in schools and engage in dialogues among students, parents, practitioners, researchers, and policy makers" (p. 19). Kim posits that "telling stories is the primary way we express what we know and who we are" (p. 9). However, stories and narratives should be distinguished. Kim posits that narratives constitute stories and "stories rely on narratives" (p. 9).

I developed a coding scheme and used these codes to identify common themes. A second coder, who holds the rank of assistant professor in science education, examined the coding scheme. Any disagreements were discussed until agreement was met. The qualitative data was put through the inductive process of coding, which "is to make sense out of text data, divide it into text or image segments, label the segments with codes, examine codes for overlap and redundancy, and collapse these codes into broad themes" (Creswell, 2012, p. 243).

Themes for identification were those that are ordinary, unexpected, hard-to-classify, and, major and minor (Creswell, 2012). A saturation point was recognized where no new information was identified in the data. Finally, layering and interrelating themes was used to add more rigor to the analysis. Layering means "representing the data using interconnected levels of themes" and interrelating means to connect the themes "to display a chronology or sequence of events" (Creswell, 2009, p. 252).

In the next stage, since no instrument was developed for collection of quantitative data, the qualitative data was used to narrow the selection of variables from a national dataset, ELS:2002.

Stage 3

In this stage, the results of the qualitative data were used to re-examine, in a more formative assessment, the quantitative data. I used a rigorous examination of the qualitative data by applying the three-dimensional space approach (Clandinin & Connelly, 2000). Emerging from the data was first-person oral accounting or retelling of personal or social experiences. In this stage, variables were identified for their presence in the database as well as missingness and response codes. Those identified variables were further examined. For instance, having positive relationships with teachers, peers, and parents afforded analysis of the teacher relationship variable.

In the formative assessment during this stage, the qualitative data sources were re-examined in order to lend credence to the selection of the final set of variables. This assessment afforded the ability to identify possible factors for analysis, to get a better understanding from first person stories, and to clarify the variables for a rigorous test in the following stage. Ollerenshaw and Creswell (2002) noted that "researchers narrate the story and often identify themes or categories that emerge from the story" (p. 332).

In restorying, I used a three-dimensional space approach, which is based on Dewey's philosophy of experience conceptualized as personal and social (Clandinin & Connelly, 2000; Ollerenshaw & Creswell, 2002). This approach is an analysis of qualitative data from three perspectives: Interaction, Continuity, and Situation or Place.

Stage 4

During this stage, the researcher decided on and selected the final set of variables for the summative assessment. The major emphasis in this stage was to analyze the quantitative data using appropriate statistical tests.

Also, a factor analysis was conducted to create a composite variable for sense of belonging since this variable was unavailable in the dataset.

Stage 5

The two databases were then integrated. This integration afforded a better understanding of either sets of data. The data allowed for interpretation. The qualitative results were used to provide more depth, insight, and texture of the quantitative data. Creswell (2014) suggests that the interpretation should follow the analysis of the stage results.

Sampling Strategy and Data Collection

Sampling in mixed methods design has been discussed (Creswell, 2012; Collins, Onwuegbuzie, & Jiao, 2007; Onwuegbuzie, & Collins, 2007). Sampling design "plays a pivotal role in determining the type of generalizations that is justifiable….whereas large and random samples tend to allow statistical generalizations, small and purposive samples tend to facilitate analytical generalizations and case-to-case transfers" (Collins, Onwuegbuzie, & Jiao, 2007, p. 273).

For this study, the parallel relationship of the samples for the qualitative and quantitative components suggests that the samples for either component for the research are different but drawn from the same population of interest. Consequently, the qualitative phase engaged participants who met similar demographics as the population of interest. Although Creswell and Plano Clark (2011) suggest that participants come from those in the quantitative phase, access to participants in the first phase of the present study imposes a limitation.

Qualitative Sample

To obtain the qualitative data, a purposeful sampling was done to identify women for the semi-structured interviews (N = 5). Four of the participants are college age students attending a state college in a large, southeastern state. One is a freshman, two are sophomores, and the other

a junior. The other participant graduated from college with a bachelor's degree and is a first-year middle school science teacher. The sample inclusion criteria fit the demographics of female, Mexican descendent who identify as first, second or third generation and completed high school with math credits beyond Algebra 2. Taken into consideration was high school graduation or three years after high school graduation. All semi-structured interviews were electronically recorded, and during these interviews, I recorded brief field notes. I interviewed all participants in a mutually agreed upon place—the college's cafeteria—except for the teacher since we met in her classroom. Each interview lasted approximately half an hour and was without interruptions.

Quantitative sample

The quantitative data comes from the ELS:2002 database which provides a workable sample of Mexican descendent female students (*n* = 710) from a larger national, weighted sample of 2,257 Hispanic students who represented 13.6 percent of the target population.

The ELS:2002 database represents a national probability sample of 752 public, Catholic, and private schools from which 15,362 out of 17,591 eligible selected sophomores completed the base-year questionnaire. The base-year data collection included 13,488 parents, 7,135 teachers, 743 principals, and 718 librarians (Ingels, Pratt, Rogers, Siegel, & Stutts, 2005). A two-stage sample selection process was used for ELS:2002 with schools selected using a probability proportional to size (PPS), then a random sample selection of approximately 26 students per school were selected from these lists with an oversampling of Asian and Hispanic students (Ingels, Pratt, Rogers, Siegel, & Stutts, 2005).

ELS:2002 represents a longitudinal study of high school students in the United States and seeks to provide trend data about their critical transitions. The ELS:2002 study follows students as they proceed through high school and into postsecondary education and accounts for those

who drop out as well as those who begin careers immediately after high school. The 2002 sophomore cohort was followed at 2-year intervals. Data collected related to educational processes and outcomes, pertaining to learning, predictors of dropping out of high school, and high school effects on access and success in postsecondary education and the workforce (Ingels, Pratt, Rogers, Siegel, & Stutts, 2005).

The ELS:2002 dataset allows for robust statistical power, given the sample size (Hinkle, Wiersma, & Jurs, 2003). The ELS:2002 study was designed to be comparable with other longitudinal studies. These studies include the National Longitudinal Study of the High School Class of 1972 (NLS:72), the High School and Beyond longitudinal study of 1980, and National Educational Longitudinal Study of 1988 (NELS:88; Ingels, et al., 2005). The base-year (2002) data collection instruments for the Education Longitudinal Study of 2002 (ELS:2002) consisted of questionnaires for students, parents, teachers, school administrators, and librarians. In addition, a math and reading achievement test, and a school observation form for facilities were included. The first follow-up data collection instruments comprised seven questionnaires and another mathematics achievement test (Ingels, et al., 2005).

Sample sizes used in this study were as follows. The final analysis includes 90 clusters and 530 total students which made for an average cluster size of 5.71 students. Clusters with only one student were not used in the analysis. Regional distribution was approximately northeastern (1.5%), midwestern (14.4%), south (31.6%), and west (52.5%).

An argument in favor of the importance of the cluster sample size over the level-1 sample size has been advanced (Bell, Morgan, Kromrey, & Ferron, 2010). Notwithstanding, threats to statistical power exists as the number of groups falls below a threshold, and less power creates an unacceptable risk of not detecting cross-level interactions (e.g., between schools and students);

therefore, an adequate number of individual observations and adequate number of groups are needed (Garson, 2012). Power of .80 and alpha .05 were used.

A design effect, $[1 + (n - 1)\,\rho]$, where ρ the intraclass correlation (ICC), was calculated for both sets of models. The results were 1.97 for the listwise deletion and 2.98 for the imputed models. These are based on the intercepts only model.

Sample sizes were calculated using $\gamma = 2.802SE(\gamma)*(\sqrt{(\tau^2 + \sigma^2)} / \sqrt{n})$. The sample sizes needed were 1708 and 1949 for the listwise and imputed models respectively using the results from the mathematics achievement model. Design effect affects the accuracy of the standard error of the parameters and if greater than 1 the model is less efficient, and power affects tests of the random slope variances at school level (Snijders, 2005).

For the logistic model, and for the same power and alpha level, the sample size is 181 using .60 as a hypothesized value as an expected probability of Mexican American high school girls to take Algebra 2 and .30 as a hypothesized expectation.

Given the unbalanced cluster sizes, full information maximum likelihood (FIML) estimator was used for the continuous dependent variable and Gauss-Hermite Quadrature estimation was used for the dichotomous dependent variable (Raudenbush, Bryk, Cheong, Congdon, & Du Toit, 2011). These estimators were used with the statistical analysis. Given the nature of the data structure, weights were applied as recommended (see Carle, 2009 for a discussion).

Measures and covariates

The factors and covariates for testing emerged from the qualitative data. The researcher, acting as the instrument, collected qualitative data using semi-structured interviews that lasted approximately 30 minutes each. From this data, the researcher used the emerging themes to

determine and to select the variables for the next stage. For quantitative data, the researcher identified variables from a ELS:2002 national longitudinal database survey.

Two dependent variables were examined. One was continuous (BYTXMIRR) since it was a standardized measurement of mathematics achievement. The other (F1RACADC) was dichotomous and discrete and had the measurement of being either present or absent.

Variables were used at two levels. Variables used at the student level (L1) included: social economic status (BYSES1), generational status (BYGNSTAT), sense of belonging (BELONG), parent expectation (BYPARASP), homework rules (BYP69B), Math self_efficacy (BYMATHSE), number of AP courses (F1RAPMA), and seeing counselor for college advise (F1S48A). Variables used at the school level (L2) included: teacher encouragement relationship (BYTSTREL), dropout prevention (BYA03R), percentage of Hispanic teachers (F1A32A), and percentage of minority students (CP04PMIN). The operational definitions of these variables will follow.

It is well known that listwise deletion (casewise analysis) utilizes only records with all data points present. Any case missing at least one data value is excluded from analysis. One advantage of this method is that all values are used in the analysis, which means simple implementation and may yield more accurate parameter estimates. However, missing data may reduce representative sample size, thus bias parameter estimates and reduce statistical power.

Cox, McIntosh, Reason, and Terenzini (2014) noted that researchers can ill-afford any unnecessary loss of statistical power. These researchers also noted that rarely do researchers access full datasets from survey research. Keeping these issues in mind, the second set of models will include imputed data. Scheffer (2002) suggested disadvantages of using imputed data include data that may influence the imputation and data that may be seen as “NOT real data” that

influences variance estimates needed to reflect uncertainty. In addition, the use of single imputation gives reduced variance estimates, so the uncertainty due to imputation may not be reflected. Advantages of using imputed data include the use of non-discarded data and the use of a complete dataset for analysis (http://www.massey.ac.nz/~wwiims/research/letters/).

Missing data analysis was not conducted because the researcher wanted to conduct analysis on listwise deletion (non-imputed) and imputed datasets.

Multiple Imputation

Three major assumptions provide the rationale for treating data with missing data (Donders, van der Heijden, Stijnen, & Moons, 2006; Scheffer, 2002). Data could be not missing at random (NMAR), missing completely at random (MCAR), or missing at random (MAR). NMAR suggests that the value of the unobserved variable itself predicts missingness. For instance, high income respondents may skip certain questions. MCAR data suggests that neither the variables in the dataset nor the unobserved value of the variable itself predict whether a value will be missing. For example, some respondents may be selected to answer additional questions, or twins may not answer a particular question. MAR data suggests that a missing variable depends on whether other variables (but not itself) can predict missingness. For example, women may decline to answer a question. MAR also relates to ignorability, which relates to the notion that the probability of missingness does not depend on the missing information itself.

As noted earlier, data analysis with only complete cases may lead to biased estimates, as such, the use of multiple imputation has been implemented. Such imputation techniques rely on direct maximum likelihood or stochastic techniques such as multivariate normal distribution (MVN) or fully conditional specification (FCS). MVN assumes a joint distribution of the imputed variables, while FCS considers that some imputed data have dichotomous data (Lee & Carlin, 2010; Snijders & Bosker, 2012).

In the present analysis, SAS software was used to conduct the imputation. The imputation algorithm was FCS, which depends on multiple input chained equations (MICE). Twenty imputed datasets were created; however, only the first five were selected since these can serve as a sufficient amount (Royston, 2004). The proportions of missing variables of interest are noted (see Table F.1). The imputed variables included sense of belonging (BELONG), parental expectation (BYPARASP), math self-efficacy (BYMATHSE), rule for home-work (BYP69B), seen counselor (F1S48A), dropout prevention (BYA03R), teacher student relationships (BYTSTREL), percent of minority students (P_MINSTU), percent of Hispanic Teachers (P_HISPTC).

Response variables

Math IRT score (BYTXMIRR). This variable indicates an estimate of the number of items a student would have answered correctly had she or he responded to all 72 items in the ELS:2002 math item pool. The score is a sum of probabilities which are taken into account when computing this score. IRT accounts for each test item difficulty, discriminating ability, and a guessing factor. IRT uses the overall pattern of correct and incorrect responses to estimate ability and compensates for a low-ability student guessing correctly on several difficult items. Enough items answered right and wrong to establish a pattern does not pose a problem for omitted items. Scoring with IRT makes it useful to compare scores from forms of different difficulty (Ingels, et al., 2004). Academic concentrator (F1RACADC). Indicates the respondent met at least one credit higher than Algebra 2. Students may take Algebra 2 before Geometry or vice versa. This variable is coded as a dichotomous variable (1 = *met requirements*, 0 = *did not meet requirement*).

Explanatory variables

Social Economic Status (SES) (BYSES1). Based on five equally weighted, standardized components which include parents' education; family income; parents' occupation prestige and

imputed if missing. The 1961 Duncan index determined the occupation prestige values (Ingels, et al., 2004). This is a continuous variable and standardized (see Table E.1 and Table F.1.).

Generational status (BYGNSTAT). Indicates whether the participant is newly immigrated, first generation (i.e., participant was born in the United States, but mother was born in Puerto Rico or a non-US country), or second or more generation (i.e., both participant and their mother were born in the US). This variable was dummy coded with newly immigrated as the reference group. This variable is recoded (newly immigrated as Generation 1; first generation as Generation 2; second or more generation as Generation 3).

Sense of belonging (BELONG). A factor composite of three variables: *In class often feels put down by teacher* (BYS20H)*; In class often feels put down by students* (BYS20I), *and Does not feel safe at this school* (BYS20J). Factor analysis was conducted (see Table G.1). This variable was group mean centered and created by the researcher.

Parent expectation (BYPARASP). This variable is a composite variable. Converted to a dichotomous variable (0 = *less than Bachelor's degree,* 1 = *earn at least Bachelor's degree*).

Homework rules (BYP69B). Indicates family rules for home-work. This is a dichotomous variable coded (0 = *no*, 1 = *yes*).

Math self_efficacy (BYMATHSE). A factor composite of five variables: *Can do excellent job on math tests* (BYS89A); *Can understand difficult math texts* (BYS89B); *Can understand difficult math class* (BYS89L); *Can do excellent job on math assignments* (BYS89R); *Can master math class skills* (BYS89U). This is a continuous variable and standardized.

Number of Advanced Placement (AP) math courses (F1RAPMA). A variable to indicate the total Carnegie units which is equivalent to a one-year academic course taken one period a

day, five days a week, in Advanced Placement/International Baccalaureate (AP/IB) Math. This is re-coded as dichotomous (0 = *none*, 1 = *at least one*).

Counselor Relationship (F1S48A). This variable describes whether the respondent has gone to his or her high school counselor for college entrance information. This is coded as dichotomous (0 = *no*, 1 = *yes*).

Teacher Encouragement Relation (BYTSTREL). This variable provides a scale measure of the respondent's perceptions of student-teacher relations. Higher values indicate more positive student-teacher relations. The variable, created through factor analysis, is a continuous variable and standardized. The coefficient of reliability (alpha) for the scale is .73 (Ingels, et al., 2004).

Dropout prevention (BYA03R). A variable that indicates the school has a dropout program. This is coded as dichotomous (0 = *no*, 1 = *yes*).

Hispanic Teachers (F1A32A). This variable provides a measure of the percentage of full-time Hispanic teachers. This variable comes from the Administrator Questionnaire and relabeled (P_HISPTC). This variable was grand mean centered, with mean = 0 and keeps its standard deviation.

Percent of Minority Students (CP04PMIN). This variable comes from the Common Core of Data 2003-2004; Private School Survey 2003-2004 (Ingels, et al., 2004). This indicates the percent minority students in the school. This variable comes also from the Administrator Questionnaire and was relabeled (P_MINSTU). This variable was grand mean centered, with mean = 0 and keeps its standard deviation.

Data Analysis

Qualitative Data

For qualitative data analysis, I used a three-dimensional space approach, which is based on Dewey's philosophy of experience conceptualized as personal and social teased apart into

interactions, continuity, and specific situations or physical places (Clandinin & Connelly, 2000; Ollerenshaw & Creswell, 2002). Interaction involves personal and social relationships. As such, I analyzed transcripts for personal experiences and highlighted interactions of the individual with parents, teachers, and peers. Continuity has a time dimension. This afforded analysis of the transcripts for information about past, present, and future experiences. Situation in the landscape of the storyteller affords an analysis of place. I looked at interactions, continuity, and specific situations or physical places as an analytical tool (see Table 3.1). I used qualitative analysis software, NVivo11, for identifying themes which were coded.

Table 3.1. Three-dimensional space narrative structure

Interaction	Personal	Inward reflection on feelings, hopes, and moral dispositions
	Social	Outward view of existential conditions with other people, their assumptions, and perspectives
Continuity	Past	Reflection on prior experiences, feelings, memories, and stories
	Present	Look at current experiences as well as feelings and actions relating to events
	Future	Look forward to possible experiences and actions
Situation or Place		Reflect on context, time, and place situated with boundaries that include others' perspectives

Note: Adapted from Clandinin & Connelly (2000). Layout adapted from Ollerenshaw & Creswell (2002).

Philosophical Assumptions. People bring meaning to their lives, which suggests that storied texts make for personal meaning and not necessarily as factual occurrences and multiple realities come into play (Overcash, 2004; Polkinghorne, 2007; Seidman, 2013). The personal and subjective evidence imply that the epistemological nature of narrative research is through the

subjective. The researcher's values as they relate to the study is noted (Creswell, 2013) as it relates to being interested in others and their stories are of worth (Seidman, 2013).

Quantitative Data

The structure of the ELS:2002 data is nested by students within schools. As such, the researcher selected hierarchical generalized linear modeling (HGLM) for data analysis. A two level HGLM seems most appropriate given two levels of random variation among students within school and among schools (Guo & Zhao, 2000; Raudenbush, & Bryk, 2002).

The advantage of using HGLM includes the ability of the model structure to account for the variance component at the school level. An initial two-level model, student level (L1) and school level (L2) was specified in which the response variable was modeled without prior predictors.

This model, the unconditional, was developed to compare to more complex models. This unconditional model is a random effects ANOVA model

$$Y_{ij} = \mu + U_j + R_{ij}$$

where μ is the population grand mean, each group j has a 'true mean' $\mu + U_j$, and each measurement of a micro-unit within j deviates by some R_{ij} (Snijders & Bosker, 2012).

Note that U_j is a random variable. We assume independence on all variables, with group effects U_j that have a population mean 0 and variance τ^2, and the residuals having mean 0 and variance σ^2 (*population within-group variance*) (Snijders & Bosker, 2012).

The model provides the *intraclass correlation coefficient* (ICC) which is "the degree of resemblance" between micro-units, say students, within the same macro-units, say schools (Snijders & Bosker, 2012).

We can see that Var (Y_{ij}) = $\tau^2 + \sigma^2$ and the ICC, $\rho_1 = \tau^2 / (\tau^2 + \sigma^2)$. A statistical test could be conducted to test H_0 that the true between group variance is no different from 0 (Snijders & Bosker, 2012).

