GRADUATE DEGREE ASPIRATIONS OF LATINO UNDERGRADUATE ENGINEERING STUDENTS AT A RESEARCH INSTITUTION

A Thesis

Presented to the faculty of the Department of Educational Leadership and Policy Studies

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in

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by

Karla Gonzalez

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GRADUATE DEGREE ASPIRATIONS OF LATINO UNDERGRADUATE ENGINEERING STUDENTS AT A RESEARCH INSTITUTION

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Department of Educational Leadership and Policy Studies
Abstract

of

GRADUATE DEGREE ASPIRATIONS OF LATINO UNDERGRADUATE
ENGINEERING STUDENTS AT A RESEARCH INSTITUTION

by

Karla Gonzalez

Brief Literature Review

The field of engineering lacks considerable diversity, in particular at the academic level and even greater strain at the graduate level. Latinos are the largest growing underrepresented minority group (URMs) in the United States, yet they represent a minimal percentage of those earning graduate degrees within engineering. It is documented well, Latino students tend to lack institutional (secondary school, high school counselors) support and familial (lack of experience on parent’s behalf with educational systems) support to enroll in a four-year institution and even less in an engineering program (Camacho & Lord, 2011; Chapa & De La Rosa, 2006; Desmond & Lopez Turley, 2009). Once within an engineering program, expectations and support offered greatly affect a students’ aspiration to obtain a graduate degree. Being a Latino decreases the students’ likelihood of understanding and knowing strategies that will successfully lead them to admittance in a graduate program.

Various entities play an important role in the encouragement and development of a Latino student’s aspirations to obtain a graduate degree. Familial values and members provide students with knowledge, support and guidance (students’ initial social and
cultural capital) that can affect the student’s future educational aspirations. Once enrolled at four-year institutions, these social and cultural capitals expand to include university entities. Institutional entities can greatly affect student development of identity, integration into campus culture, and awareness of self. Institutional agents, such as faculty, staff and administration, peers/student organizations, and undergraduate research programs may assist, expose and encourage Latinos to aspire to obtain a graduate degree.

Statement of Problem

The purpose of this study was to identify 1) factors at a public research institution affect the choices of engineering students’ to aspire to continue their education in a graduate program and 2) the roles of ethnicity and generation in the choice of engineering students’ to aspire to continue their education in graduate programs.

Methodology

A mixed-method study consisting of two parts was conducted. The first method is an anonymous mixed-methods online survey (consisting of both quantitative and qualitative portions) was distributed to undergraduate students currently enrolled as engineering students at Central Research University (pseudonym of a university). Data was filtered by generational and ethnic characteristics (Latino and non-Latino) using descriptive statistics. The second method is a semi-structured face-to-face interview. A systematic approach was used to identify key words and phrases identifying themes described in literature.
Conclusions and Recommendation

The findings in this study were mostly consistent with prior research discussed in the literature review. Latino graduate aspirations were affected more so by institutional agents than by familial interactions. In addition, Latinos reported higher levels of aspirations for graduate degrees than non-Latino students did. Furthermore, faculty interaction and encouragement was the highest rated non-peer institutional agent among both Latino and non-Latinos. Although institutional agents have a high impact on student aspirations, future studies should explore how family, generational variables and cultural values influence student aspirations to attend graduate school, including support and motivation.

_______________________, Committee Chair
José Chávez, Ed.D.

_______________________
Date
DEDICATION

This work is for parents, who crossed the border to provide me with the life I have today. To my mother, who showed me what real hard work was. With the alarm clock in the morning of the sound of a machine and the lullaby at night of the sound of a machine. Mom, your hard work, continues to be my inspiration. To my father, for being my friend with the great advice.

A special thanks to my siblings who carved the path and expectation of a higher education. Lastly, a thank you to my faculty from both undergraduate and graduate programs, without you this publication could have never existed.
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In 