For the math achievement as outcome, the response variable is a continuous variable, Y_{ij} for student i in school j and X_{ij} will be an explanatory variable at the student level. The model with the variables of interest is shown here:

The NULL MODEL

$$BYTXMIRR_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

The L1 MODEL

$$BYTXMIRR_{ij} = \beta_{0j} + \beta_{1j}*(BYSES1_{ij}) + \beta_{2j}*(GEN\_2_{ij}) + \beta_{3j}*(GEN\_3_{ij})$$

$$+ \beta_{4j}*(BELONG_{ij}) + \beta_{5j}*(\ BYPARASPij) + \beta_{6j}*(\ BYMATHSE_{ij})$$

$$+ \beta_{7j}*(BYP69Bij) + \beta_{8j}*(F1RAPMAij) + \beta_{9j}*(F1S48Aij) + r_{ij}$$

The L2 MODEL

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(BYTSTREL_j) + \gamma_{02}*(P\_MINSTU_j) + \gamma_{03}*(P\_HISPTC_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}*(BYTSTREL_j) + \gamma_{12}*(P\_MINSTU_j) + \gamma_{13}*(P\_HISPTC_j) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}*(BYTSTREL_j) + \gamma_{22}*(P\_MINSTU_j) + \gamma_{23}*(P\_HISPTC_j)$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}*(BYTSTREL_j) + \gamma_{32}*(P\_MINSTU_j) + \gamma_{33}*(P\_HISPTC_j)$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}*(BYTSTREL_j) + \gamma_{42}*(P\_MINSTU_j) + \gamma_{43}*(P\_HISPTC_j) + u_{4j}$$

$$\beta_{5j} = \gamma_{50} + \gamma_{51}*(BYTSTREL_j) + \gamma_{52}*(P\_MINSTU_j) + \gamma_{53}*(P\_HISPTC_j)$$

$$\beta_{6j} = \gamma_{60} + \gamma_{61}*(BYTSTREL_j) + \gamma_{62}*(P\_MINSTU_j) + \gamma_{63}*(P\_HISPTC_j) + u6j$$

$$\beta_{7j} = \gamma_{70} + \gamma_{71}*(BYTSTREL_j) + \gamma_{72}*(P\_MINSTU_j) + \gamma_{73}*(P\_HISPTC_j)$$

$$\beta_{8j} = \gamma_{80} + \gamma_{81}*(BYTSTREL_j) + \gamma_{82}*(P\_MINSTU_j) + \gamma_{83}*(P\_HISPTC_j)$$

$$\beta_{9j} = \gamma_{90} + \gamma_{91}*(BYTSTREL_j) + \gamma_{92}*(P\_MINSTU_j) + \gamma_{93}*(P\_HISPTC_j)$$

The MIXED MODEL

$$
\begin{aligned}
BYTXMIRR_{ij} = {} & \gamma_{00} + \gamma_{01}*BYTSTREL_j + \gamma_{02}*P\_MINSTU_j + \gamma_{03}*P\_HISPTC_j \\
& + \gamma_{10}*BYSES1_{ij} + \gamma_{11}*BYTSTREL_j*BYSES1_{ij} \\
& + \gamma_{12}*P\_MINSTU_j*BYSES1_{ij} + \gamma_{13}*P\_HISPTC_j*BYSES1_{ij} \\
& + \gamma_{20}*GEN\_2_{ij} + \gamma_{21}*BYTSTREL_j*GEN\_2_{ij} \\
& + \gamma_{22}*P\_MINSTU_j*GEN\_2_{ij} + \gamma_{23}*P\_HISPTC_j*GEN\_2_{ij} \\
& + \gamma_{30}*GEN\_3_{ij} + \gamma_{31}*BYTSTREL_j*GEN\_3_{ij} \\
& + \gamma_{32}*P\_MINSTU_j*GEN\_3_{ij} + \gamma_{33}*P\_HISPTC_j*GEN\_3_{ij} \\
& + \gamma_{40}*BELONGIN_{ij} + \gamma_{41}*BYTSTREL_j*BELONGIN_{ij} \\
& + \gamma_{42}*P\_MINSTU_j*BELONGIN_{ij} + \gamma_{43}*P\_HISPTC_j*BELONGIN_{ij} \\
& + \gamma_{50}*BYPARASPij + \gamma_{51}*BYTSTREL_j*BYPARASPij \\
& + \gamma_{52}*P\_MINSTU_j*BYPARASPij + \gamma_{53}*P\_HISPTC_j*BYPARASPij \\
& + \gamma_{60}*BYMATHSE_{ij} + \gamma_{61}*BYTSTREL_j*BYMATHSE_{ij} \\
& + \gamma_{62}*P\_MINSTU_j*BYMATHSE_{ij} + \gamma_{63}*P\_HISPTC_j*BYMATHSE_{ij} \\
& + \gamma_{70}*BYP69Bij + \gamma_{71}*BYTSTREL_j*BYP69Bij \\
& + \gamma_{72}*P\_MINSTU_j*BYP69Bij + \gamma_{73}*P\_HISPTC_j*BYP69Bij \\
& + \gamma_{80}*F1RAPMAij + \gamma_{81}*BYTSTREL_j*F1RAPMAij \\
& + \gamma_{82}*P\_MINSTU_j*F1RAPMAij + \gamma_{83}*P\_HISPTC_j*F1RAPMAij \\
& + \gamma_{90}*F1S48Aij + \gamma_{91}*BYTSTREL_j*F1S48Aij \\
& + \gamma_{92}*P\_MINSTU_j*F1S48Aij + \gamma_{93}*P\_HISPTC_j*F1S48Aij \\
& + u_{0j} + u_{1j}*BYSES1_{ij} + u_{4j}*BELONGIN_{ij} + u_{6j}*BYMATHSE_{ij} + r_{ij}
\end{aligned}
$$

Given the models, the model building process follows. First the random effect for the intercept, the null model, is computed then additional models followed by addition of the level-1

then level-2 predictors (see Table 3.2). Some level-1 variables are randomized (Ma, Ma, & Bradley, 2008).

Table 3.2. Model building process for 2-level linear models for Math Achievement

Model 1	Model 2	Model 3	Model 4
No predictors, only random effect for intercept	Model 1 + level-1 (L1) fixed effects	Model 2 + random slopes for L1 predictors	Model 3 + level-2 fixed effects
Output to calculate ICC – variation in the outcome between L2 units (clusters)	Output indicates the relationship between L1 predictors and outcome	Random slope results show if the relationships between L1 predictors and the outcome vary between clusters; Model 2 information provided	Output indicates relationship between L2 predictors and the outcome; Model 3 information provided

Note: A multilevel model primer using SAS PROC MIXED. In *SAS Global Forum* (pp. 0-19).
Source: Adapted from Bell, B. A., Ene, M., & Schoeneberger, J. (2013). Retrieved from https://pdfs.semanticscholar.org/a216/864a2a2de19eb194c6523fb8566e601ffa32.pdf

For the dichotomous outcome, the response variable is a binary response, y_{ij} for student i in school j and X_{ij} will be an explanatory variable at the student level. The probability of $y_{ij} = 1$ is defined as $p_{ij} = Pr(y_{ij} = 1)$ with the assumption of a Bernoulli distribution (Guo & Zhao, 2000; Raudenbush, & Bryk, 2002).

The two-level model is shown here for the dichotomous outcome:

$$\log [p_{ij} / (1 - p_{ij})] = \beta_{0j} + \beta_{1j}X_{ij} \text{ (L1 model)}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j} \text{ (L2 model)}$$

$$\beta_{1j} = \gamma_{10}$$

The intercept, $\beta_{0j,}$ is the average log-odds of taking a high school math course beyond Algebra 2 at school *j*, and β_{1j} represents the slope associated with $X_{ij,}$ a student level predictor for student *i* in school *j* that shows the relationship between the predictor and the log-odds of taking a high

school math course beyond Algebra 2. The intercept, γ_{00}, represents the log-odds of taking a high school math course beyond Algebra 2 at school *j*, γ_{01} shows the slope associated with school level predictor, W_j, u_{0j} is an error term, unique effect for school *j*, and γ_{10} as the average fixed effect (constant) of the student-level predictor across schools. The fixed effect, γ_{10}, suggests the L2 model is a random intercept only model (Guo & Zhao, 2000; Raudenbush, & Bryk, 2002). The full combined model then becomes:

$$\log [p_{ij} / (1 - p_{ij})] = \gamma_{00} + \gamma_{01}W_j + u_{0j} + \gamma_{10}X_{ij} = \eta_{ij}$$

or, rearranging $$\eta_{ij} = \gamma_{00} + \gamma_{10}X_{ij} + \gamma_{01}W_j + u_{0j}$$

The log-odds of taking a math course beyond Algebra 2 for student *i* in school *j* is now determined by the log-odds of taking math beyond Algebra 2 by a typical student at some school γ_{00}, the effect at L1 ($\gamma_{10}X_{ij}$) and at L2 ($\gamma_{01}W_j$) with L2 error u_{0j} [$u_{0j} \sim N(0, \tau_{00}$].

For purposes of interpretation, the log-odds of success will be converted to probabilities:

$\phi_{ij} = e^{\eta_{ij}} / (1 + e^{\eta_{ij}})$ where $e \approx 2.72$, ϕ_{ij} is the probability of success, and 1- ϕ_{ij} is the probability of failure. The odds ratio to reflect the predicted change in odds between students with differing values of the student-level predictor would be calculated by computing $e^{(\gamma_{10})}$. The researcher built a parsimonious model, which begins with the unconditional model which is the intercept only mode (Ene, Leighton, Blue, & Bell, 2015).

Once the intraclass correlation coefficient (ICC) was calculated, the ICC estimates how much variance in the outcome exists between school level (L2) units, the researcher added the explanatory variables and to check for model fit improvement at each level. First generation is used as the reference group. One approach for model fit is to examine the deviance change in the -2 log likelihood (2LL) or change in Akaike's Information Criterion (AIC) (Agresti, 2013; Raudenbush, & Bryk, 2002).

The model building process was done to accommodate missing data as well and imputed data. The researcher did not conduct grand mean centering on predictor variables that were either continuous variables that were standardized or binary since they reflect a “meaningful zero” value for interpretation (Ene, Leighton, Blue, & Bell, 2015, p. 4).

The models for the dichotomous outcome using the variables of interest are shown below. Some variables are not shown because the model did not converge when they were present.

The NULL MODEL

$$\text{Prob}(\text{F1RACADC}_{ij}=1|\beta_j) = \phi_{ij}$$

$$\log[\phi_{ij}/(1 - \phi_{ij})] = \eta_{ij}$$

$$= \gamma_{00} + u_{0j}$$

The L1 MODEL

$$\eta_{ij} = \beta_{0j} + \beta_{1j}*(\text{BYSES1}_{ij}) + \beta_{2j}*(\text{GEN\_2}_{ij}) + \beta_{3j}*(\text{GEN\_3}_{ij}) + \beta_{4j}*(\text{BELONGIN}_{ij})$$

$$+ \beta_{5j}*(\text{BYMATHSE}_{ij}) + \beta_{6j}*(\text{BYP69Bij}) + \beta_{7j}*(\text{F1RAPMAij})$$

The L2 MODEL

$$\eta_{ij} = \beta_{0j} + \beta_{1j}*(\text{BYSES1}_{ij}) + \beta_{2j}*(\text{GEN\_2}_{ij}) + \beta_{3j}*(\text{GEN\_3}_{ij}) + \beta_{4j}*(\text{BELONGIN}_{ij})$$

$$+ \beta_{5j}*(\text{BYMATHSE}_{ij}) + \beta_{6j}*(\text{BYP69Bij}) + \beta_{7j}*(\text{F1RAPMAij})$$

The MIXED MODEL

$$\eta_{ij} = \gamma_{00} + \gamma_{01}*\text{BYTSTREL}_j + \gamma_{02}*\text{P\_MINSTU}_j + \gamma_{10}*\text{BYSES1}_{ij} + \gamma_{20}*\text{GEN\_2}_{ij}$$

$$+ \gamma_{30}*\text{GEN\_3}_{ij} + \gamma_{40}*\text{BELONGIN}_{ij} + \gamma_{50}*\text{BYMATHSE}_{ij}$$

$$+ \gamma_{60}*\text{BYP69Bij} + \gamma_{70}*\text{F1RAPMAij} + u_{0j}$$

Given the models, the model building process followed. First the random effect for the intercept, the null model, is computed then additional models followed by addition of the level-1 then level-2 predictors (see Table 3.3).

Table 3.3. Model building process for 2-level linear model course taking above Algebra 2

Model 1	Model 2	Model 3
No predictors; only intercept random effect	Model 1 + level-1 fixed effects	Model 2 + level-2 fixed effects
Output to calculate ICC – amount of variation in the dependent variable between L2 units (clusters)	Results indicate strength of the relationship between level-1 predictors and dependent variable.	L2 fixed effect results indicate the relationship between L2 predictors and dependent. Includes information for Model 2

Note: Multilevel models for categorical data using SAS® PROC GLIMMIX: The Basics. *Source:* Adapted from Ene, M., Leighton, E. A., Blue, G. L., & Bell, B. A. (2015). In *SAS Global Forum 2015 Proceedings*. Retrieved from http://analytics.ncsu.edu/sesug/2014/SD-13.pdf

Limitations of the study

The limitations of the study include the reliance of self-reported data, imputation, missing data, and lack of generalizability to all high school girls. There are limitations on the selection of variables by the researcher.

An assumption of these models relates to the vectors of the level-2 level-two residuals and level-one residuals r_{ij}, which are independent between groups and between levels. All residuals have population mean 0, given the values of each explanatory variable.

The level-one residuals r_{ij} have a normal distribution with constant variance σ^2 and the level-two random effects have a multivariate normal distribution with a constant covariance matrix--called homoscedasticity.

Summary

In this chapter, the multistage mixed methodology was introduced with a brief background of mixed methods research and its versatility. The research design was discussed, followed by a discussion of the sampling technique. Next, the factors were introduced. Then the

two models were discussed. The first model describes the continuous outcome variable—mathematics achievement, and the second model describes the binomial outcome variable—the completion of high school mathematics above Algebra 2. After the models, some of the limitations of the research were addressed.

CHAPTER 4 : RESULTS AND ANALYSIS

Introduction

This chapter describes the results and analysis of the qualitative and quantitative data for a multistage mixed methods design. The first set of results presented includes those that emerged from a national dataset followed by qualitative data that formed the basis for the beginning stages of the research. The researcher applied a three-dimensional analysis for restorying of the narrative texts. This restorying is conceptualized in three dimensions: continuity, interaction, and situation/place (Clandinin & Connelly, 2000; Ollerenshaw & Creswell, 2002). The identifying themes that emerged were used in the process of identifying factors and covariates of interest. After situating the results from the initial stages, the results from the latter stages are discussed and organized by the respective research question.

Needs Assessment

Qualitative Data Sources

The participants, Bella, Crystal, Mary, Monze, and Morena were recruited from among the student body of a large state college located in the southeastern region of the United States. I choose these names to preserve anonymity. Participants were told about the study and not paid to participate; however, at the end of each interview each participant received a $10 gift certificate card. Table 4.1 provides a general description of the participants.

Bella, Crystal, Mary, Monze, and Morena are college age women and self-identify in diverse ways. Mary self-identifies as Hispanic, while Bella, Crystal, and Morena self-identify as Mexican American, and, Monze references herself as Mexican. Only Mary's mother was born in the United States. All the other mothers were born in Mexico. Mary mentioned that her mother spent many years growing up in Mexico and then came to the US later in life. Mary is considered second generation since her mother was US born, while Bella, Crystal, Monze, and Morena are

first generation since they were born in the United States, but their parents were not born in the US.

Table 4.1. Description of participants (n = 5)

Student	Mother's Nativity	Generation	Identify	Highest HS math	Prior Math	Education Level	Career
Bella	Mexico	First	Mexican American	Calculus	Pre-Calculus	College junior	Elementary education
Crystal	Mexico	First	Mexican American	Statistics	Algebra2	College sophomore	Nursing
Mary	US	Second	Hispanic	AP Calculus	Pre-Calculus	Bachelor's	Grade 6 science teacher
Monze	Mexico	First	Mexican	College Readiness	Algebra2	College sophomore	Nursing
Morena	Mexico	First	Mexican American	College Readiness	Algebra2	College freshman	Fine arts

None of the participants reported that their parents obtained college level education. All parents attended school in Mexico, and they completed at various levels. For Crystal, her parents did not attend high school. For Bella, Mary, and Morena, their fathers and mothers attended middle school; however, only the fathers completed middle school, but they did not graduate high school.

In this sample, each participant reported that they completed Algebra 2; however, choices of math courses beyond Algebra 2 varied from pre-calculus to college readiness. Their trajectories beyond Algebra 2 varied. For instance, Monze and Morena took College Readiness in grade 12 after taking Algebra 2 in grade 11. Crystal took Statistics in grade 12 after taking

Algebra 2 in grade 11, and Bella and Mary took pre-Calculus in grade 11 following Algebra 2 in grade 1. For Bella, she took Calculus in grade 12, and Mary completed AP Calculus. Given the trajectories of the participants, Bella and Mary each enrolled and completed Calculus, with the latter completing AP Calculus. Mary took the AP Calculus exam and reported that she scored a one out of five. Mary did not report this as failing nor did she sound disappointed about this result. Mary is second generation Mexican American and Bella is first generation. The other first generation students, Crystal, Monze, and Morena completed courses in Statistics and College Readiness. Figure 4.1 shows the high school math course trajectories of the participants.

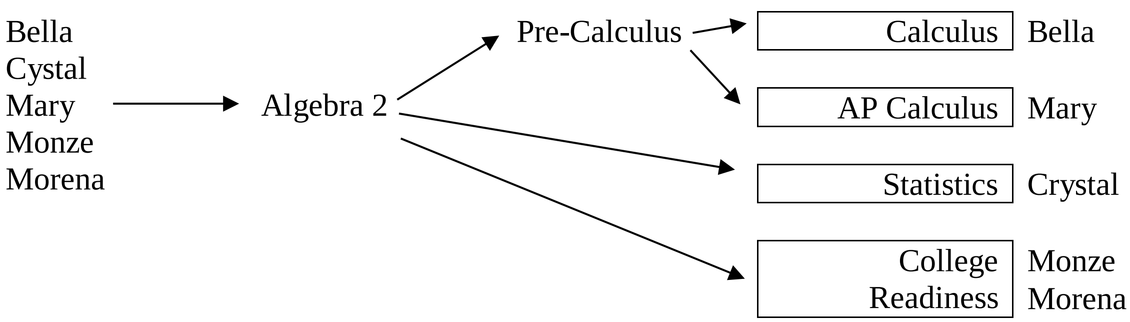

Figure 4.1. Trajectory beyond Algebra 2 with terminal math course in grade 12.

All of the participants were enrolled in college. Notwithstanding, these participants, although completing a variety of university level ready math courses, their career choices indicate difference as it relates to moving into a STEM field, although some consideration for pursing science careers occurred. Mary teaches middle school science, and Crystal and Monze are pursuing their bachelor's in nursing science (BSN). The motivation to study higher math courses and their relationship of the influence towards careers was analyzed using the temporal theme of continuity.

I met with each participant. Each interview lasted about thirty minutes. The semi-structured interview protocol is shown (see Table 4.2).

Table 4.2. Semi-structured Interview Protocol

Interview Questions
1. Would you say math is a subject that you have enjoyed studying?
2. How would you describe your overall experiences in your math classes?
3. What are some of your best moments in math classes?
4. How would you describe your worst experience in one of your math classes?
5. How do you think teachers could enrich the math experiences of girls?
6. To what extent do you consider teachers treat boys and girls differently in math classes?
7. What are your feelings about pursuing a career in science, technology, engineering, or mathematics?
8. Would you say that your parents encouraged you to pursue mathematics? (If yes or no response, ask in what ways parents encouraged/discouraged participant.)
9. What rules did your parents have for doing home-work?
10. What kinds of abilities do you think you have that separate you and your ability to do math?
11. In addition to my questions about your mathematics experiences, is there something that you would like to share relating to your experience?
12. How would you describe your ethnicity?
13. Were both of your parents born in the US?

Continuity

The temporal theme of continuity, organized around past, present, and future is central to narrative research (Clandinin & Connelly, 2000; Ollerenshaw & Creswell, 2002). These

researchers suggest an analysis of the transcript or text for past, current, and possible future experiences that influence the storyteller.

Past. Prior experiences with mathematics appeared to influence how many of the participants conceptualized their career choices. The role of math as a subject that would strongly influence their thinking towards STEM related career seems minimized. Instead, the greater influence appears to be that participants looked at adult role models, and when math was viewed as a subject to study, it was a subject to study because the class credits needed to be completed. Of interest is that most of the participants said that they liked math, and adults served as influential role models for Crystal and Mary. Crystal said, "My grandparents my aunts like they never they don't have an history in that [Math] so I think maybe if they did it could have influenced me." Mary stated, "I always wanted to teach since ummm since elementary school I felt like I want to be a teacher because I've had so many positive experiences with my teachers that I wanted to have the same experiences with other students."

For Monze, she remembered engaging in a class project. She noted:

> Being it was a math class. I remember they would give us projects for example for pi day we had to do ummm associate our artistic skills with math so what I really liked was you know I went along with my project so I remember this ummm it was like a wheel that I did. I did the pi sign around the middle then I used all the numbers for pi. I felt like it was something that I liked that I associated it with math so I had a great time doing that.

Morena recalled a statistics teacher whom she said, "[The teacher] basically common sense questions and he would expect us to know like the mathematical term for it, and I didn't really necessarily understand it. So to me that was like kinda embarrassing."

When career choices included STEM fields, these pathways changed and were based on available adult models and a deep sense of personal responsibility. Mary always wanted to be a teacher and pursed teacher certification. She said, "even though I got A's I knew that I wasn't

strong in it [math] that I was just average. So, I am like if I am just average then I am not going to go into a career that I would have to be above average." However, Mary noted that if she taught science it would be Biology. Bella noted that in middle school, "I was thinking of accounting because I really like numbers" and her preference was "probably because I knew people who were doing that….it was a safe career to go to. I didn't know anybody going to mechanical engineering. That would have helped me if there was an example for me. Hey this is what you are doing, engineering or something. Crystal said that she wanted to be an anesthesiologist. However, she noted, "it was just a lot of work and a lot of responsibility" and further stated, "I didn't want to be a doctor because I feel like doctors just go say hi and leave and they don't see you again. Nurses are more like oh I'll check you and stuff like that. So, that's why I choose to be a nurse."

For Morena, although she stated, "Math is just to me like a favorite subject" she did not pursue a career in a STEM field but decided to study fashion design since, in her opinion, her scores to go to a university were not good enough. In addition, Morena recalled the time she had to drop, in her opinion, a more challenging math course that resulted in an initial failing grade.

Despite the decision to consider STEM careers, these participants made major efforts toward positive math experiences. These positive experiences coupled with the notion that strong math backgrounds build toward STEM careers affords an examination of prior engagement with mathematics.

Present. The present considerations to study math involve completing required math courses for their respective majors. While presently in college, most of the participants enrolled in math courses that they needed to take. Although at the present college they are enrolled in does not provide advanced math courses such as Topology or Graph Theory for their majors,

each participant did not express the need to study math beyond the requirements. For instance, Morena is enrolled in intermediate algebra and doing her major in fine art. Monze is enrolled in intermediate algebra and appreciates how her teacher affords her the opportunity to emulate how to solve problems. Monze and Marina had College prep math as their highest high school math. For these students, their current, required math courses are inescapable. Monze provided insights as to their current experience with math:

> I am doing my AA and AS in nursing. It's going good. At first it was like being a freshman in college I didn't know what was going on until afterwards. At the beginning when I had said that I was doing my AS they said that I didn't need math. And to be honest with you I was kinda happy because I was like yeah no math and then after and I go back and speak to the counselor again I spoke to them about trying to do the bachelors in nursing and they said pursuing your AA and AS was the best so for the AA part of nursing you need math so I am like darn, so I kinda feel like I had known that before I would have taken math right after high school because I felt like it was fresh in my mind and you know I knew this information a lot. Later I felt like I got a little so rusty at math so you know…

Future. As it relates to the future, my analysis took into consideration the way participants referred to the future ways of using math or seeing how math would factor into their futures. When asked about studying more advanced math once she graduated from high school, Mary had a strong reaction against the idea:

> Oh no, oh no no no. I wouldn't want to. When I was in high school in AP Calculus I said that wouldn't want to take this in college. I was surprised that I passed with an A even though when we took the AP exam at the end of the year I think I got a 1. (whispering) So, I am like I don't ever want to take this in college. That was it. I am done.

On the other hand, Bella wants to be able to take pre-calculus. For Bella, given her comfort level with math, this is not a surprise. Bella confidently noted that an advance math course was in her future. She remembered, "College Algebra then I had statistics here [referring to present college]. But since I want to continue I want to do pre-calculus here too."

Bella and Mary completed calculus in high school; however, Mary did not think that additional higher level math was something that she would pursue. Bella mentioned the possibility of pursuing pre-calculus. Of interest here, to contrast the students with math trajectories towards calculus in grade 12, Mary studied AP Calculus and seems to have maximized her interest. Mary reported receiving a low AP test score. Was the low score a mitigating factor why she did not pursue further math studies? Was Mary not receiving the kinds of support and recognition of her ability? Did Bella see many more opportunities than Mary?

Interaction

Interaction involves the personal and social, and I analyzed the transcript for personal experiences and interactions with other people. From the participants' perspectives, their relationships with others highlight how they recognized their importance.

Personal. The participants noted general math experiences that depended on their own effort. Bella took the path toward pre-calculus when "they were telling me to take statistics it was easier." She noted that she "would stay up late and night doing those problems because I knew in the future it was going to help out a lot." Crystal found that Geometry "was tough" and "started focusing and once I saw my bad grades I was 'no' I had to get better and start studying more." Mary took AP Calculus, but along the way "it was like frustrating with the work that it just felt like not overwhelming but it was a lot like what did I get myself into." For Monze, she noted, "I am not the best in math I mean I am better in other subjects like maybe science and so. When it comes to math it's just 'cause I second guess myself a lot." Morena stated:

> I am pretty good at math. Ever since I was little I've been good at math. I feel like that's my favorite subject and I spend more time studying that than I should be studying other subjects that I don't understand. I study math and I get better at it and I am pretty good at it. You would show me a math problem and I am pretty good at it and I can solve it.

Morena, however, shared that she got a bad grade in statistics. This bad grade affected her decision to stay in that class. She said that since this was her first bad grade, she decided to go to an easier course, College Readiness.

The stated experiences by the participants then raise a few questions. How does math self-efficacy relate to further study of mathematically related subjects? What is the relationship between math-self efficacy and math achievement? These participants never revealed that they were afraid of math nor that they were less confident in these classes. The expression of personal effort as well as supporting relationships were mentioned by the participants.

Social. Participants noted the level of relationships with parents, teachers, counselors, and peers. It was found that although parents had rules for doing home-work, they were less able to help as their daughters progressed through high school, and it became difficult to serve as career role models, but encouragement was abundantly clear. Typical of the participants were comments about the encouragement of parents.

The role of parents and personal interaction was demonstrated for instances with home-work. Interactions varied. For home-work rules, Mary, a second generation, received more leeway from her parents as it relates to home-work rules, than Bella, a first generation. Mary reflected:

> My mom really didn't have rules for doing home-work. She just knew she just knew that she didn't have to worry about me not doing my home-work. Cause I was one of those good students who would do everything would turn everything in. So doing well in school was really important to me because my mom would say if you do well in school then you can get a better career and be successful so that's what. So I would do it by myself no one had to tell me Mary do your homework.

And Bella remembered:

> It was just home-work before going out or watching tv. We didn't go out much so. I had so many classes. Middle school you have so many classes so I didn't have freetime so I would just work on my home-work, I would just tell myself you half an hour for this and

> an hour for that so for math I knew it was more than an hour so, I would try to do some of it on the bus and when I got home I would work on the easy stuff and then math.

Parental expectations for education was not surprising among the participants. Parents encouraged their daughters to go farther than they did. Notwithstanding, parents were not in a position to model, by way of their experiences, education beyond the high school level. Bella shared:

> Oh ammm the parents. I know that the expectations they would push us to go up. If I had my parents they stopped helping me in elementary so if I had not done it myself to work up and to see how the problems worked if I had just depended on my parents to help me their level of education maybe that would be an important maybe.

And for Morena:

> The fact that they weren't they couldn't speak our languages that well they would encourage us to go further and we eventually were able to translate to them more than we were used to. Back then it was just we started off basically full Spanish. We came to school we had ESL we did a lot better. After that they basically our parents were telling us like do more like try to get there so that we could translate communicate better. My weakness kinda getting older my weakness was Spanish. But I was like I don't understand if that was my first language.

Mary noted:

> My mom yes. I don't really talk to my dad but my mom she was very supportive of me. I would tell her what I wanted to do and she would be behind me one hundred percent. Now, when it came to helping me with homework she could not she couldn't help me. I was on my own at that part. But other than that, she was very supportive.

Although parents, especially mothers encouraged education as instrumental, the ability to be role models problematized cultural expectations and gender role expectation. The question of interest for me here would raise the issue of parental educational expectation and its correlate to parental educational level as well as actual educational level completed by their daughters.

Crystal provided some insight:

> For the Mexican culture, it's a lot of stay at home moms and the dad goes and does the jobs and stuff….. So, I think that like the Mexican American women they usually go for oh that way…. I think it's going to bring more of a mix because now that's there a lot of

> oh I'm going to do what I wanna do women are like I'm not going to stay home I'm going to go and do what I want….the generation before like I said my mom my grandma my aunts they were more like I am just going to stay home and cook do that and I respect that and I see that. That's good and something that you should do. I think the generation coming is seeing more like ok I can do that but I can also go and do what I like.

Mary stated:

> ….so, if the people they look up to is their mom and they see that their mom is at home. And if there is a dad. Because my stepdad he was very gender bias. So, he was more favorable to the boys than the girls even though I was better excelling [but] I feel like my mom pressured me more to be successful rather than my brother. Because he started college but he dropped out. And right now, I am trying to push my sister to do well. Get your grades in [sister's name] do well. I just want her to do better also.

Mary, as a second-generation Mexican woman, seems to move away from a stronger stereotype interpretation with the assistance of her mother. Unlike Crystal, who acknowledges the female role but sees a place for compromise, Mary uses her sister as a clear indication to break the expectation in pursuit of a career. While parents may not have the educational levels to emulate, their encouragement was consistent. Teachers may serve as the needed role models. Interactions with teachers functioned in important ways.

Teacher encouragement and support were consistent with positive social interactions. Participants expected teachers to be engaging and to serve as role models; however, at times, these interactions were uncomfortable. Morena stated that teachers need to "have the patience and time to teach." As an example, she mentioned that her statistics teacher was unresponsive at times. She stated:

> I would ask him and he would be like I already showed you, it's on the board and then I would look at the board and go like what. So, I feel like if you had the patience to actually show them stuff and sit down and show them and be like you do this and you do like step by step process they would understand it.

Unlike Morena, who enjoyed math but recalls not having support, other participants reported positive relationships with math teachers. Bella noted that her teacher would bring over college

friends or students of his and at the end of the day he would say, “ok I want you do a challenge with her. I want you to write a problem for her and I would prove to you that she can do it.”

Crystal noted that her teachers were instrumental in assisting her. She stated:

> They meant a lot. For example, when I was studying Geometry my teacher would stay after class with me and would help me. And my stats he would always like like be on top of us with everything. So, they all pushed me and helped me to get better grades.

For Mary, she too recalled teachers being helpful:

> If I went like after class or before class to ask them if I had ummm if they could help me on something then they would they would do that…. I remember in elementary school when we first started learning fractions my teacher I’m like I really don’t get this and she like took me aside and worked with me so they were all really helpful.

And Monze noted, “Algebra 1 in my freshmen year it was good what I like about the teacher was he was really hard on us. I mean at first I was like why is he so hard but then you see the outcome and you say I remember this.”

Teacher relationships reinforced the notion that these participants could study math given encouragement. As such, how teachers’ relationships and responsive teaching positively impact mathematics achievement should be understood. Do other adults in the school milieu such as counselors and their responsiveness to students make a difference?

Counselors, for this sample, appeared absent. None of the participants engaged with their high school counselor to examine their career choices. Counselors did not approach these participants, neither did participants find reasons to talk with their counselors for academic reasons. As it relates to counselors: Bella said that she did not think the counselors knew about her, so “maybe they would have pushed me or advised me to do a math career.” And for Crystal:

> I really didn’t think but now that I have graduated high school more now when I look back they should have helped me they should have like if they saw that I got a bad grade like they should have been on top of me.

Mary stated:

> Pretty funny is that I never really talked to my counselor in high school. I only talked to her like a few times. Maybe only once….The only person that I would talk to was the career counselor, and I would talk to him about how to do resumes and things like that doing applications.

Monze shared:

> At first I didn't know who my counselor was. Before I just knew like they would help us with our schedules. I didn't know who it was until later….I didn't need anything from the counselor. I guess I was fine academically so she didn't need them to see me so I felt that was ok.

Morena seems to have summed it when she said, "I feel like they didn't. They had maybe 500 to 600 students. So, I don't think they were into everybody."

Although Mary followed a trajectory of a strong math student, she hardly engaged with her counselors and this engagement occurred mainly with the career counselor about resumes. Of interest is that the other participants, such as Monze and Morena, did not engage with their high school counselors. These participants did not seem to find a reason to reach out to counselors, neither did their counselors reach out to them. Unlike counselors, peers played important roles as it relates to engaging with mathematical ideas and reinforcing the notion that math was worthwhile as a subject to continue to study.

As it relates to peers, the participants had friends who supported their aspirations or did not distract in their studies. Participants mentioned some experience with teasing. However, peers enabled a sense of comfort with studying mathematics. It appears that the racial composition of the school did not affect approaches to engaging with mathematics. Bella noted that she "had nerdy friends," and they "would stay and study." For Mary, her friends were also helpful:

> If we had to do, like if we were working on home work we could work on home work or study for a test…. they were on the same path as me so we were both working together so

> we don't want to get a bad grade in that class so it was the high-level kids we were always working together helping each other.

Crystal noted, "The people that I really hung out with they didn't really care too much about school….I didn't really let them influence me too much." In fact, Bella, who went on to study calculus, stated, "my teacher would go she got the highest score in math test or something. They wouldn't like that and would take it the wrong way and would bully." But Morena, who did not study advanced math recognized that her friends "did have an influence because they weren't as good at math" and she assisted these peers since they recognized her ability. Morena stated:

> I feel like me being good at math I could probably help them out. They would come to me and I would help them out with their homework. They would come to me and be like 'hey do you know how to solve this would you help me out.' And I would you do like this I would show them a different problem and they got the hang of it with me. I used to have even classes with my friends. There were times that I did have them but not always.

For these participants, it appears that peer relationships were more coherent among the weaker students and mixed among the stronger students.

Situation

Situations or places specific in the landscape of the storyteller should also receive some analysis (Ollerenshaw & Creswell, 2002). The participants situated themselves mostly at school and their experiences appeared to be mostly positive. Although no discussion of the physical state of their schools arose, the school itself was a place where more positive experiences with math occurred.

Bella found school as a place to demonstrate her mathematical prowess. She relayed the experience of one math teacher who would "bring over college friends or students of his and at the end of the day he would say ok I want you do a challenge with her." An experience such as this, exemplifies how Bella was at ease to use the space to show her skills.

Morena lit up when she spoke about being a sunshine student in elementary school but not honors in middle school. However, she seems proud of her high grades. She stated, "I was also like a sunshine student in elementary school in middle school I would get like I wasn't in honors kids but I would have honors grades like an honors student would have." Morena liked school, but she noted that the testing was difficult.

Mary recalled that she had middle school counselors who were aware of her presence. Along with her counselors, teachers created positive and safe spaces. Mary said, "I felt like I want to be a teacher because I've had so many positive experiences with my teachers that I wanted to have the same experiences with other students. So, I always to be a teacher, this is what I want to be when I grow up is a teacher."

Mary recalled fondly these positive relationships with teachers. These memories influenced her decision to follow a career in teaching.

The notion of positive experiences in school as a safe space emerges in the experiences of Monze. Comparing Algebra 1 and Algebra 2 classes, Monze spoke about the differences in grouping in these classes. She noted that in Algebra 2 everyone would talk and interact with the teacher. In that class the seating was arranged in groups of three which accommodated more interaction, while in Algebra 1, they sat in traditional rows. In fact, Monze stated that she sat up front and felt a little left out, but she also stated that this was probably a good thing for her.

The racial composition of the school did not appear to factor into how the participants identified themselves as it relates to studying mathematics. For Mary, who completed AP Calculus in grade 12, her school was equally Hispanic with "some Asians and African Americans" and she noted that her math classes were mixed. Crystal's school, as contrast to Mary's was described where "there was a lot of white Americans and a lot of African

Americans." Crystal, noted, "There weren't a lot of Hispanics but there was some." Monze noted that in her school there were "more Whites and African Americans than there were Hispanics" and she also noted that in her algebra class "mostly the Caucasians would sit with the Caucasians. And African-Americans with the African-Americans, and I feel like there were not that many Hispanics" and these groupings seem to suggest she felt isolated. Bella, who also completed Calculus, like Mary, noted that her high school was majority white then the next largest group was Hispanics followed by Black and Asians. She noted, "The Asians would always be treated like they were smart though" and stated that this was due to cultural stereotypes. Bella noted that she got placed into her honors class because of her grades. No tracking seems to be the case with these participants. However, Bella stated that in her more advanced classes many Hispanics started but seem to change to non-honors.

> They would think they are not capable of doing it and maybe because the teachers didn't expect them to succeed so it was probably a drawback. But then those who stayed like me I was taught that we're here we have a right and we shouldn't let go of that right to education and we shouldn't throw that away so. My parents they like I said they did not advance much in their education, so education was really a big thing and so there was those who stayed and that I had befriended they had the same parents who had the same expectation of much from them so they continued.

School, as a place for these participants, was a place that they were encouraged to attend.

These participants found these spaces to be positive and the school populations were not predominantly Hispanic. However, of interest is the presence of the number of Hispanics in Mary's and Bella's schools. Mary was able to pursue Calculus. However, Bella also pursued Calculus in her school that had a majority White population.

Of concern is Bella mentioning the lack of Hispanics in her advanced classes. Why would Hispanic students not continue to see these classes to completion? Why in Monze's math

classes do we see these racial groupings which made her feel isolated? Does the number of Hispanic students have an effect on taking advanced math classes?

Taken together, the qualitative data provided some grounding. The conceptual framework that emerged from the needs assessment centered on minority student mathematics achievement. Given that all participants were Mexican descent, 80% first generation, and all were enrolled in college, as well as their sense that they could do math and that their trajectories put them on the math ladder, the end results were of concern since they all took Algebra 2 but none pursued STEM careers outside of nursing or teaching science, despite enrolling in additional math courses. Would a more rigorous examination of a nationwide collection of data provide insights?

Quantitative Data Sources

Prior to the quantitative data analysis, the researcher examined all variables for accuracy of data entry and missing values (see Appendix E) and followed the recommendations for pre-data analysis as prescribed by Tabachnick and Fidell (2013).

A correlation matrix was examined at the student level and school level. At the student level, the highest correlation (ρ = .20) was between sense of belonging (BELONG) and math self-efficacy (BYMATHSE), and at the school level, the highest correlation (ρ = .19) was between percent of Hispanic teachers (P_HISPTC) and percent of minority students (P_MINSTU). To meet the inclusion criteria for the sample, the researcher selected responses on the dependent variables, Algebra 2 (F1RACADC) and IRT math score (BYTXMIRR). These inclusion criteria ensured that those in the sample were part of both waves of the study and more likely to have complete data. Descriptive statistics obtained from the database for the sample used in the needs analysis stages are provided. These results afforded the researcher a better understanding of the data to be used for further analysis (see Table 4.3). A comparison to the larger dataset provided some insight.

Table 4.3. Weighted Statistics for Outcome and Covariates Mexican Americans females

Variable	Description	Mean	*s*	Min	Max
Dependent					
F1RACADC	Credit above Alg2	.13	.33	.00	1.00
BYTXMIRR	IRT math score	30.30	1.40	12.75	62.42
Student level					
BYSES1	ELS:02 Standardized	-.57	.67	-1.97	1.60
BYSEX	Gender (1 = female)	1.00	.00	1.00	1.00
BYHISPAN	Ethnicity (1 = Mexican American)	1.00	.00	1.00	1.00
BYGNSTAT	Generation Status	2.14	.83	1.00	3.00
BYMATHSE	Math self-efficacy	-.15	.91	-1.83	1.77
BYP69B	Rule for home-work (1 = yes)	.92	.28	.00	1.00
BYPARASP	Parent expectation	5.44	1.33	2.00	7.00
F1S48A	Counselor for college info	.76	.43	.00	1.00
F1RAPMA	AP math Carnegie credits	.07	.30	.00	3.00
BELONG	Sense of belonging	3.10	.57	.00	5.00
School level					
BYA03R	Prevention dropout (1 = yes)	.01	.08	.00	1.00
BYTSTREL	Teacher student relationships	.12	.94	-3.82	2.33
P_MINSTU	Percent of minority students	.66	.29	.01	1.00
P_HISPTC	Percent of Hispanic teachers	.20	.24	.00	.95
n (unweighted)	710				
n (weighted)	183,775				

Mexican American female high school students (n = 710; weighted n = 183,775) were less likely to have math credits above Algebra 2 (M = .13, SD = .33) than students in the larger sample (M = .24, SD = .43), and their average Math IRT scores lower (M = 30.30, SD = 1.40) as compared to the larger sample (M = 37.91, SD = 11.88).

Mexican American female standardized family SES levels were lower (M = -.57, SD = .67), they did not take as many AP math courses, at most 3 Carnegie units (M = .06, SD = .30) as compared to 4.5 Carnegie units, (M = .12, SD = .39).

Mexican American females were also less likely to see seek out their college counselors (M = .76, SD = .43) than their contemporaries (M = .79, SD = .41) and to express a lower sense of belonging (M = 3.10, SD = .57) as opposed to (M = 3.14, SD = .53).

However, they were more likely to have parents who expect them to graduate university with at least a bachelor's degree (M = 5.44, SD = 1.33) as compared to the larger sample (M = 5.31, SD = 1.29) and to have higher teacher student relationships (M = .12, SD = .94) than their contemporaries (M = .01, SD = .99).

Mexican American high school female students attended schools with larger populations of minority students (M = .66, SD = .29).

A comparison of descriptive statistics for variables is provided (see Table 4.4). Seven research questions were posed, and the corresponding analytical methods are shown (see Table 4.5). As it relates to the analysis of the quantitative data, computations included listwise and imputed data.

Clusters with single counts were removed. As a result, the quantitative analysis was conducted with clusters with at least two students.

Table 4.4. Descriptive statistics of selected variables ELS:2002 sample

	Other students			Mexican American females			
Variable	*n**	*Mean*	*SD*	*n**	*Mean*	*s*	*Skewness*
Credit above Alg2 (F1RACADC)	2,927,304	.24	.43	183,775	.13	.33	2.25
IRT math score (BYTXMIRR)	2,927,304	37.91	11.88	183,775	30.30	1.40	.54
SES (BYSES1)	2,927,304	.03	.71	183,775	-.57	.67	.42
Math self-efficacy (BYMATHSE)	2,060,338	.02	1.00	116,723	-.15	.91	.40
Rule for home-work (BYP69B)	2,386,446	.93	.26	151,670	.92	.28	-3.02
Parent expectation (BYPARASP)	2,927,304	5.31	1.29	183,775	5.44	1.33	-.82
Counselor for college info (F1S48A)	1,896,223	.79	.41	107,137	.76	.43	-1.19
AP math credits (F1RAPMA)	2,927,304	.12	.38	183,775	.06	.30	5.54
Sense of belonging (BELONG)	2,815,407	3.14	.53	178,423	3.10	.57	-.41
Prevention dropout (BYA03R)	2,884,064	.04	.19	180,740	.01	.08	13.17
Teacher relationships (BYTSTREL)	2,679,697	.01	.99	165,994	.12	.94	-.45

(Table 4.4 continued)

	Other students			Mexican American females			
Variable	*n**	*Mean*	*SD*	*n**	*Mean*	*s*	*Skewness*
Percent of minority students (P_MINSTU)	2,860,132	.32	.31	182,913	.66	.29	-.70
Percent Hispanic Teachers (PCT_HISPTC)	2,059,905	.04	.10	114,015	.20	.24	1.70
N (unweighted)	14,810			710			
Valid *n* (listwise)*	1,052,090*			47,421*			

**Note*: Weighted

As it relates to the research questions, the first five questions were answered using the quantitative data. The final two questions were answered using the qualitative data. The methods used for the first research question included the analysis of the continuous variables. This analysis was used to identify significant student and school level effects.

The second research question was answered by looking at the dichotomous variable outcome. The identification of significant effects was able to be used to answer the research question.

To answer question three, the school level coefficients were inspected and set to their grand mean. To answer question four, the continuous outcome variable analysis was inspected. The null models were used to identify the variance components.

Table 4.5. Research Questions and Methods Used

Research Questions	**Methods Used**
RQ1: What student-level factors (e.g., family SES, generation status, math self-efficacy, sense of Belonging, parental expectation, rules for doing home-work, and having AP Math credits) and school-level factors (e.g., teacher student relationships, percentage of minority students, and percentage of Hispanic teachers) are associated with math achievement among Mexican American female high school students?	Analysis of quantitative data with continuous dependent variable
RQ2: What is the likelihood that these student-level factors and school-level factors influence the likelihood of Mexican American female students to take advanced high school mathematics courses beyond Algebra 2?	Analysis of quantitative data with dichotomous dependent variable
RQ3: What is the impact of these student-level factors on mathematics achievement while controlling for school-level factors?	School level regression coefficients identified
RQ4: How much of the variance in math achievement scores is attributable to Mexican American female students and to schools?	Examined the intraclass correlation coefficient (ICC)
RQ5: How do these factors differ among immigrant and nonimmigrant students?	Descriptive data from the sample examined
RQ6: What kinds of encouragement and experiences in mathematics classes influence the likelihood to study higher level mathematics?	Use semi-structured interviews conducted with a parallel sample of participants
RQ7: How can the emerging qualitative data be used to provide a deeper understanding of the strength of the relationship of possible student-level factors and school-level factors that influence the likelihood of taking advanced high school mathematics courses?	Merging of the qualitative and quantitative databases

The descriptive data of the analytic sample was compiled. Each generation was identified, and the variables of interest were compared among the three generations. Table 4.6 shows the descriptive data of the analytic sample.

Table 4.6. Descriptive Statistics for Analytic Sample

	Generation Status					
	1		2		3	
Variables	*M* (sd)	*n*	*M* (sd)	*n*	*M* (sd)	*n*
Dependent						
Credit above Alg2 (F1RACADC) (1 = yes)	.15 (.36)	130	.15 (.36)	140	.18 (.39)	180
IRT math score (BYTXMIRR)	28.13* (1.12)	120	30.46 (1.17)	140	32.98 (1.58)	180
Student level						
SES (BYSES1)	-.90* (.59)	120	-.72* (.63)	140	-.21* (.69)	180
Math self-efficacy (BYMATHSE)	-.21 (.81)	70	-.07 (.92)	80	-.15 (.98)	120
Rule for home-work (BYP69B) (1 = yes)	.90 (.30)	120	.89 (.32)	130	.94 (.25)	170
Parent expectation (BYPARASP) (1 = yes)	.88 (1.41)	120	.91 (1.30)	140	.86 (1.37)	180
Counselor for college info (F1S48A) (1 = yes)	.74 (.44)	80	.85 (.36)	90	.75 (.43)	110
AP math Carnegie credits (F1RAPMA) (1 = yes)	.05 (.21)	120	.08 (.27)	140	.06 (.24)	180
Sense of belonging (BELONG)	2.95* (.58)	120	3.17 (.52)	130	3.20 (.52)	180
School level						
Dropout prevention (BYA03R) (1 = yes)	.02 (.13)	120	.04 (.19)	140	.03 (.18)	180

(Table 4.6 continued)

	Generation Status					
	1		2		3	
Variables	*M* (sd)	*n*	*M* (sd)	*n*	*M* (sd)	*n*
Teacher relationships (BYTSTREL)	.30 (.92)	110	.16 (.89)	120	.08 (.93)	170
Percent of minority students (P_MINSTU)	.73* (.24)	120	.74* (.27)	130	.62* (.29)	180
Percent of Hispanic teachers (P_HISPTC)	.25 (.26)	80	.34 (.31)	90	.28 (.26)	130

n = 530 (unweighted); *n* = 149,935 (weighted)

Note: **p* < .05; Chi-square test on nominal variables and Welsch's *t*-test on continuous variables

What student- and school-level factors are associated with mathematics achievement?

Listwise deletion. The model building process began with a one-way ANOVA (Model I; no predictors, only random effect for intercept). Results indicate a school mean, γ_{00} = 31.05 and variability, τ_{00}, exists across schools (23.83; $p < .001$; see Table I.1).

Model II (means as outcome) includes Model I as nested and student level (L1) fixed effects which indicate the relationship between level-1 predictors and the outcome. Some continuous variables such as SES, math self-efficacy, and teacher student relationships were either standardized or dichotomous, so there was no need to center these. sense of belonging was group centered. Variables of significance included sense of belonging (4.60, $p < .01$), parental expectation (6.42, $p < .05$), math self-efficacy (2.44, $p < .05$), and AP Math (9.34, $p < .01$).

Model III (random coefficients as outcomes) incorporates Model II and student level (L1) random effects which show if the relationships between level-1 predictors and the outcome vary between level-2 units. The researcher selected student SES, sense of Belonging, and math self-

efficacy to vary randomly across schools. These selections were based on *segmented assimilation theory* which seeks to explain that modes of incorporation vary for immigrant groups. Significant fixed effects included parental expectation (5.51, $p < .05$), math self-efficacy (2.75, $p < .001$) and AP Math (1.70, $p < .001$), as well as for student SES, γ_{10}, 2.73, $p < .05$), sense of Belonging, γ_{40}, (4.39, $p < .01$), and a significant variance component for math self-efficacy (6.98, $p < .05$).

Model IV (random coefficients and slopes as outcomes) includes nested Model III and school level (L2) fixed effects results which indicate the relationship between level-2 predictors and the outcome. The school variables, all grand mean centered, were teacher student relationships (BYTSTREL), percentage of minority students (P_MINSTU), and percentage of Hispanic teachers (P_HISPTC). The dropout prevention variable was added but convergence did not occur, so the variable was dropped from the analysis. At the school level, percentage of minority students, γ_{02}, was found to be significant (-53.74, $p < .001$). At the student level, significant relationships existed for sense of Belonging, γ_{40}, (4.00, $p = .004$), an interaction between sense of belonging and teacher student relationship, γ_{41}, (-3.63, $p = .008$), and an interaction between sense of belonging and percentage of minority students, γ_{42}, (7.06, $p = .039$). Math self-efficacy, γ_{60}, was significant (3.17, $p < .001$). There was an interaction between Math self-efficacy and percentage of Hispanic teachers, γ_{63}, (-4.63, $p = .02$). AP Math, γ_{60}, was significant (13.37, $p < .001$). Based on the variance components, only math self-efficacy was found to have a significant relationship between schools and among students.

Model fit statistics showed some differences in Deviance -2(ln L_0 - ln L_1) between nested models. Comparing Model I and II, it was found that Model II was significantly different from Model I, χ^2 (9) = 2394.76710, $p < .001$. Comparing Model II and III, it was found that Model III

was no different from Model II, χ^2 (9) = 9.37, $p > .5$. Comparing Model III and IV, it was found that Model IV was not significantly different from Model III, χ^2 (30) = 35.88, $p > .05$ (see Table I.1)

Imputed data. The One-way ANOVA (Model I; no predictors, only random effect for intercept) results indicate a significant grand school mean, γ_{00}, 31.22 ($p < .001$) and variability exists across schools (52.23; $p < .001$).

Model II (means as outcome) incorporates Model I and student level (L1) fixed effects which indicate the relationship between level-1 predictors and the outcome. Variables of significance include third generation status (1.62, $p < .05$), sense of belonging (2.33, $p = .002$), parental expectation (5.20, $p < .001$), math self-efficacy (1.88, $p < .001$), AP Math (1.87, $p < .001$), and seen counselor (2.52, $p < .001$).

Model III (random coefficients as outcomes) incorporates Model II and student level (L1) random effects which show if the relationships between level-1 predictors and the outcome vary between level-2 units. The researcher selected student SES, sense of Belonging, and math self-efficacy to vary randomly across schools. Significant effects included being third generation (2.44, $p = .002$), parental expectation (6.37, $p < .001$), math self-efficacy (1.02, $p = .002$), AP Math (9.34, $p < .001$), and seen counselor (2.76, $p < .001$). From the variance components, student SES, sense of belonging, and math self-efficacy vary significantly across schools; however, only math self-efficacy was also a significant fixed effect on math achievement.

Model IV (random coefficients and slopes as outcomes) incorporates Model III and school level (L2) effects results which indicate the relationship between level-2 predictors and the outcome. The school variables added included teacher student relationships, percentage of minority students, and percentage of Hispanic teachers. The last two variables were grand mean

centered. Significant relationships existed for being third generation (2.30, p = .005), a positive interaction between being third generation and the percentage of minority students (7.91, p < .001), and an interaction between being third generation and the percentage of Hispanic teachers (-5.68, p = .037).

Parental expectation was significant (11.83, p < .001), as well as an interaction with percent of minority students (-18.84, p < 001). Math self-efficacy, was significant (.94, p = .005). Taking AP math was found to be significant (12.03, p = .009). A significant positive relationship existed for seen counselor (1.87, p = .018). Random effects for SES, sense of Belonging, and math self-efficacy were found to be significant (p < .001). However, math self-efficacy was also significant as a fixed effect.

Model fit statistics showed some differences in Deviance -2 (ln L_0 - ln L_1) between nested models. Comparing Model I and II, it was found that Model II was significantly different from Model I, χ^2 (9) = 2793.52, p < .001. Comparing Model II and III, it was found that Model III was significantly different from Model II, χ^2 (9) = 4592.53, p < .001. Comparing Model III and IV, it was found that Model III was significantly different from Model IV, χ^2 (30) = 752.38, p < .001 (see Table J.1 and Table K.1).

Qualitative data sheds light on these findings, especially as it relates to parent expectations and relationships with counselors must be noted.

Mary, who took AP Calculus noted:

> people they look up to is their mom and they see that their mom is at home. And if there is a dad. Because my stepdad he was very gender bias. So, he was more favorable to the boys than the girls even though I was better excelling [but] I feel like my mom pressured me more to be successful.

Mary, as a second-generation Mexican woman, seems to move away from a stronger stereotype interpretation with the assistance of her mother.

As it relates to the role of counselors, many of the participants seem to experience a minimum of interactions with counselors and these interactions remained low into the college years. Monze, who seems to struggle with math, stated:

> At the beginning when I had said that I was doing my AS they said that I didn't need math. And to be honest with you I was kinda happy because I was like yeah no math and then after and I go back and speak to the counselor again I spoke to them about trying to do the bachelors in nursing and they said pursuing your AA and AS was the best so for the AA part of nursing you need math so I am like darn, so I kinda feel like I had known that before I would have taken math right after high school because I felt like it was fresh in my mind.

Crystal said that after she graduated high school, she looks back and feels like counselors "should have helped me they should have like if they saw that I got a bad grade like they should have been on top of me." Monze echoes this:

> At first I didn't know who my counselor was. Before I just knew like they would help us with our schedules. I didn't know who it was until later….I didn't need anything from the counselor. I guess I was fine academically so she didn't need them to see me so I felt that was ok.

Although Mary followed a trajectory of a strong math student, she hardly engaged with her counselors and this engagement occurred mainly with the career counselor about resumes.

Of interest is that participants such as Monze and Morena did not consult with counselors.

What factors influence mathematics course taking beyond Algebra 2?

Listwise deletion. The model building began with the null or unconditional model only using the dependent variable. This model not only provides an overall estimate of course taking beyond Algebra 2 for students at a typical school but also provides information on the variability on course taking beyond Algebra 2 between schools. Because of the nature of this model, the singleton clusters were also used. See Table 4.7 for results.

Table 4.7. Three Model Estimates on taking math above Algebra 2 listwise deletion

	Model I	Model II	Model III
Fixed Effects			
School level			
School Mean, γ_{00}	-2.28*** (.29)	-3.86** (1.45)	-3.77* (1.63)
Teacher Student Relationships, γ_{01}			-.05 (.21)
Percent Minority Students, γ_{02}			-.57 (.77)
Student level			
Student SES, γ_{10}		0.19 (.31)	0.09 (.33)
Second Generation, γ_{20}		-.55 (.51)	-.47 (.52)
Third Generation, γ_{30}		-.37 (.52)	-.26 (.53)
Sense of Belonging, γ_{40}		.75* (.40)	.80* (.40)
Math Self-efficacy, γ_{50}		.18 (.21)	.19 (.21)
Rules for Home-work, γ_{60}		.03 (.62)	-.02 (.63)
Error variance			
Level-2 Intercept, τ_{00}	2.08*** (.84)	$1.15^{\S}$ (.73)	0.94 (.67)
Model Fit			
-2LL	364.30	232.37****	221.95*

Table 4.7 (continued)

Note: Standard errors in parenthesis. ****likelihood ratio test significant; ****p* < .001, ***p* < .01, **p* < .05; §marginal; All school-level predictors are grand mean centered

There is a significant amount of variability in the log-odds of taking math courses beyond Algebra 2 between schools [τ_{00} = 2.08; z (113) = 2.47, p = .0068).

The estimate, γ_{00}, (-2.28) represents the conditional expected log-odds for Mexican American females of high school math course taking beyond Algebra 2 at a typical school, when $u_{0j} = 0$ and var $(u_{0j}) = \tau_{00}$. The predicted probability (PP) for taking beyond Algebra 2 becomes $\phi_{ij} = e^{-2.28} / (1 + e^{-2.28}) = .1023$, and $1 - \phi_{ij} = 1 - .1023 = .8977$ is the probability of not taking math beyond Algebra 2.

The next model, Model II with Model I nested, included fixed effects for level-1 predictors with a random intercept. Significant fixed effects include the intercept, γ_{00}, (-3.86, p = .009), and sense of belonging, γ_{40}, (.75, p = .050).

The final model, Model III, included level-2 fixed effects. Significant effects include the intercept, γ_{00}, (-3.77, p = .02) and sense of belonging, γ_{40}, (.80, p = .05). Model II was found to be a better fitting than Model I, χ^2 (7) = 131.93, p < .001). Model III was found to be a better fitting than Model II, χ^2 (2) = 10.4, p < .05).

Controlling for all other student and school characteristics, the relationship for sense of belonging is positive and significant. This indicates that as sense of belonging increases, the predicted log-odds of taking high school math beyond Algebra 2 increases. The odds ratio, $e^{(.89)}$ = 2.23, Wald [1.01, 4.93] suggests that for one unit increase in sense of Belonging, the expected change in the odds of taking math above Algebra 2 is 2.23 times greater than for students with average sense of belonging for a given school.

Given the final model, Model III, the odds ratio that a second generation rather than a first generation peer will take math above Algebra 2 is $e^{(-.47)}$ = .624, Wald [.22, 1.75]. This suggests that second generation Mexican American female high school students have about a 38% reduction in the odds of a first generation taking math beyond Algebra 2.

Given the model, the odds ratio that a third generation rather than a first generation peer will take math above Algebra 2 is $e^{(-.26)} = .771$, Wald [.27, 2.20]. This suggests that a third-generation Mexican American female high school student has about a 23% reduction in the odds of a first generation taking beyond Algebra 2.

Doing HW and log odds on Algebra 2 is $e^{(-.02)} = .978$, Wald [.28, 3.92]. This suggests that Mexican American female high school students who have rules for doing homework have a greater odds, about 0.978 times the odds of having math credits beyond Algebra 2 than those who do not have rules for doing homework.

Imputed data. The model building began with the null or unconditional model using only the dependent variable. Model I. Reference group is first generation. The amount of the total variation in the probability of taking math courses beyond Algebra 2 accounted for by schools, the intra-class correlation (ICC), was calculated with an adjustment of 3.29 in the variation since the logistic distribution is assumed to have level-1 residual with a mean of 0 and 3.29 as variance (Ene, Leighton, & Bell, 2014). So, $\tau_{00} = 9.32 / (9.32 + 3.29) = .74$ which suggests that about 25% of the variability in taking math courses beyond Algebra 2 is to be accounted for by students and other unknown factors. There is a significant amount of variability in the log-odds of taking math courses beyond Algebra 2 between schools ($\tau_{00} = 9.32$, $p < .001$).

The estimate, γ_{00},(-1.74) represents the conditional expected log-odds of course taking beyond Algebra 2 at a typical school, when $u_{0j} = 0$ and var $(u_{0j}) = \tau_{00}$. The predicted probability (PP) for taking Algebra 2 becomes $\phi_{ij} = e^{-1.74} / (1 + e^{-1.74}) = .15$, and $1 - \phi_{ij} = 1 - .15 = .85$ is the probability of not taking Algebra 2. The results above indicate this probability significantly varies across schools.

Model II included level-1 predictors with a random intercept. Significant fixed effects included the intercept, γ_{00}, (-3.41, *p-value* < .001) and parental expectation, γ_{50}, (1.51, $p < .001$).

The final model, Model III, random intercept only with Model II nested, included level-2 fixed effects. Significant effects included the intercept, γ_{00}, (-3.94, $p < .001$) and parental expectation, γ_{50}, (2.00, $p < .001$). Table 4.8 shows these results.

Given the final model, teacher relationship is not significant, so for a first generation Mexican American female, this means the estimated odds is $e^{(-3.94 - .11)} = .0174$ and the predicted probability is .0171 on taking above Algebra 2.

For a second generation, this means the estimated odds is $e^{(-3.94 - .11 -.52)} = .0104$, and the predicted probability is .0103 on taking above Algebra 2. For a third generation Mexican American female, this means the estimated odds is $e^{(-3.94 - .11 + .07)} = .0187$, and the predicted probability is .0183 on taking above Algebra 2.

Second generation, $\gamma_{20,}$ is negative but not significant (-0.52, $p > .05$). The odds of a second generation rather than a first generation peer will take math above Algebra 2 is $e^{(-.52)} = .5945$, Wald [.297,1.201]. The predicted probability becomes $e^{(-3.94 - .52)} / (1 + e^{(-3.94 - .52)}) = .0116$ or 1.2% chance for taking above Algebra 2.

Third generation, $\gamma_{30,}$ is positive but not significant (0.067, $p > .05$). The odds of a third generation rather than a first generation peer will take math above Algebra 2 is $e^{(0.067)} = 1.069$, Wald [.605,1.889]. The predicted probability becomes $e^{(-3.94 + .067)} / (1 + e^{(-3.94 + .067)}) = .0204$ or 2% chance for taking above Algebra 2.

For first generation, the predicted probability becomes $e^{(-3.94)} / (1 + e^{(-3.94)}) = .0190$ or 1.9% chance for taking math above Algebra 2.

Table 4.8. Results for Three Model Estimates taking math above Algebra 2 (imputed data)

	Model I	Model II	Model III
Fixed Effects			
School level			
School Mean, γ_{00}	-1.74*** (.19)	-3.41*** (.44)	-3.94*** (.62)
Teacher Student Relationships, γ_{01}			-.11 (.25)
Percent Minority Students, γ_{02}			-.57 (.73)
Student level			
Student SES, γ_{10}		-.20 (.21)	-.24 (.25)
Second Generation, γ_{20}		-.45 (.29)	-.52 (.36)
Third Generation, γ_{30}		.05 (.25)	.07 (.29)
Sense of Belonging, γ_{40}		.37 (.24)	.38 (.28)
Parental Expectation, γ_{50}		1.51*** (.27)	2.00*** (.47)
Math Self-efficacy, γ_{60}		.13 (.12)	.15 (.14)
Rules for Home-work, γ_{70}		.07 (.52)	.09 (.70)
Seen Counselor, γ_{90}		0.29 (.19)	.33 (.24)
Error variance			
Level-2 Intercept, τ_{00}	9.32*** (3.05)	10.04*** (3.17)	9.81*** (3.12)
χ^2	10260.73	9968.15	9954.91

Note: Standard errors in parenthesis. ****likelihood ratio test significant; ***$p < .001$, **$p < .01$, * $p < .05$; §marginal; All school-level predictors are grand mean centered

Given the final model, Model III, the effect of percentage of minority students in a school on taking math above Algebra 2, while controlling for all other variables is negative but not

significant, $\gamma_{02,}$ = -.57 (p > .05). This indicates that the odds of taking math above Algebra 2 reduces for every unit increase in the percentage of minority students. For a first generation, this means the estimated odds is $e^{(-3.94 - .57)}$ = .0110, and the predicted probability is .0109 on taking Algebra 2 controlling other factors. For a second generation Mexican American female, the estimated odds is $e^{(-3.94 - .57 - .52)}$ = .0065, and the predicted probability is .0065 on taking above Algebra 2. For a third generation Mexican American female, the estimated odds is $e^{(-3.94 - .57 + .067)}$ = .0118, and the predicted probability is .0116 on taking above Algebra 2.

For SES, $\gamma_{10,}$ is negative but not significant (-.24, p > .05). This indicates that the log odds of taking math above Algebra 2 decreases while controlling for the other variables. For a first generation, after controlling for all other variables, the estimated odds is $e^{(-3.94 - .24)}$ = .0153, and the predicted probability is .0151 on taking above Algebra 2. For a second generation, this means the estimated odds is $e^{(-3.94 - .24 - .52)}$ = .0091, and the predicted probability is .0090 on taking above Algebra 2. For a third generation Mexican American female, this means the estimated odds is $e^{(-3.94 - .24 + .07)}$ = .0164, and the predicted probability is .0161 on taking math above Algebra 2.

For sense of Belonging, $\gamma_{40,}$ is positive but not significant (.39, p > .05). This indicates that the log odds of taking math above Algebra 2 increases for every unit increase sense of belonging after controlling for all other factors. The estimated odds for taking math above Algebra 2 is 1.47 Wald [.84, 2.58] which indicates that for any school, students with a unit increase in sense of belonging have a 1.47 times increase in the odds of taking above Algebra 2. For a first generation, this means the estimated odds is $e^{(-3.94 + .39)}$ = .0287, and the predicted probability is .0279 on taking Algebra 2. For a second generation, this means the estimated odds is $e^{(-3.94 + .39 - .52)}$ = .0171, and the predicted probability is .0167 on taking above Algebra 2. For a

third generation Mexican American female, this means the estimated odds is $e^{(-3.94 + .39 + .067)}$ = .0307, and the predicted probability is .0298 on taking above Algebra 2.

For math self-efficacy, $\gamma_{50,}$ is positive but not significant (.15, $p > .05$). This indicates that the log odds of taking math above Algebra 2 increases for every unit increase in math self-efficacy. For a first generation, this means the estimated odds is $e^{(-3.94 + .15)}$ = .0226, and the predicted probability is .0220 on taking above Algebra 2 after controlling for other factors. For a second generation, the estimated odds is $e^{(-3.94 + .15 - .52)}$ = .0134, and the predicted probability is .0133 on taking above Algebra 2. For a third generation Mexican American female, this means the estimated odds is $e^{(-3.94 + .15 + .067)}$ = .0242, and the predicted probability is .0236 on taking Algebra 2.

For home-work rules, $\gamma_{60,}$ is positive but not significant (.09, $p > .05$). This indicates that the log odds of taking math above Algebra 2 decreases with home-work rules. For a first generation, this means the estimated odds is $e^{(-3.94 + .09)}$ = .0213, and the predicted probability is .0208 on taking above Algebra 2. For a second generation, the estimated odds is $e^{(-3.94 + .09 - .52)}$ = .0127, and the predicted probability is .0125 on taking above Algebra 2. For a third generation Mexican American female, the estimated odds is $e^{(-3.94 + .09 + .07)}$ = .0228, and the predicted probability is .0223 on taking Algebra 2.

The qualitative data provides some explanation of these results. Mary, a second generation Mexican American, when asked about studying more advanced math said:

> Oh, oh no no no. I wouldn't want to. When I was in high school in AP Calculus I said that wouldn't want to take this in college. I was surprised that I passed with an A even though when we took the AP exam at the end of the year I think I got a 1. (whispering) So, I am like I don't ever want to take this in college. That was it. I am done.

On the other hand, Bella wants to be able to take pre-calculus. For Bella, given her comfort level with math, this is not a surprise. Bella, a first generation, confidently noted that an advance math

course was in her future. She stated. “I had statistics here [referring to present college]. But since I want to continue I want to do pre-calculus here too.”

Of interest here, to contrast the students with math trajectories towards calculus in grade 12, Mary studied AP Calculus and seems to have maximized her interest. Mary reported receiving a low AP test score. Was the low score a mitigating factor why she did not pursue further math studies? Was Mary not receiving the kinds of support and recognition of her ability? Did Bella see many more opportunities than Mary?

What is the impact on math achievement while controlling student and school factors?

Listwise deletion. At the student level, the regression coefficients for several variables that included SES, being second generation, being third generation, parental expectation, rules for hw, and seeing counselor were not statistically significant, so there is not enough evidence to conclude these have an impact. The school level variables for teacher relationship and percent of minority students were not statically significant.

Conditional on controlling for all other factors, a unit increase in sense of belonging is 4.00 and significant ($p < .05$) as well as an interaction with teacher relationships, γ_{41}, which is significant (-3.63, $p < .01$) and an interaction with percent minority students, γ_{42}, (7.06, $p < .05$). A unit increase in math self-efficacy is 3.17 and significant as well as an interaction with percent Hispanic teachers, γ_{63}, (-4.63, $p < .05$). Having AP math credit, γ_{80}, is (13.73, $p < .001$). At the school level, a unit increase in the percent of minority students is -53.74 and significant ($p < .001$). The variance component, τ_{66}, suggests that a sense of belonging is significant across schools, as well. However, given model fit results. Reliance for interpretation becomes challenging with this model. Notwithstanding, the variable, sense of belonging looks promising.

Imputed data. At the student level, the regression coefficients for SES, being second generation, sense of Belonging, and rules for home work were not statistically significant, so there is not enough evidence to conclude these have an impact. The school level variables for teacher relationship and percent of minority students, and percent of Hispanic teachers were not statically significant. Conditional on controlling for all other factors, being third generation is 2.30 ($p < .05$), and there is an interaction with percent of minority students which is 7.91 ($p < .001$). Third generation has an interaction with percent Hispanic teachers, γ_{33}, (-5.68, $p < .05$). Parental expectation of a college degree is 11.83 and significant as well as an interaction with percent of minority students, γ_{52}, (-18.84, $p < .001$).

Having AP math credit is (12.03, $p < .05$). At the school level, a unit increase in percent of minority students is -53.74 and significant. A unit increase in math self-efficacy, γ_{60}, (.94, $p < .05$) is significant and having AP math credits is significant.

The variance component for math self-efficacy suggests that not only does math self-efficacy vary between students, but also math self-efficacy varies between schools.

How much variance in math achievement is attributable to students and schools?

Listwise deletion. The one-way ANOVA (Model I; no predictors, only random effect for intercept) results indicate a grand school mean, $\gamma_{00} = 31.05$ and variability, τ_{00}, exists across schools (23.83; $p < .001$). The intraclass correlation coefficient, ICC, $\rho = \tau_{00} / (\tau_{00} + \sigma^2) = 23.83 / (23.83 + 92.12) = .2055$, suggests that approximately 21% of the total variance in student Math IRT scores exists across schools. This suggests that about 79% of the variance attributable to students and other unexplained factors.

The between-school variance in the intercepts explained by the student model becomes $[\tau_{00(null)} - \tau_{00(student)}] / \tau_{00(null)} = [(23.83 – 6.35)] / 23.83 = .73$, and within-school variance

explained by the student model is [$\sigma^2_{(null)} - \sigma^2_{(student)}$] / $\sigma^2_{(null)}$ = [(92.12 – 67.39)] / 92.12 = .27 using MODEL II since the variance estimates exist for each slope.

Imputed data. Results indicate the grand school mean, γ_{00}, 31.22 and variability exists across schools (52.23; $p < .001$). The intraclass correlation coefficient, ICC, $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$ = 52.23 / (52.23 + 72.90) = .4174, which suggest that 42% of the total variance in student Math IRT scores exists across schools. This suggests that about 58% of the variance is attributable to students and other unexplained factors

Between-school variance in the intercepts explained by the student model becomes [$\tau_{00(null)} - \tau_{00(student)}$] / $\tau_{00(null)}$ = [(52.23 – 35.41)] / 52.23 = .32, and within-school variance explained by the student model is [$\sigma^2_{(null)} - \sigma^2_{(student)}$] / $\sigma^2_{(null)}$ = [(72.90 – 57.29)] / 72.90 = .21 using MODEL II since the variance estimates exist for each slope.

What factors differ among immigrant and nonimmigrant students?

Differences among the three generations show an increasing mean math achievement score, and first generation score is significantly different (M = 28.13, SD = 1.12, $p < .05$). First and second generation are similar in having at least one math credit above Algebra 2 (M = .15, SD = .36), and third generation is higher (M = .18, SD = .39).

As it relates to the factors, SES mean increases by generation and is significant between generation 1 and the other generations (M = -.90, SD = .59, $p < .05$), and there is a significant difference between generation 2 and 3 (M = -.72, SD = .63; M = -.21, SD = .69, $p < .05$). Each generation falls below the standardized mean.

Parents of second generation have the highest expectancy for their daughters graduating college (M = 5.67, SD = 1.30) as opposed to first generation (M = 5.41, SD = 1.41) and third generation (M = 5.38, SD = 1.37). However, the differences were not statistically significant.

Second generation are higher when seeing the counselor (M = .85, SD = .36) than first generation (M = .74, SD = .44) and third generation (M = .75, SD = .43). As it relates to having at least one AP math credit, second generation are higher (M = .08, SD = .27) than first generation (M = .05, SD = .21) and third generation (M = .06, SD = .24).

As it relates to teacher relationships, first generation seem to have stronger relations (M = .30, SD = .92) than second generation (M = .16, SD = .89) and third generation (M = .08, SD = .93).

Third generation attend schools with lower proportions of minority students (M = .62, SD = .29, $p < .05$) than second generation (M = .74, SD = .27) and first generation (M = .73, SD = .24). Second generation attend schools with higher percentage Hispanic teachers (M = .34, SD = .31) than first generation (M = .25, SD = .26) and third generation (M = .28, SD = .26; see Table 4.6).

Sense of belonging for first generation (M = 2.95, SD = .58, $p < .05$) was significantly different from second (M = 3.17, SD = .52) and third (M = 3.20, SD = .58; $p < .05$).

The qualitative data provides examples that highlights some of the possible differences among these variables. Some of the notable variables include rules for home-work, gender expectations, and teacher relationships.

For example, with Mary, a second generation, home-work was treated differently when contrasted with Bella, a first generation. Perhaps Mary’s ability afforded such a difference? We expect parents of the second generation to be less laissez faire about home-work. Mary said, “My mom really didn’t have rules for doing home-work. She just knew she just knew that she didn’t have to worry about me not doing my home-work. Cause I was one of those good students who

would do everything would turn everything in." However, for Bella, "it was just home-work before going out or watching tv." This is not a surprising response from a first-generation parent.

Parents encouraged their daughters to pursue education. The expectations of parents to go to college were similar. Bella shared:

> Oh ammm the parents….they would push us to go up. If I had my parents they stopped helping me in elementary so if I had not done it myself to work up and to see how the problems worked if I had just depended on my parents to help me their level of education maybe that would be an important maybe.

> The fact that they weren't they couldn't speak our languages that well they would encourage us to go further and we eventually were able to translate to them more than we were used to. Back then it was just we started off basically full Spanish. We came to school we had ESL we did a lot better. After that they basically our parents were telling us like do more like try to get there so that we could translate communicate better. (Morena)

> My mom yes. I don't really talk to my dad but my mom she was very supportive of me. I would tell her what I wanted to do and she would be behind me one hundred percent. Now, when it came to helping me with homework she could not she couldn't help me. I was on my own at that part. But other than that, she was very supportive. (Mary)

Although parents, especially mothers encouraged education as instrumental, the ability to be role models problematized cultural expectations and gender role expectation. The question of interest for me here would raise the issue of parental educational expectation and its correlate to parental educational level as well as actual educational level completed by their daughters.

> For the Mexican culture, it's a lot of stay at home moms and the dad goes and does the jobs and stuff….. So, I think that like the Mexican American women they usually go for oh that way…. I think it's going to bring more of a mix because now that's there a lot of oh I'm going to do what I wanna do women are like I'm not going to stay home I'm going to go and do what I want….the generation before like I said my mom my grandma my aunts they were more like I am just going to stay home and cook do that and I respect that and I see that. That's good and something that you should do. I think the generation coming is seeing more like ok I can do that but I can also go and do what I like. (Crystal)

Mary stated:

> ….so, if the people they look up to is their mom and they see that their mom is at home. And if there is a dad. Because my stepdad he was very gender bias. So, he was more

> favorable to the boys than the girls even though I was better excelling [but] I feel like my mom pressured me more to be successful rather than my brother. Because he started college but he dropped out. And right now, I am trying to push my sister to do well. Get your grades in [sister's name] do well. I just want her to do better also.

Teacher relationships were important and positive for the participants. Bella noted that her teacher would bring over college friends or students of his and at the end of the day he would say, "Ok I want you do a challenge with her. I want you to write a problem for her and I would prove to you that she can do it." Crystal acknowledged that teachers "meant a lot. For example, when I was studying Geometry my teacher would stay after class with me and would help me. And my stats he would always like like be on top of us with everything. So, they all pushed me and helped me to get better grades." Mary shared her memories from elementary school when she stated, "when we first started learning fractions my teacher 'I'm like I really don't get this' and she like took me aside and worked with me, so they were all really helpful." All the participants seem to have positive relationships with their teachers.

What kinds of experiences influence the likelihood to study math above Algebra 2?

The levels of encouragement varied and suggest how these levels may have influenced the participants and their approaches to math. Encouragement was seen not only as words. For Crystal models were influential. She stated, "My grandparents my aunts like they never they don't have a history in that [Math], so I think maybe if they did it could have influenced me." Mary may have seen ahead the need to ensure she was grounded in an expected level of mathematics knowledge. Hence, for her, the career trajectory played a role in self-motivation. She said, "since elementary school I felt like I want to be a teacher because I've had so many positive experiences with my teachers that I wanted to have the same experiences with other students."

The experiences in math class were comforting and challenging. Monze acknowledges her positive experiences; however, her trajectory into more advanced math seems to fall short. Monze shared being in math class and leveraging her artistic skills. She stated:

> I remember they would give us projects for example for pi day we had to do ummm associate our artistic skills with math …. I remember this ummm it was like a wheel that I did. I did the pi sign around the middle then I used all the numbers for pi. I felt like it was something that I liked that I associated it with math so I had a great time doing that.

Morena ran into a challenge. Her math trajectory also fell short. She shared a short episode:

> I went to a class once in statistics…. I didn't really necessarily understand it. So to me that was like kinda embarrassing. That was my first grade it was an actual grade. I thought that it was something opinionated. And it turns out that it wasn't. So, when I got my first grade in the class so it was an F and I feel like to me that was shocking to get a bad grade in math…. I ended up just leaving the class cause I felt ashamed and I don't think I would be capable I wouldn't understand statistics and I moved to math for college readiness.

For Morena, although she stated, "Math is just to me like a favorite subject" she did not pursue a career in a STEM field but decided to study fashion design since, in her opinion, her scores to go to a university were not good enough. In addition, Morena recalled the time she had to drop, in her opinion, a more challenging math course that resulted in an initial failing grade.

Monze is enrolled in intermediate algebra and appreciates how her teacher affords her the opportunity to emulate how to solve problems. Monze and Marina had College prep math as their highest high school math. For these students, their current, required math courses are inescapable. Monze provided insights as to their current experience with math.

The racial composition of the school did not appear to factor into how the participants identified themselves as it relates to studying mathematics. For Mary, who completed AP Calculus in grade 12, her school was equally Hispanic with "some Asians and African Americans" and she noted that her math classes were mixed. Crystal's school, as contrast to Mary's was described where "there was a lot of white Americans and a lot of African

Americans." Crystal, noted, "There weren't a lot of Hispanics but there was some." Monze noted that in her school there were "more Whites and African Americans than there were Hispanics" and she also noted that in her algebra class "mostly the Caucasians would sit with the Caucasians. And African-Americans with the African-Americans, and I feel like there were not that many Hispanics" and these grouping seem to suggest she felt isolated. Bella, who also completed Calculus like Mary, noted that her high school was majority white then the next largest group was Hispanics followed by Black and Asians.

How does the emerging qualitative data provide a deeper understanding of the factors?

The emerging qualitative data suggests some grounding for understanding. The qualitative data relating to student-level factors reveal many similarities and some differences among the participants. The composite of SES includes parental education levels and income levels. None of the parents were reported to have graduated beyond high school. In terms of income, none of the participants were asked about this. However, when describing their parents, participants did not mention the career trajectories or occupations of their parents. Student generational levels among the participants only included one second generation and four first generations. The second-generation student and one first generation student took Calculus in high school, whereas, one other first generation took statistics, and the other two took college readiness as courses in grade 12. Only one participant, Bella, seems interested in advanced math. sense of belonging is exemplified when Monze and Bella shared their feelings of experiences with isolation. Monze spoke of the opportunities to work in groups, and that was important to her. She did mention sitting up-front in the class, and although she stated this was good for her, she did share the sense of feeling isolated. Bella mentioned not seeing more Hispanics in her advanced math classes. Although she expressed a concern about the lack of Hispanics in these

classes, she knew she had the ability and stayed in these classes. Parents were reported to have the desire to see their daughters succeed and obtain higher levels of education, despite none of the parents obtained levels of education beyond high school. Math self-efficacy ranges in these participants.

The level of math self-efficacy aligned with the emerging understanding of the participants and their levels of mathematics in grade 12. For Monze, she said that she second guesses herself when engaged with math. She also attributes a low-level interest in math to her parents not going to college. Morena thought she could not do statistics, and she left that course for what she perceived was a less rigorous course. For Bella, her teachers afforded her to exhibit her abilities. These activities allowed Bella to realize that math is something she can do. Although Mary studied AP Calculus, she did not want to study math beyond this level. Notwithstanding, Mary took a variety of math courses, did well, and even commented, “this [math] is good stuff.”

Rules for home-work had various ways of being enforced. For instance, Bella, who has a high interest in math was expected to do her home-work. Monze had rules but it was loosely defined for her. Mary did not have a rule because she was self-directed and disciplined to do her home-work. Only Mary reached AP math and took the exam. She received the lowest score—one—on the AP exam. Notwithstanding, her trajectory included many math courses that ended with AP Calculus in grade 12. Her math course work included, “Algebra 1B and 1A in middle school then Geometry in 9th grade Algebra 2 honors in 10th grade then pre-calculus in 11th graded then grade AP calculus in 12th grade.”

As it relates to the school-level factors, the qualtative data suggests that teacher student relationships were important to the participants. Many of the participants shared how math

teachers made them feel good and were helpful. However, one participant shared an experience of a math teacher who sometimes set opposite gender teams in math activities. The percentage of minority students in the composition of the school did not appear to factor into how the participants identified themselves as it relates to studying mathematics. However, for Mary, who completed AP Calculus in grade 12, her school was equally Hispanic with “some Asians and African Americans,” and she noted that her math classes were mixed. Of interest is the presence of the proportion of Hispanics in Mary’s and Bella’s school. In their schools, they completed Calculus. But a concern is Bella mentioning the lack of Hispanics in her advanced classes. Crystal’s school, in contrast to Mary’s was described where “there was a lot of white Americans and a lot of African Americans.” Crystal stated that she studied statistics in grade 12. No data from the qualitative data accounted for the role of or the percentage of Hispanic teachers.

Validity

Combining qualitative and quantitative studies create the problem of integration, hence, assessing validation issues must be addressed (Onwuegbuzie, & Johnson, 2006). Mixed methods researchers recommend that validity be termed *legitimation* as a bilingual nomenclature and posited nine types of legitimation: sample integration, insider-outsider, weakness minimization, sequential, conversion, paradigmatic mixing, commensurability, multiple validities, and political (Onwuegbuzie & Johnson, 2006).

Sample integration legitimation applies to situations in which statistical generalizations from the sample participants can be made to a larger target population. The researcher used the ELS:2002 database, which is a national representative sample of high school students. The Hispanic students were over sampled (Ingels, et al., 2005). The qualitative phase of the proposed included use of a sub-sample of Hispanic students from the same population, and should reduce the problem of statistical generalization.

Insider-outsider legitimation refers to the degree to which the researcher accurately presents and utilizes the emic and etic. The emic (viewpoint of the group member) and the etic (viewpoint of the researcher) are addressed. Members were provided opportunities to read and check their interview transcripts. Members affirmed that they trust the documents were translated correctly. Their stories were recorded and transcripts generated. Their words were documented as direct quotations.

A peer was recruited to review the data and check the interpretations. The researcher presented an interpretation of these words. The researcher is seen as having the role of an outsider since the researcher is neither female nor of Mexican descent. Notwithstanding, the researcher is an immigrant to the United States and can empathize with the challenges faced by this population such as issues with assimilation and modes of incorporation such as phenotype, educational attainment, and social support. An advantage of outsider role is to be free of bias; however, a disadvantage is the inability to have insider perspectives.

Weakness minimization refers to the extent to which "the weakness from one approach can be compensated by the strengths from the other approach and then plan and design the study to fulfill this potential" (Onwuegbuzie, & Johnson, 2006, p. 58). The researcher utilized the nature of the ELS:2002 data to be generalizable and to make statistical inferences. The qualitative data provided the personal perspectives of members of the population of interest.

Paradigmatic mixing legitimation involves the researcher "making the use of paradigm assumptions explicit and conducting research that fits with the stated assumptions" (Onwuegbuzie, & Johnson, p. 59). The meta-inferences made are evaluated using a research lens that factors in the multiple learning trajectories of observers and actors, as well as the notion that

our environments and stories are grounded in multiple realities, and we bring a multiplicity of values that should be considered where all are privileged.

Finally, multiple validities legitimation “refers to the extent to which all relevant research strategies are utilized and the research can be considered high on the multiple relevant ‘validities’” (Onwuegbuzie, & Johnson, p. 59). To this end, the researcher addressed validity of the quantitative phase and the qualitative phase. For instance, with respect to the ELS:2002 data, checks to ensure missing data and participant attrition will be addressed. Also, many of the models included fit statistics.

Potential Ethical Issues

Protective measures to ensure the anonymity of the participants included the security of all data. The recordings and notes were safely stored electronically with a password. Any paper copies were kept in a locked drawer. In addition, participants were provided the opportunity to provide an alias which was used throughout the interview and on any documents.

Creswell (2014) posits that regardless of the qualitative inquiry method, anonymity of the informants needs to be assured. One approach is to assign aliases to individuals. Also, the researcher needs to tell participants about their participation in the study, explain the purpose of the study, and should not engage in “deception about the nature of the study” (p. 174). All participants signed consent forms and were informed prior to their interview about the nature of the present study and its potential uses and given an opportunity, which they declined, for member checks (Creswell, 2012).

CHAPTER 5: DISCUSSION

Introduction

This chapter centers on a discussion of the findings. The results from the previous chapter will be used as the focus of the discussion. In addition, the discussion will tie back to the literature to make connections. The discussion is organized around each research question. A brief discussion about implications and possible future research follows as a conclusion to the chapter.

Discussion

After a brief look at a national dataset, followed by interviews, when taken together, provided direction for the selection of possible factors and covariates for examination at the early stages. From the interviews that made up the qualitative database, the data indicated that Bella, Crystal, Mary, Monze, and Morena all took Algebra 2, but their divergent high school math course selection beyond this threshold (Adelman, 1999) and possible factors that explain their math achievement, given that they are Mexican American females and of differing generations, needed further examination. This qualitative data was used as a formative assessment, which then lead to a summative assessment which involved a more rigorous reexamination of the quantitative data base. Selected variables were identified at the quantitative stage, and a hierarchical generalized linear modeling (HGLM) applied. Two theories were used to explain the outcomes.

Ogbu's cultural-ecological theory posits that minorities differ from one another with respect to *societal and school factors* (the system) and *community forces* as it relates to the degree to which groups experience social and economic discrimination, how they develop their attachment to minority cultural values, and how they utilize socialization practices related to culturally-specific values. Segmented assimilation theory suggests that disparities in human

capital and methods of incorporation will translate into patterned differences in adaptation patterns by immigrant offspring. Segmented assimilation theory seeks to answer, among others, the question of downward trends as it relates to what sector of society particular immigrant groups assimilate. There are distinct forms of adaptation: acculturation and parallel integration into the middle-class, a path to assimilation and into the underclass, or rapid economic advancement with “deliberate preservation of the immigrant community's values and tight solidarity” (Portes & Zhou, 1993, p. 83).

There may be some support for segmented assimilation theory as it relates to second generation academic decline. The results of the predicted probability for taking mathematics beyond Algebra 2, which are lower for the second generation, may be indications of the beginning decline. However, generation status alone should not be the only factor in understanding immigrant children and academic success (Bondy, Peguero, & Johnson, 2016b). In the present sample, one such factor at play may be SES, which for second generation falls almost one standard deviation. The interaction between third generation and teachers, suggests a decline in these relationships and have an effect on mathematics achievement. As such, the cultural-ecology of schooling may receive some support.

Student- and school-level factors are associated with mathematics achievement

As it relates to identifying from among the selected variables, especially those relating to mathematics achievement, the raw and imputed data provided some guidance for interpretation. Although the data suggests an improvement in scores by subsequent generations, we should note that the gap between first and second generation is wider than between second and third. Notwithstanding, as it relates to math achievement, the overall mean of approximately 33 points was stable in both imputed and imputed models. And this result was significant across schools.

Some variables were not significant when used in the imputed and non-imputed models. For instance, in the non-imputed data models, SES as a student level variable was significant in Model III but not as a random effect in Model IV. Using the imputed data models, SES was not significant as a fixed effect but was significant in the variance components.

The literature suggests that overall, many Mexican Americans live below the poverty line, and this may be explained by household occupation status predominately in the service sector (Pew Hispanic Center, 2016). SES has been found to be significantly related to academic achievement among Latinos (LeFevre & Shaw, 2012; Mosqueda & Maldonado, 2013), and for Mexican American students, low SES was related to access to additional educational opportunities in the form of an afterschool science program (Worthy, 2006). In addition, the school level variables (i.e., teacher student relationships, percent of minority students, and percent of Hispanic teachers) were not significant.

Some factors were found to be significant. For instance, in the listwise deletion model, the negative slope for the percentage of minority students was found to be significant across schools, but this was not the case for the imputed model where the slope was positive but not significant. A sense of belonging was found to have a positive fixed and random effect, as well as a positive interaction with the percent of minority students and a negative interaction with teacher relationships in the non-imputed model. However, in the imputed model, sense of belonging was found to be positively significant when fed into the model as a fixed effect. This result may attach the findings that suggested among Mexican adolescents, gender was negatively related to belonging and positively predicted GPA, and belonging was negatively associated to lower peer GPA (Delgado, Ettekal, Simpkins, & Schaefer, 2016).

Neither second nor third generation was found to have significance in the non-imputed models. The positive slopes associated with math self-efficacy and AP math in both non-imputed and imputed models were not surprising. However, it is noted that although taking AP math is associated with STEM-related college tracks, it was found that many Hispanic female high school students planned to pursue humanities, business, and medical fields (Robinson, 2003) and their AP Calculus scores are still low (e.g., in 2016, average AP Calculus scores fall below 3). The data suggests taking AP math as a positive effect on mathematics achievement, but this is not surprising. However, the struggle to get AP course work to translate to STEM careers among Mexican American females is to be further understood. Notwithstanding, although levels of segregation of high schools persist, it has been found that the percentage of minority students and the chance of taking higher level math courses increase in schools with larger populations of minority schools (Kelly, 2009). Perhaps at the school level, factors exist that have an interaction effect. Interestingly, we find one of the participants, Mary, took AP and scored a low grade. There appeared to be no second-generation advantage, in her case.

Using the imputed models, only third generation showed a significant positive effect. There was also a positive interaction with the percent of minority students but a negative interaction with the percent of Hispanic teachers. This negative interaction may be on account of the percent of Hispanic teachers available across schools. The data seems to suggest that Mexican American girls attend segregated high schools but third generation may be attending schools with lower proportions of Hispanic teachers, and their teacher relationships may be fragmented. There is a need for all students to have positive relationships with their teachers. There is a call for “cultural synchronicity” especially with Hispanic teachers and Hispanic students (Bondy, Peguero, & Johnson, 2016, p. 20).

Third generation significance in academic achievement is supported in the literature as well as the narrow differences between third generation and second generation and non-significant in academic achievement between first and second generation even though second generation had higher scores (Duong, et al., 2015). It has been found that among Hispanic students, generational status did not influence academic achievement (Kao & Tienda, 1995). However, among Mexican Americans, research suggests that first and second generation immigrant students outperform other generations, and third generation seem to have academic stagnation (Salgado, 2016).

Factors influence mathematics course taking beyond Algebra 2

Some of the selected variables that were used to test whether students would take credits beyond Algebra 2 contributed to non-convergence of the models. For instance, dropped variables were the school having a drop-out program, taking AP math, and the percentage of Hispanic teachers. The non-imputed and imputed models suggested significant log-odds of Mexican American female students taking high school math above Algebra 2 at a typical school. These results indicated low predicted probabilities. The imputed model revealed a low predicted probability, and the non-imputed model was even lower. Notwithstanding, the non-imputed model revealed sense of belonging as a significant predictor in the log odds of taking math beyond Algebra 2.

For the imputed model, the sense of belonging coefficient and parental expectation were found to be predictors with the largest conditional log-odds of a female Mexican American student taking Algebra 2.

Cooper, Robinson, and Patall (2006) suggest that the effects of homework on outcomes other than achievement have not been empirically tested. In the current study, an attempt to

examine the log-odds of rules for home-work on taking high school math beyond Algebra 2 among Mexican American females found a non-significant effect. Research here attempts to look at the effects of home-work on taking more advanced high school math courses, and the log odds suggests that doing home-work adds to the probability that students will take Algebra 2. Math-self efficacy includes math self-concept, and doing math home-work is positively associated with math self-concept (Xu, Yuan, Xu, & Xu, 2016).

The impact on math achievement while controlling student and school factors

After controlling for school and student level variables holding at their mean, the results from the imputed model suggest third generation adds points to math achievement above first generation students but not much more above second generation. Perhaps academic stagnation is there. Conditional on controlling for all other factors, third generation has an interaction with percent of minority students which is 7.91 and significant, and being third generation has an interaction with percent Hispanic teachers which is -5.68 and significant. This negative interaction suggests that for third generation, that the percentage of Hispanic teachers do not add to mathematics achievement. This result may suggest the need to balance the percent of Hispanic teachers who could relate to Mexican American female high school students. Do teacher student relationships for Mexican American girls deteriorate as it relates to the percentage of Hispanic teachers?

Although theory suggest a second-generation advantage, the present study suggests that third generation Mexican American students' performance on mathematics achievement is higher than second and first generation. Ogbu and Simons (1998) argue that dominant behaviors of disengagement among minorities have resulted from historical treatment and the interpretation of such treatment, the dual frame of reference affords immigrant parents and their children to

believe that the educational system provided better than their homeland and should be used for credentialing. As a result, immigrant children do better than native born children. For Ogbu and Simons, third generation would be worse off academically than second or even first generation immigrants. From the present study, we take note of the narrowing math achievement gap between second and third generation.

Parental expectation of a college degree is positive and significant but there is an interaction with the percent of minority students which is -18.84 and significant. This may indicate that Mexican American parents expect their daughters, to "go up" as stated by Bella. However, the percent of minority students may dampen these expectations. Among the participants, none of their parents went to college; however, participants shared that their parents had high academic expectations. In fact, all these women are on the path to have a college degree trajectory.

The differences in parental educational levels and their daughters' levels of education need to be understood especially with nativity considerations. The issue of parents and the percent of minority may suggest that these parents with daughters in these schools may be in schools with low SES and other factors may need to be accounted for in the model. Parents may be encouraging their daughters to advance in educational aspirations, but when asked, they may express that given the contextual factor of a segregated school, they may not believe that their daughter would get ahead academically.

AP math credits is positive and significant, but at the student level. Maybe adding this as a random variable in other models would be necessary.

Variance components for SES and sense of belonging suggests differences in the relationship between schools and math achievement. The variance component for math self-

efficacy suggests that not only does math self-efficacy vary between students, but also math self-efficacy varies between schools.

Exploring the listwise deletion model, a unit increase in sense of belonging is 4.00 and significant as well as an interaction with teacher relationships which is -3.63 and significant, and sense of belonging has an interaction with percent minority students which is 7.06 and significant. Sense of Belong has a negative effect and an interaction with the percent of Hispanic teachers which is -5.31 but not significant. A unit increase in math self-efficacy is 3.17 and significant as well as an interaction with percent Hispanic teachers which is -4.63 and significant. The findings could be taking into account for possible exploration along with other factors for better models.

Variance in math achievement attributable to students and schools

Research question four was to answer the question that relates to the amount of the variance in math achievement scores that is attributable to Mexican American female students and schools. An examination of the contribution between students and schools seem to suggest a large amount of variance attributable to schools.

The analysis of the null models for both non-imputed and imputed models suggests that multilevel modeling is needed with more predictors to create a better model fit (Garson, 2012; Hox, Moerbeek, & van de Schoot, 2010). Using the non-imputed data significant variability in math achievement exists across schools. The intraclass correlation coefficient, ICC, suggests that the remaining variance, in this case about 72% should be attributable to other student factors. But we note the possibility of missing data.

The imputed data model account for a significant variability between schools and this result suggested that about 60% of the remaining variance would be attributable to students. As

expected the variances between schools vary much more that within school variances. This strengthens the notions for one of the assumptions for the need to use HLM for cluster data. The imputed model seems to suggest that additional factors need to be considered since more of the student level variance is left to be explained.

How factors differ among the generations

To explain how the selected factors differ among the generations, we first consider that third generation math achievement exceeds first and second generation. First generation scores were significantly different. However, the achievement results suggest second generation Mexican American female students scores approach those of third generation, and their scores are significantly different from the first generation.

On many factors, the second generation seems to fare much better than first and third. For instance, second generation have high math self-efficacy, higher parental expectations to go farther in college, take more AP math credits, and attend schools with higher percentage of Hispanic teachers. However, they live in households that are more than one-half a standard deviation below the poverty line and lower than third generation. This difference was significant. The present sample seems to suggest a significant difference between generations with respect to SES. Among Mexican American female high school students, first generation SES was significantly below second and third. It has been found among Mexican youth that when immigrant status was correlated with low SES, lack of parental and counselor guidance support existed (Perez-Brena, Delgado, De Jesús, Updegraff, & Umaña-Taylor, 2017).

Second generation parents have the highest level of expectation for college graduation, and it’s not surprising that their children consult with counselors at higher rates which aligns with Ogbu’s theory. However, they seem to have lower teacher relationships than first generation

but much better than third generation. It has been found that third generation students have higher incidents of negative interactions with teachers and first generation Latina/o students seek out similar co-ethnic teachers in order to relate with teachers on a cultural level and whom they may share their concerns (Salerno & Reynolds, 2017).

The Latino high school student dropout rate is related, in part, to their sense of belonging and lack of attachment to school (Gándara, 2010; Gillen-O'Neel and Fuligni, 2013) and negatively associated to lower peer GPA (Delgado, Ettekal, Simpkins, & Schaefer, 2016). Else-Quest, Mineo, and Higgins (2013) posited that improving women and ethnic minority representation in STEM fields is "anchored in the influence of role models and mentors" and that these role models have the "greater potential to recruit students into particular academic majors when they convey a sense of Belonging" and shape attitudes and beliefs about abilities (p. 305). Although Gillen-O'Neel and Fuligni (2013) found that sense of belonging declined over the years for Latinas, the present study finds a significant positive relation between Mexican American females and across schools on mathematics achievement. In fact, sense of belonging was shown to have a large odds ratio on having the success of taking math beyond Algebra 2. This effect was large for first generation and suggests a higher predicted probability (.27) than second generation (.25) and third generation (.26) of taking math beyond Algebra 2.

Of interest is the finding that sense of belonging for first generation was lower, so it may seem that other factors may be needed to explain why their math achievement is lower than second and third generation.

Gillen-O'Neel and Fuligni (2013) posited that "the extent to which students maintain a sense of belonging at school may predict whether or not they leave high school prematurely" (p. 678). Else-Quest, Mineo, and Higgins (2013) posited that improving women and ethnic minority

representation in STEM fields is "anchored in the influence of role models and mentors" and that these role models have the "greater potential to recruit students into particular academic majors when they convey a sense of Belonging" and shape attitudes and beliefs about abilities (p. 305).

The present results suggest a significant relationship between being self-identified as third generation, and math achievement after controlling for school and student level variables holding at their mean, the results suggest that being third generation adds about two and a half more points to the overall math achievement mean above first generation students and about one half point above second generation. Being third generation seems to interact with the percent of minority students and the percentage of Hispanic teachers. However, additional investigations will be needed since the amount of imputation on the Hispanic teacher variable may not provide the level of accuracy needed.

The present study found that the participants had positive interactions with teachers, and these relationships did not seem dependent on generational status although first generation had the highest reported relationships with teachers. It has been found that teachers equitably rewarded immigrant and language-minority students with high grades based on perceptions, but gaps in advancing in math based on these perceptions and differential returns to students' hard work suggest that high schools are failing to foster success for some of the best and brightest children of immigrants; teachers grade students equitably but hold stronger beliefs that nonimmigrant students will attend college (Blanchard & Muller, 2015). A view of the descriptive data shows first generation students report having the highest teacher relationships and third generation with the lowest.

The data suggests that first and second generation Mexican American females attend public schools with high ratios of minority students. The imputed data suggests a significant

negative interaction between parental expectation and percent of minority students. However, access to AP math may be possible, since the data suggest a positive interaction.

Interestingly, the qualitative data suggests that all students attained at least Algebra 2 in the *math ladder*, but only one informant mentioned that she took AP Math, and her AP test score, which she self-reported, was low. AP math test scores for most Hispanic females continue to fall in the lowest score categories. For instance, in 2016, the average score among Hispanic females on Calculus AB was 2.17 and slightly higher (2.97) for Calculus BC Among a sample of high school students—only 13% scored 5 and 48% scored 1 (College Board, 2017). Bozick and Ingels (2007) found the Algebra II–Precalculus sequence was followed by a low percentage of students (6.8%). They found that students who take Precalculus paired with another course had the largest gains in math achievement over a two-year period (6.9 points), and those who followed the geometry–Algebra II gained 5.2 points, while those who had no math beyond Algebra II only gained 4 points. The indication that these informants took Algebra 2 may have been a result of curriculum efforts to ensure all students receive credits for this math course (Fl. Stat. §1003.4285(1)). In the present study, second generation followed by third generation students seem more likely to have at least one AP math credit, to have seen their counselors, and to have parents who expect them to go far in college.

A look at the descriptive data suggests second generation Mexican American females seem to have stronger math self-efficacy than first generation and even stronger than first generation. Parents of second generation students may be pushing these students to do well and also the amount of experience second and first generation students have with US schools may be attributable to these factors. First generation students may be redirected to lower level courses because of language barriers, among other possible factors. As such, the lower mathematics

achievement among first generation is not surprising. Of interest is that the mathematics achievement scores of second generation students in this sample was lower than third and they had the lowest predicted probabilities of taking Algebra 2 after holding school and other student factors at their mean. These findings seem to suggest that other factors may be playing in second generation lower achievement. The immigrant paradox argues that second generation students do better despite their disadvantages, however, other factors such as parental education may contradict such notions (Feliciano, & Lanuza, 2017).

Encouragement and experiences that relate to studying math beyond Algebra 2

Research question six was posed to develop a greater understanding of Mexican American female high school students and the kinds of experiences in mathematics classes and the encouragement that they receive to study math. The informants mentioned that they had no immediate female relatives who pursued careers in math. Understanding adults' behaviors becomes critical for advancing theoretical knowledge of the environmental transmission of gendered math attitudes (Gunderson, Ramirez, Levine, & Beilock, 2012). As such, this lack of modeling feeds into the notions of increased math self-efficacy. These students then rely on mathematics teachers and perhaps peers to model mathematical dispositions.

The informants mentioned positive relations with teachers. Mary spoke about her math teacher impressed with her math interests. As a result, this encouragement seems to have added to Mary's pursuit of math beyond Algebra 2; she took Calculus, although not going farther. Math self-efficacy needs modeling to provide constant support. Four experiences readily influence self-efficacy beliefs: enactive attainment, vicarious experience, verbal persuasion, and physiological reactions (Zimmerman, 2000; Usher & Pajares, 2009). On the other hand, we see Morena did not do well in Statistics. The immediate failure grade and the lack of anyone to

provide the encouragement that she needed, made her walk away from this high-level course to a less challenging math course. Among college and non-college Latinas with low mathematics trajectories and negative recollections of math, the college women mentioned math and their lack of mastery of the content; one developed a strategy to improve her math grades by relying on a family member as a vicarious source (Zaragoza-Petty, & Zarate 2014).

In addition, although Mary and Bella progressed respectively to Calculus and AP Calculus, their influence sources may have been limited to teachers. Bandura (1982) argues that the construct of self-efficacy is a construct embedded in a theoretical system and differs from confidence. Pampaka, Kleanthous, Hutcheson, and Wake (2011) found statistically significant positive correlations, suggesting that the math self-efficacy score of the students can predict their achieved grade.

Peers are important. The informants suggested that their schools had Hispanic student representation. However, one participant mentioned that these peers appeared to shy away from higher math courses. She mentioned a sense of isolation in higher math courses. None of these participants mentioned being teased or felt peer pressure not to perform. One of the factors in studying minority student perception and response to schooling is symbolic adaptation and peer relationships.

Among involuntary immigrant students, their perceptions and responses to schooling could be strongest when they perceive school as threating to minority culture (Ogbu & Simons, 1998). The present study seems to support prior research which suggests that larger proportions of minority students have negative effects on academic achievement and one of the present models, listwise deletion, using the percent of minority students as a fixed school level effect, support prior research (Mickelson, Bottia, & Lambert, 2013; Orfield and Frankenberg (2014).

Notwithstanding, it has been found that greater opportunities are provided for minority students to study higher level math in schools with larger minority populations (Kelly, 2009). The imputed data suggests a small, non-significant positive interaction as it relates to percentage of minority students with sense of belonging on math achievement. The imputed model suggests that being third generation and has a positive interaction with the percent of minority on mathematics achievement.

As shared in their interviews, participants relayed that counselors and their role did not seem to be a factor with academic success. The quantitative data suggests a strong positive significant relationship between seeing the counselor and math achievement. Most, if not all the participants had little or no relationships with their counselors, as it relates to academic achievement. We have to wonder if this is negative *marianismo* (self-silencing and subordinate to others) that was found to be associated with lower positive academic attitudes (Piña-Watson, Lorenzo-Blanco, Dornhecker, Martinez, A. & Nagoshi, 2016).

The quantitative results, from the non-imputed data, suggest a small counselor effect. And from the imputed data, this effect was positive and significant on math achievement. The counselor variable was not used to test the probability for taking math beyond Algebra 2 since the models did not converge when this variable was entered. Ogbu and Simons argue that in the dual frame of reference, involuntary immigrants are ambivalent about the role of adults in schools. Involuntary immigrants see their parents not getting ahead. Actual experiences with education and with opportunity structure or rewards of education influence their behavior much more than abstract beliefs about education (Ogbu & Simons, 1998).

The relationship between Mexican American female high school students and their counselors need to be strengthened. Vela, et al. (2013) suggest that it is possible that Latina/o students have negative interpretations of evaluations and feedback from their school counselors

which negatively impacted enrollment in AP courses. These researchers found perceptions of school counselors' high expectations as a positive predictor of AP course enrollment.

Ogbu and Simon (1998) argued that immigrant students interpret the relationship with school personnel under a cultural model of schooling. The beliefs by minorities about or interpretations of the relationship with schools and authorities are interpreted through the lens of the dual frame of reference, and the strength of the relationships relate to how they perceive treatment from the system. Auberbach (2002) found that among Latino immigrant parents who held beliefs that education was important for their children perceived counselors as fully helping. However, these parents portrayed counselors as "stubborn, unfeeling" bureaucrats (p. 1381).

How the emerging qualitative data provides a deeper understanding

The final research question focused on how the emerging qualitative data can be used to provide a deeper understanding of the strength of the relationship of possible student-level factors and school-level factors that influence the likelihood of taking advanced high school mathematics courses. Based on the multistage mixed methods research design, an interrogation of the two databases provides the quantitative data and qualitative data arising from rigorous interviews that could provide a direction.

Once the interviews were conducted, the conceptual framework was reinforced. Prior readings about persistently low academic achievement, especially among Mexican Americans, informed the appropriate theories that may explain this persistence. The quantitative variables of interest were selected. The qualitative data in the present study showed that all the participants enrolled in at least one high school math course above Algebra 2. These participants achieved the threshold on the *math ladder* (Alderman, 1999). Notwithstanding, among these participants in the first generation, two went on to enroll in either Calculus or Statistics. The other two enrolled in a college math preparation course, one who first enrolled in a statistics course but dropped.

One participant who identified as second generation went on to enroll in AP Calculus. These participants acknowledged that they enjoyed math to some extent; however, they did not have other female family role models to encourage pursuing mathematics as a subject to study. Math self-efficacy relates to having models such as teachers and other adults (Zaragoza-Petty, & Zarate, 2014). Mary and Bella developed positive relationships with teachers who showed an interest in their math abilities. However, for Morena and Crystal, math teachers were important to helping with providing students with a sense of confidence in doing math, but their teachers did not go out of the way to provide support in these student's math interest. Unfortunately, all the participants suggested that their school counselors were not available to the extent expected. Improving women and ethnic minority representation in STEM fields is "anchored in the influence of role models and mentors" (p. 305). The quantitative analysis suggests that school counselors and teacher relationships have roles to play in the development of math success for Mexican American female students.

Peers did not seem to play a major role in the academic life of the participants. However, the researcher did not explore these relationships. Notwithstanding, one participant shared her concerns about not seeing more Hispanics in upper level math courses in which she was enrolled. Another participant wondered about peers who drop more advanced classes. The expressions of empathy with peers may be the need to have more peers in their math class which may be a signal for connections with cultural sympathizers. From the quantitative data, the strong positive interaction effects with the percent of minority students but negative with teachers may suggest some concerns. Teacher relationships with students need to have a positive effect on math achievement.

The importance of doing home-work was explored from both databases. The participants' experiences with having rules for home-work were mixed. Although parents expected their daughters to do home-work, there seems to be no enforcement of rules for doing home-work. The quantitative results did not show rules for home-work as a significant predictor of math achievement or predicting taking math beyond Algebra 2. Even though the quantitative data show that rules for doing home-work was strong across generations, the effects were generally not significant. Although the listwise deletion computation shows an interaction between rules for home-work and the percentage of Hispanic teachers, these results should be taken with precaution since more than five percent of the variable, percentage of Hispanic teachers (F1A32A), was missing. Rules for doing home-work was not a significant predictor for taking high school mathematics beyond Algebra 2. In fact, the results suggest a reduction in the odds of taking math beyond Algebra 2. Ogbu argues a coping strategy associated with perceptions of dominant culture is to avoid homework.

Math self-efficacy was a factor that should get more attention. The participants expressed a range of abilities with math. For instance, we notice Bella and Mary expressing comfort levels with math and having the confidence. Perhaps this sense translates to their moving farther ahead on the ladder than say, Monze and Morena. For Monze and Morena, they expressed they liked math, but Morena left a class, once she received a low grade, and Monze relies on her teacher to show the math.

Only one participant self-identified as second generation. When compared to the other participants, the distinguishing factor as it relates taking Algebra 2 is a course in AP Calculus. Mary took the exam, but she scored low. AP math scores among Mexican American girls are generally low. The redeeming factor appears to be a sense of Belonging. None of the participants

expressed not fitting into school. Bella reported some teasing, but those experiences seem to be mitigated by her teacher encouragement and sharing her success in math.

Research Implications and Future Steps

Establishing causality using cross-sectional data is difficult. As such, one of the implications of the present study would be for mixed methods researchers to examine longitudinal data to explore causality. Acculturation needs to be taken into consideration. Third generation may suggest time and acculturation reaches a plateau with third generation since second generation are positioned to do better academically by leaning on parental optimism (Kao & Tienda, 1995). It was found a high correlation between GPAs and identifying closer with their culture, Spanish language preference and proficiency (Colón & Sánchez, 2010). The question raised would then include the extent of acculturation on mathematics achievement and math course taking among Mexican American females.

Another implication would include the encouragement of teacher administrators to recruit high school counselors who would make the effort to seek out Mexican American females. As suggested by past research (Gibson & Ogbu, 1991; Kao & Tienda, 1998; Ogbu, 1991; Valenzuela, 1999), Mexican American students' negative experiences with school systems have negative effects on educational aspirations, which behooves high school counselors to develop greater awareness to inform all students about opportunities such as course taking and career pathways. Among a sample of mostly Mexican Americans, it was found that school counselors' high expectations were found to be a positive predictor of AP enrollment (Vela, Zamarripa, Balkin, Johnson, & Smith, 2013). In fact, these researches found a positive relationship between students "who perceive higher expectations from school counselors and enrollment rates in AP courses" and they also found that Latina/o students who fostered a greater sense for Mexican culture are more likely to take AP courses. Low AP enrollment may be an indication of tracking.

Research has suggested that the log-odds of Mexican Americans in college math tracks are lower than other students (Ballón, 2008).

A further implication of the present study includes how to leverage sense of belonging in mathematics classrooms. Gillen-O'Neel and Fuligni (2013) argue that little is known about the long-term effects of school belonging over the course of high school and the extent of its association with academic achievement and value of school. They found that sense of belonging could decline over the four years in high school. Cooper (2013) found that Latinas engaged more in class when the teacher showed a sense of caring.

The present findings suggest that first generation Mexican American female low math achievement could be boosted with increased use of Spanish discourses in mathematics classrooms. Valenzuela (1999) speaks to the notions of *subtractive schooling* which is the elimination of cultural references from school milieus and argues for increasing cultural connections such as languages. The present data suggests a low mean in the percentage of Hispanic teacher representation. This finding may suggest that first generation use of Spanish in mathematics classrooms may need to be examined. In addition, educational policy makers should increase the use of Spanish language training among high school mathematics teachers.

Random slope models in the logistic models would be useful. The random slope model would be more realistic and we would get a better representation of the uncertainty about the fixed as well as more accuracy as it relates to the standard errors (Hox & Roberts, 2011).

A challenge for researchers would include the use of complete datasets. Hierarchical Linear Modeling is subject to the vicissitudes of missing data. Consequently, techniques to deal with missing data and HLM continue to receive treatment. One concern is the researcher's

knowledge of the distribution of missing data given the observed data, so the choice of variables must be given additional consideration for its inclusion in the model (Hox & Roberts, 2011).

There should be methods that continue to examine how multistage mixed methods align with sampling techniques. For instance, mixed methods researchers could examine how multistage designs using qualitative data would align using the longitudinal quantitative dataset. Researchers would need to apply the revision of the data and examine how the variation in concerns of participants over time as individual academic trajectories change. Researchers would need to interrogate both sets of data over time.

Additional research should take into consideration regional differences. With respect to the population of Mexican Americans, greater concentrations live in the west and southwest regions such as in Arizona (91%), California (83%), and Texas (88%). Concentrations of Mexican Americans in particular regions may explain some variability in math achievement and math course taking in high school above Algebra 2. If these concentrations account for poverty rates, then SES factors could be further teased apart. Some researchers suggest that discussions about mathematics course taking in high school occurred less frequently among students, teachers, and parents when children were from lower SES backgrounds (Crosnoe & Schneider, 2010). For Mexican American female high school students, words of wisdom are insufficient. Counselors need to be more involved, teacher relationships should be fostered, and enrollment in AP math courses encouraged. For Mexican American high school females, developing a sense of belonging appears as a necessary condition that relates to mathematics achievement and the chances of taking advanced high school mathematics courses.

There needs to be an inspection of the high school transcript data for Mexican American females. The ELS:2002 database provides for data collection beyond high school graduation.

Thus, this inspection would be to examine long term math course choices on college going and career goals.

The research on the amount of hours spent on math home-work among Mexican American female high school students should be encouraged.

Based on the present study, the development of additional studies should use some of the factors explored here. To advance the research on Mexican American females in high school, student level factors should certainly include sense of Belonging, math self-efficacy, parental expectation as it relates to graduating college. School level factors should include the percent of Hispanic teachers.

Limitations

Like many studies, the present exploratory analysis includes a few that warrants the reader's attention. First, the researcher used quantitative data that was self-reported by students, parents, and administrators. One of the challenges to overcome with survey data includes the collection of complete data. Thus, the percentage of missing data was always a concern. The accuracy of the standard errors and the ability to make inferences can be challenged. Notwithstanding, imputation is an agreed upon technique that deals with missing data; however, the discussion on the accuracy of imputation methods is ongoing.

Second, generalizability beyond high school Mexican American females becomes a limitation. Nevertheless, the research as it relates to female academic achievement should be pursued bearing in mind that Mexican Americans are not monolithic and comparisons to other groups should be given reconsideration, given the challenges associated with persistent low academic achievement (Gutiérrez 2008; Gutiérrez 2012b; Mantute-Bianchi, 1991).

Third, the present study uses data from a longitudinal study. This data came from a nationally representative study of 10th graders in 2002 and 12th graders in 2004

(https://nces.ed.gov/surveys/els2002/). Studies and calls to use this national dataset, known as ELS:2002, still occur (see http://www.aera.net/Professional-Opportunities-Funding/AERA-Funding-Opportunities/Institute-on-Statistical-Analysis). Nevertheless, changing demographics, economic opportunities, efforts to improve educational conditions among Mexican American females may have influenced higher math achievement since the ELS:2002 database was constructed. Nonetheless, persistence in low math achievement among Mexican American high school achievement still exists (e.g., in 2016, average AP Calculus scores fall below 3).

Fourth, given the exploratory nature of the present study, some cases were dropped to address the high percentage of single clusters. This opened the problem of small cluster size; however, arguments for using singletons and HLM can be handled as long as the number of clusters are large (Bell, Morgan, Kromrey, & Ferron, 2010).

There needs to be more robust methods to test the design effect. More robust tests would include the use of the predictors.

The educational aspirations as well as academic achievement of Mexican American females continue to progress, and, coupled with migration, will afford new communities and economies (Castillo, 2016). Notwithstanding, the growth of our population as it relates to the proportion of Mexican Americans and educational achievement cannot and should not be ignored. We need to understand the factors that continue to challenge Mexican American academic achievement, especially mathematics achievement. Math achievement relates to STEM education, and the dearth of Mexican American females in science related fields need further understanding. The present study suggests that we need to ensure that, among Mexican American females, the sense of belonging and math self-efficacy develop to ensure greater math achievement. All people everywhere endure the challenges of life (Castillo, 2016).

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APPENDIX A : TYPOLOGY OF MEXICAN DESCENDANTS

Category	Time in U.S.	Identify as	Primary Language	Minority Status	Academic Response
Recent Mexican Immigrant	< 5 years	Mexicanos; Mexico is home	Spanish	Voluntary immigrant	
Mexican oriented	At least 5 years	Mexicanos; U.S. is home	Bilingual /dominant English	Voluntary immigrant	
Mexican American	Almost always U.S. born	(a) acculturated (b) acknowledge Mexican parentage but moved away from Mexican culture (c) Mexicanos at home Anglos at school	English (Spanish language proficiency varies)	Neither explicitly nonimmigrant nor immigrant	
Chicano /	More second generation	Mexican; Mexicanos; Chicanos	English	Involuntary immigrant	want to do well but exhibit frequent absences, disruptive behavior, fail classes
Cholo (stereotyped gang members)	More than second generation	Mexican; Mexicanos; Chicanos	English	Involuntary immigrant	Similar to Chicanos

Figure A.1. Five-category typology of Mexican descendants. Adapted from Matute-Bianchi, M. E. (1991). Situational ethnicity and patterns of school performance among immigrant and nonimmigrant Mexican descent students. In John Ogbu (Ed.), *Minority status, opposition oppositional culture, & schooling* (397-432). New York, NY: Routledge.

APPENDIX B : MULTISTAGE DESIGN

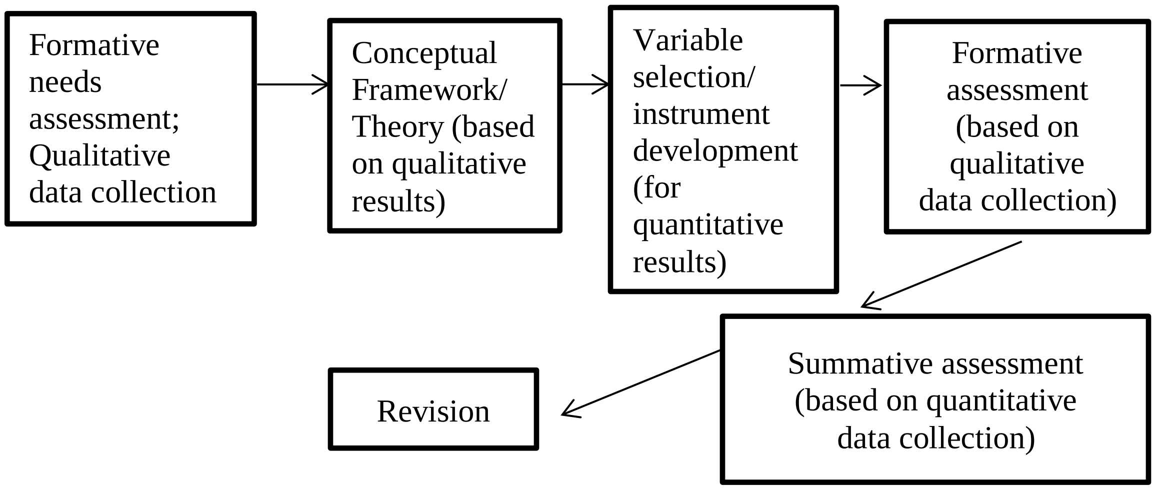


Figure B.1. Multistage exploratory design. Adapted from Creswell, J. W. (2015). *A concise introduction to mixed methods research*, p. 58. Thousand Oaks, CA: SAGE**.**

APPENDIX C : IRB APPROVAL

ACTION ON EXEMPTION APPROVAL REQUEST

LSU

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu | lsu.edu/irb

TO: Lester Archer
ELRC

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: March 2, 2016

RE: IRB# E9804

TITLE: A Mixed Methods Analysis of School-Level and Student-Level Effects: Mexican-American Female Students and Mathematics Course Taking Above Algebra 2

New Protocol/Modification/Continuation: New Protocol

Review Date: 3/2/2016

Approved X **Disapproved** ______

Approval Date: 3/2/2016 **Approval Expiration Date:** 3/1/2019

Exemption Category/Paragraph: 1; 2b; 4a

Signed Consent Waived?: No

Re-review frequency: (three years unless otherwise stated)

LSU Proposal Number (if applicable):

Protocol Matches Scope of Work in Grant proposal: (if applicable)

By: Dennis Landin, Chairman DLandin

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. **SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.**

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

Figure C.1. IRB Approval

APPENDIX D : SEMI-STRUCTURED INTERVIEW PROTOCOL

- Would you say math is a subject that you have enjoyed studying?
- How would you describe your overall experiences in your math classes?
- What are some of your best moments in math classes?
- How would you describe your worse experience in one of your math classes?
- How do you think teachers could enrich the math experiences of girls?
- To what extent do you consider teachers treat boys and girls differently in math classes?
- What are your feelings about pursuing a career in science, technology, engineering or mathematics?
- Would you say that your parents encouraged you to pursue mathematics?
  (If yes or no response, ask in what ways parents encouraged/discouraged participant.)
- What rules did your parents have for doing home-work?
- What kinds of abilities do you think you have that separate you and your ability to do math?
- In addition to my questions about your mathematics experiences, is there something that you would like to share relating to your experience?
- How would you describe your ethnicity?
- Were both of your parents born in the US?

APPENDIX E : VARIABLES USED IN THE MODEL

Table E.1. Variables used in the model

	Variable Name	Variable Label	Levels
Demographics			
Sex	BYSEX	Sex-composite	1 = male 2 = female
Ethnicity	BYHISPAN	Student's Hispanic subgroup-composite (restricted)	1 = Mexican, Mexican American, Chicano 2 = Cuban 3 = Dominican 4 = Puerto Rican 5 = Central American (Costa Rican, Guatemalan, Honduran, Nicaraguan, Panamanian, Salvadoran) 6 = South American (Argentinean, Colombian, Peruvian, etc.)
SES (composite)	BYSES1	Socio-economic status composite	Continuous -2.11-1.82,.0418/.743
Dependent Variable			
Academic concentrator (composite)	F1RACADC	Academic concentrator	0 = does not meet requirement 1 = met requirement
Math IRT score	BYTXMIRR	Math IRT estimated number right	
Independent Variables			
Generation (composite)	BYGNSTAT	Generational status	1 = Newly immigrated 2 = First generation 3 = Second or more generation

(Table E. 1. continued)

Belonging (composite)	BYS20H	*In class often feels put down by teachers*	1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree
	BYS20I	*In class often feels put down by students*	1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree
	BYS20J	*Does not feel safe at this school*	1 = Strongly Agree 2 = Agree 3 = Disagree 4 = Strongly Disagree
Math self-efficacy	BYS89A	*Can do excellent job on math tests*	1 = Almost never 2 = Sometimes 3 = Often 4 = Almost always
	BYS89B	*Can understand difficult math texts*	1 = Almost never 2 = Sometimes 3 = Often 4 = Almost always
	BYS89L	*Can understand difficult math class*	1 = Almost never 2 = Sometimes 3 = Often 4 = Almost always
	BYS89R	*Can do excellent job on math assignments*	1 = Almost never 2 = Sometimes 3 = Often 4 = Almost always
	BYS89U	*Can master math class skills*	1 = Almost never 2 = Sometimes 3 = Often 4 = Almost always
Homework rules	BYP69B	Family rules for 10th grader about doing homework	0 = no 1 = yes
Parent expectation (composite)	BYPARASP	How far in school parent wants 10th grader to go	1 = Less than high school graduation

(Table E. 1. continued)

			2 = High school graduation or GED only 3 = Attend or complete a 2-year school course in a community or vocational school 4 = Attend college, but not complete a 4-year degree 5 = Graduate from college 6 = Obtain a Master's degree or equivalent 7 = Obtain a Ph.D., M.D., or other advanced degree
Dropout prevention program	BYA03R	Alternative/dropout prevention school (restricted)	0 = no 1 = yes
Percent minority students in school	CP04PMIN	Percent minority-2003/04 CCD/PSS (restricted)	Continuous
Teacher-student relations (composite)	BYTSTREL	Scale of respondent's perceptions of student-teacher relations	Continuous; N (0,1)
Sought information about the entrance requirements of colleges	F1S48A	Has gone to counselor for college entrance information	0 = no 1 = yes
Number of AP/IB math courses	F1RAPMA	Total AP/IB math courses	
Hispanic Teachers	F1A32A	% of full-time teachers are Hispanic	Continuous

APPENDIX F: DESCRIPTIVE STATISTICS VARIABLES OF INTEREST ELS:2002 DATABASE

Table F.1. Descriptive Statistics Variables of Interest

Variable	Label	Mean	Std Dev	Std Error	Min	Max	N	N Miss	% Miss
F1RACADC	Academic concentrator	.2698	.4439	.0036	.0000	1.0000	14810	1389	9.38
BYTXMIRR	Math IRT estimated number right	38.0594	11.8782	.0942	12.5230	69.7190	15890	305	1.92
BYHISPAN	Student's Hispanic subgroup	-2.2515	1.9317	.0156	-3.0000	6.0000	15240	953	6.25
BYSEX	Sex-composite	1.5021	.5000	.0040	1.0000	2.0000	15370	827	5.38
BYSES1	Socio-economic status composite	.0418	.7430	.0060	-2.1100	1.8200	15240	953	6.25
BYGNSTAT	Generational status	2.6637	.6606	.0057	1.0000	3.0000	13340	2859	21.43
BYPARASP	How far in school parent expects	5.3849	1.2748	.0101	1.0000	7.0000	16020	178	1.11
BYS20H	In class often feels put down by teacher (see Factor 2, p. 199)	3.1288	.6953	.0058	1.0000	4.0000	14480	1715	11.84
BYS20I	In class often feels put down by students	3.0759	.7121	.0059	1.0000	4.0000	14460	1740	12.04
BYS20J	Does not feel safe at this school	3.2741	.7248	.0060	1.0000	4.0000	14400	1802	12.52

(Table F.1. continued)

Variable	Label	Mean	Std Dev	Std Error	Min	Max	N	N Miss	% Miss
BYMATHSE	By mathematics self-efficacy	.0276	1.0017	.0098	-1.8310	1.7720	10440	5754	55.10
F1S48A	Gone to counselor for information	.8034	.3974	.0040	.0000	1.0000	9700	6495	66.94
F1RAPMA	Total AP/IB math courses	.1294	.4023	.0033	.0000	5.0000	14810	1389	9.38
			Level-2 Descriptive Statistics						
BYTSTREL	Teacher student relationships	.0603	1.0056	.0085	-3.8170	2.3320	13870	2330	16.80
BYA03R	Alternative/dropout prevention school	.0289	.1676	.0013	.0000	1.0000	15690	507	3.23
F1A32A	Percent of full-time teachers Hispanic	.0476	.1163	.0011	.0000	.9500	11090	5106	46.04
CP04PMIN	Percent minority students	.3239	.3217	.0026	.0000	1.000	15780	413	2.62

APPENDIX G : RESULTS OF FACTOR ANALYSIS

Table G.1. Result of Factor Analysis Sense of Belonging

	Rotated factor loading		
Variables	Factor1	Factor2	Communality
BYS20H In class often feels put down by teachers	.105	.777	.604
BYS20I In class often feels put down by students	.161	.790	.627
BYS20J Does not feel safe at this school	.031	.717	.518
BYS90B Important to friends to study	.764	-.013	.596
BYS90D Important to friends to get good grades	.816	.082	.666
BYS90F Important to friends to finish high school	.726	.205	.539
BYS90H Important to friends to continue education past high school	.820	.142	.673

Note: Two factors, sense of belonging (Factor1), and friends_education (Factor2) were created.

APPENDIX H : LETTER TO PARTICIPANTS

Date here

Dear parent / potential gatekeepers:

I am a doctoral student in the College of Human Sciences and Education, Louisiana State University, Baton Rouge (LSU). I am conducting a study that seeks to find factors that are highly associated with Latinas achievement in mathematics. I am writing to ask whether you would be willing to allow your daughter to participate in this study. The extent of this participation is to meet for an interview.

The purpose of my study is to identify factors that affect high school girls' selection of mathematics courses beyond Algebra 2. My plan is to first examine a national representative dataset of students. Then, I plan to interview students who can provide information that the database cannot provide. Each interview should last no more than one hour. You will be notified about this second meeting, before it occurs.

Study participation will be deemed parental consent; however, your child's consent will also be needed. Please note that all data collected will be anonymous and confidential. At no time will information that will identify your student be matched, except for the purposes of the study. Should participants have any complaints, they may contact Dennis Landin, Chairman, Institutional Review Board, (225) 578-8692, irb@lsu.edu, www.lsu.edu/irb. You may also contact my immediate supervisor/doctoral committee chair S. Kim MacGregor, Department of Educational Leadership, Research, and Counseling (225) 578-2150, smacgre@lsu.edu.

Many thanks in advance for your consideration of this project. Should you want to be a part of this study, please let me know and if you require further information.
Regards,

Lester A. C. Archer
333 Peabody Hall
Louisiana State University
Baton Rouge, LA 70820
215.20.2998

APPENDIX I : MODEL ESTIMATES ON MATH IRT SCORE LISTWISE DELETION

Table I.1. Model Estimates on Math IRT Score Listwise Deletion

	Model I	Model II	Model III	Model IV
Fixed Effects				
School Mean, γ_{00}	31.05*** (.73)	13.73* (5.75)	15.69** (5.44)	22.42*** (5.27)
School level variables				
Teacher Student Relationships, γ_{01}				9.12 (6.83)
Percent Minority Students, γ_{02}				-53.74*** (13.11)
Percent Hispanic Teachers, γ_{03}				24.87 (14.78)
Student level variables				
Student SES, γ_{10}		2.29 (1.38)	2.73* (1.16)	2.53 (1.34)
Teacher Student Relationships, γ_{11}				1.12 (1.11)
Percent Minority Students, γ_{12}				-1.97 (2.81)
Percent Hispanic Teachers, γ_{13}				-2.44 (2.59)
Second Generation, γ_{20}		-1.33 (1.77)	-2.0 (1.58)	-1.91 (1.98)
Teacher Student Relationships, γ_{21}				2.53 (2.16)
Percent Minority Students, γ_{22}				-4.04 (4.66)
Percent Hispanic Teachers, γ_{23}				6.08 (4.54)

(Table I.1 continued)

	Model I	Model II	Model III	Model IV
Fixed Effects				
Third Generation, γ_{30}		1.56 (1.81)	1.24 (1.65)	-.29 (1.72)
Teacher Student Relationships, γ_{31}				.16 (2.52)
Percent Minority Students, γ_{32}				8.41 (5.00)
Percent Hispanic Teachers, γ_{33}				8.72 (4.76)
Sense of Belonging, γ_{40}		4.60** (1.40)	4.39** (1.38)	4.00** (1.34)
Teacher Student Relationships, γ_{41}				-3.63** (1.33)
Percent Minority Students, γ_{42}				7.06* (3.35)
Percent Hispanic Teachers, γ_{43}				-5.31 (2.86)
Parental Expectation, γ_{50}		6.42* (2.71)	5.51* (2.62)	1.89 (3.56)
Teacher Student Relationships, γ_{51}				3.14 (3.55)
Percent Minority Students, γ_{52}				18.39 (13.80)
Percent Hispanic Teachers, γ_{53}				-4.61 (11.72)
Math Self-efficacy, γ_{60}		2.44* (.96)	2.75*** (.82)	3.17*** (.89)
Teacher Student Relationships, γ_{61}				-.08 (1.02)

(Table I.1. continued)

	Model I	Model II	Model III	Model IV
Percent Minority Students, γ_{62}				-.18 (2.19)
Percent Hispanic Teachers, γ_{63}				-4.63* (2.05)
Rules for HW, γ_{70}		-2.57 (2.53)	-2.93 (2.41)	-2.96 (2.88)
Teacher Student Relationships, γ_{71}				-2.12 (2.97)
Percent Minority Students, γ_{72}				1.33 (1.33)
Percent Hispanic Teachers, γ_{73}				-15.19* (7.74)
APMATH, γ_{80}		9.34** (3.21)	1.70*** (2.72)	13.37*** (2.90)
Teacher Student Relationships, γ_{81}				1.52 (3.07)
Percent Minority Students, γ_{82}				7.70 (8.71)
Percent Hispanic Teachers, γ_{83}				-5.59 (6.13)
Seen Counselor, γ_{90}		.48 (2.10)	1.24 (2.01)	.44 (1.85)
Teacher Student Relationships, γ_{91}				1.62 (1.36)
Percent Minority Students, γ_{92}				4.43 (6.56)
Percent Hispanic Teachers, γ_{93}				1.58 (9.15)

(Table I.1. continued)

	Model I	Model II	Model III	Model IV
Random Effects				
Level-2, τ_{00}	23.83*** (6.78)	6.35 (6.56)	112.08 (10.59)	1.36 (1.17)
τ_{11}			5.60 (2.36)	1.60 (1.26)
τ_{44}			12.74 (3.57)	.16 (.40)
τ_{66}			6.98* (2.64)	4.33*** (2.08)
Level-1, σ^2	92.12 (6.62)	67.39 (9.16)	57.52 (7.58)	51.25 (7.16)
ρ	.21			
-2 ln L	3535.2367	1140.4696	1131.0974	1095.2128
χ^2		2394.7671***	1263.6697	168.4569
Proportion of between-school variance in the intercepts explained by student model $[\tau_{00(null)} - \tau_{00(student)}] / \tau_{00(null)}$		.73		
Proportion of within-school variance explained by student model $[\sigma^2_{(null)} - \sigma^2_{(student)}] / \sigma^2_{(null)}$		.27		

****p* < .001, ***p* < .01, **p* < .05; §marginal; All school-level predictors are grand mean centered; standard errors in parenthesis

APPENDIX J : FOUR MODEL ESTIMATES MATH IRT SCORE (IMPUTED DATA)

Table J.1. Data Results for Four Model Estimates on Math IRT Score (Imputed data)

	Model I	Model II	Model III	Model IV
Fixed Effects				
School Mean, γ_{00}	31.22*** (.71)	24.86*** (1.78)	23.95*** (2.41)	22.68*** (3.35)
School level variables				
Teacher Student Relationships, γ_{01}				-2.80 (2.24)
Percent Minority Students, γ_{02}				1.25 (9.17)
Percent Hispanic Teachers, γ_{03}				-2.05 (9.17)
Student level variables				
Student SES, γ_{10}		1.40* (.71)	1.81 (1.21)	1.53 (1.40)
Teacher Student Relationships, γ_{11}				.81 (1.07)
Percent Minority Students, γ_{12}				-6.54 (4.99)
Percent Hispanic Teachers, γ_{13}				1.92 (4.44)
Second Generation, γ_{20}		1.01 (1.01)	.84 (1.15)	2.04 (1.16)
Teacher Student Relationships, γ_{21}				2.43 (1.36)
Percent Minority Students, γ_{22}				1.09 (2.96)

(Table J.1. continued)

	Model I	Model II	Model III	Model IV
Percent Hispanic Teachers, γ_{23}				-7.51 (4.28)
Third Generation, γ_{30}		1.62* (.81)	2.44** (.80)	2.30** (.81)
Teacher Student Relationships, γ_{31}				.24 (.91)
Percent Minority Students, γ_{32}				7.91*** (1.82)
Percent Hispanic Teachers, γ_{33}				-5.68* (2.73)
Sense of Belonging, γ_{40}		2.33** (.76)	1.92 (1.28)	1.96 (1.98)
Teacher Student Relationships, γ_{41}				-.49 (1.28)
Percent Minority Students, γ_{42}				7.60 (6.86)
Percent Hispanic Teachers, γ_{43}				-7.90 (5.69)
Parental Expectation, γ_{50}		5.20*** (1.03)	6.37*** (1.30)	11.83*** (1.40)
Teacher Student Relationships, γ_{51}				-.13 (1.28)
Percent Minority Students, γ_{52}				-18.84*** (5.13)
Percent Hispanic Teachers, γ_{53}				-6.63 (4.01)
Math Self-efficacy, γ_{60}		1.88*** (.37)	1.02** (.33)	.94* (.32)

(Table J.1. continued)

	Model I	Model II	Model III	Model IV
Teacher Student Relationships, γ_{61}				-.03 (.29)
Percent Minority Students, γ_{62}				.03 (1.01)
Percent Hispanic Teachers, γ_{63}				.07 (.76)
Rules for HW, γ_{70}		-.57 (1.20)	-.77 (1.62)	-4.04 (2.97)
Teacher Student Relationships, γ_{71}				1.83 (1.79)
Percent Minority Students, γ_{72}				-.35 (7.12)
Percent Hispanic Teachers, γ_{73}				8.84 (7.61)
APMATH, γ_{80}		1.87*** (2.09)	9.34*** (2.31)	12.03** (4.64)
Teacher Student Relationships, γ_{81}				-2.25 (3.02)
Percent Minority Students, γ_{82}				8.48§ (4.40)
Percent Hispanic Teachers, γ_{83}				-6.11 (12.71)
Seen Counselor, γ_{90}		2.52*** (.66)	2.76*** (.61)	1.87* (.79)
Teacher Student Relationships, γ_{91}				.43 (.56)

(Table J.1. continued)

	Model I	Model II	Model III	Model IV
Percent Minority Students, γ_{92}				4.27 (2.76)
Percent Hispanic Teachers, γ_{93}				.12 (2.50)
Random Effects				
τ_{00}	52.23*** (7.06)	35.41*** (4.81)	101.78*** (14.83)	83.22*** (12.28)
τ_{11}			116.67*** (17.91)	123.09*** (18.77)
τ_{44}			129.39*** (2.89)	178.55*** (28.16)
τ_{66}			8.79*** (1.44)	8.15*** (1.34)
σ^2	72.90 (.97)	57.29 (.76)	35.00 (.47)	32.75 (.44)
ρ	.42			
-2 ln L	82565.28	79771.76***	75179.24	74426.86
χ^2		2793.52***	4592.53***	752.38***
Between-school variance in the intercepts explained by the student model $[\tau_{00(null)} - \tau_{00(student)}] / \tau_{00(null)}$		.32		
Within-school variance explained by student model $[\sigma^2_{(null)} - \sigma^2_{(student)}] / \sigma^2_{(null)}$		.21		

***p < .001, **p < .01, *p < .05; §marginal; All school-level predictors are grand mean centered; standard errors in parenthesis; *SD* for variance components

APPENDIX K : DESCRIPTIVE STATISTICS OF IMPUTED DATA

Table K.1. Descriptive Data of Imputed Data

Variable	Description	*M (SD)*	*Min*	*Max*	*Skewness*
Dependent					
F1RACADC	Credit above Alg2	.13 (.36)	.00	1.00	1.93
BYTXMIRR	IRT math score	30.62 (10.44)	13.89	62.42	.49
Student level					
BYSES1	ELS:02 Standardized	-.55 (.71)	-1.97	1.60	.45
BYMATHSE	Math self-efficacy	-.14 (.93)	-3.39	2.88	.21
BYP69B	Rule for home-work (1 = yes)	0.91 (.28)	.00	1.00	-2.94
BYPARASP	Parent expectation	.88 (.32)	.00	1.00	-2.40
F1S48A	Counselor for college info (1 = yes)	.77 (.42)	.00	1.00	-1.26
F1RAPMA	AP math Carnegie credits	.07	.31	.00	3.00
BELONG	Sense of Belonging	3.13 (.54)	1.00	4.54	-0.37
School level					
BYA03R	Prevention dropout (1 = yes)	.03 (.17)	.00	1.00	5.59
BYTSTREL	Teacher student relationships	.18 (.91)	-3.82	3.16	-.32
P_MINSTU	Percent of minority students	.69 (.28)	.00	1.00	-.91
P_HISPTC	Percent of Hispanic teachers	.29	.00	1.00	.79

(Table K.1. continued)

Variable	Description	*M (SD)*	*Min*	*Max*	*Skewness*
n (unweighted)	10,430				

APPENDIX L : REQUEST USE QUALITATIVE INQUIRY

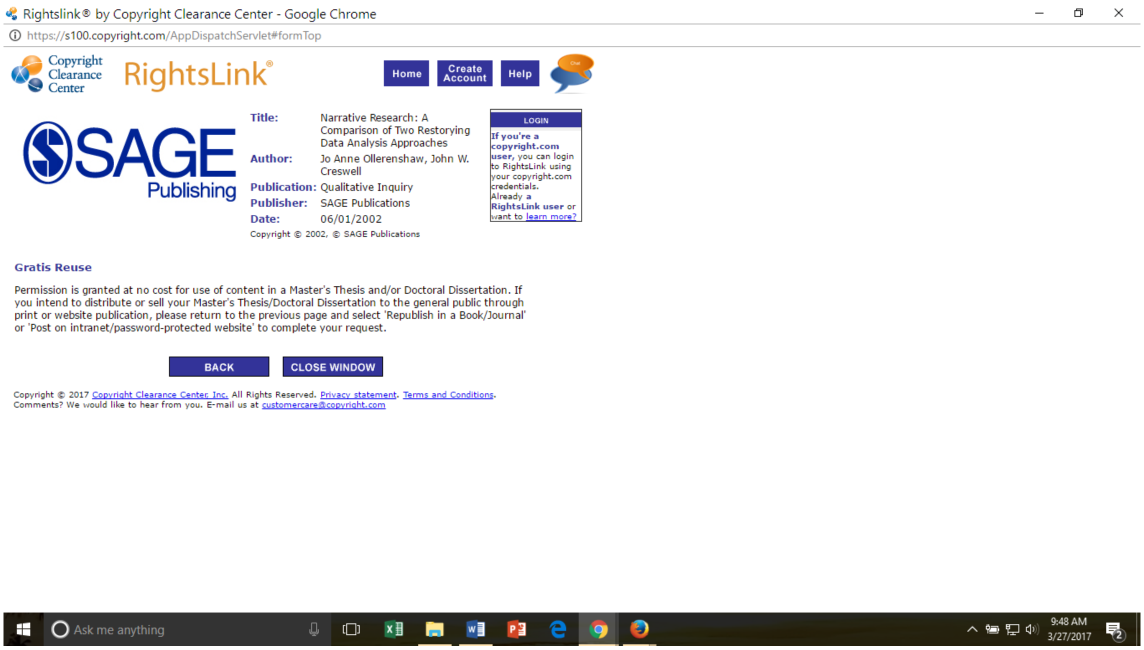
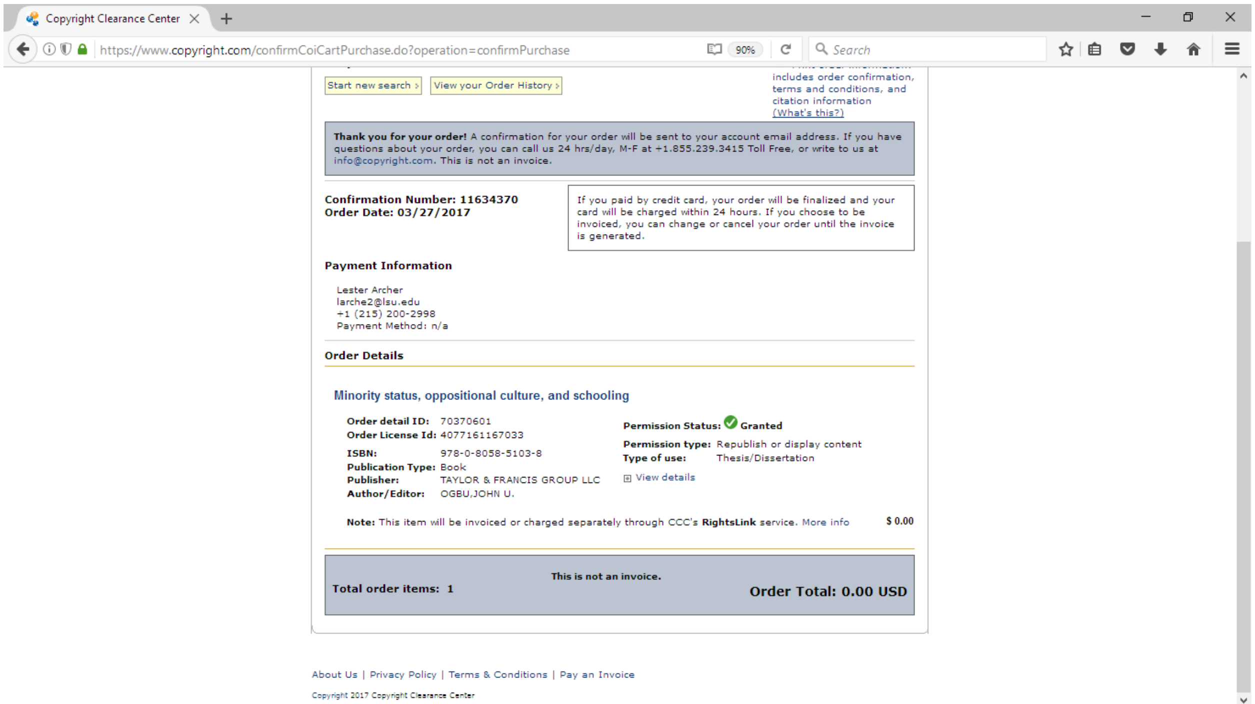


Figure L.1. Permission request Qualitative Inquiry

APPENDIX M : REQUEST USE MEXICAN AMERICAN TYPOLOGY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Payment Information

Lester Archer
larche2@lsu.edu
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Payment Method: n/a

Order Details

Minority status, oppositional culture, and schooling

Order detail ID: 70370601
Order License Id: 4077161167033
ISBN: 978-0-8058-5103-8
Publication Type: Book
Publisher: TAYLOR & FRANCIS GROUP LLC
Author/Editor: OGBU,JOHN U.

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Figure M.1. User granted Routledge

APPENDIX : N REQUEST USE MULTISTAGE MODEL

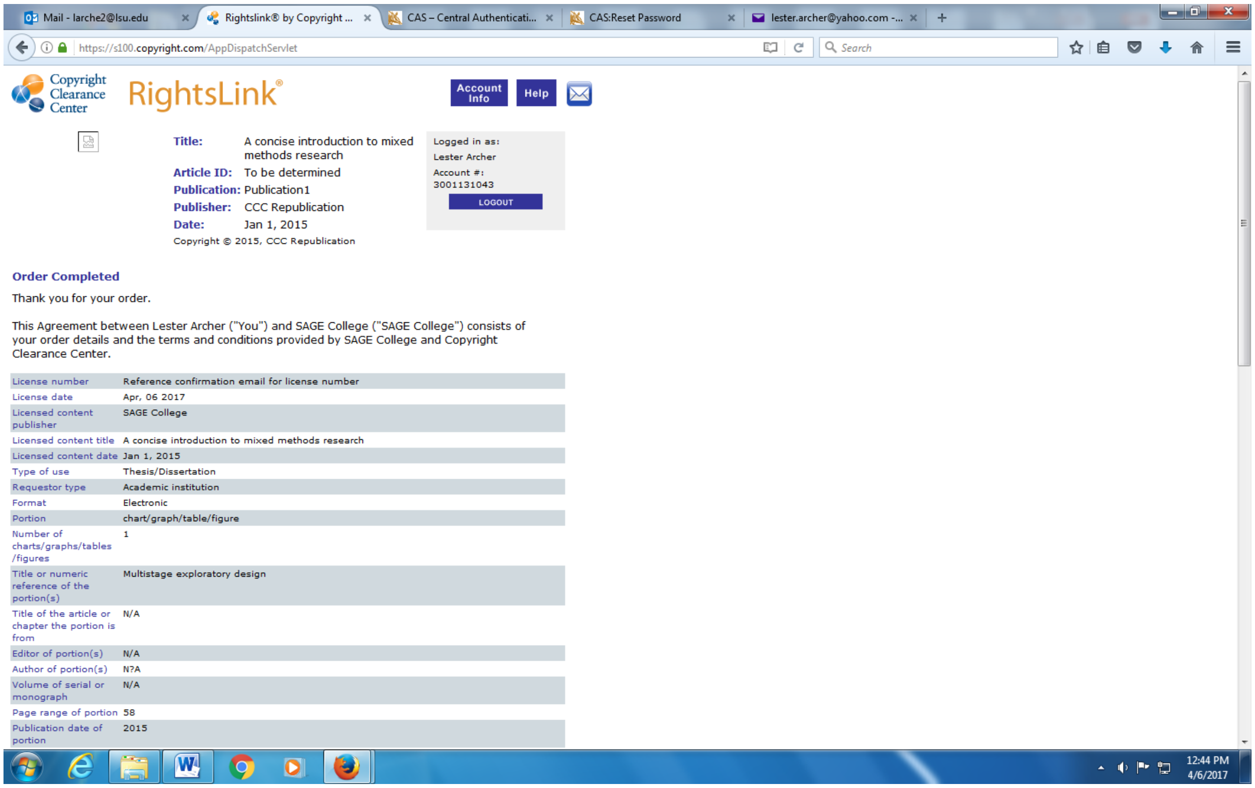

Figure N.1. User request SAGE publications

APPENDIX: O DISCLOSURE RISK REVIEW

Received	Due	Returned	Title	Author(s)	Dataset(s)
4/4/2017	4/6/2017	4/6/2017	A MIXED METHODS ANALYSIS OF SCHOOL- AND STUDENT-LEVEL EFFECTS: MATHEMATICS COURSE COMPLETION AND ACHIEVEMENT BEYOND ALGEBRA 2 AMONG MEXICAN AMERICAN FEMALE HIGH SCHOOL STUDENTS	Lester Archer	ELS

_X_ No disclosure risks identified.

OR

___ Risks identified. Please see below.

Page	Para	Line	Comment

VITA

Lester Adrian Charles Archer, born in Georgetown, Guyana, emigrated to The United States and completed his studies. He attended The George Washington University for his undergraduate degree, and completed graduate degrees at The University of Southern Mississippi, Rosemont College, and Villanova University. He plans to complete a terminal degree and to graduate from Louisiana State University.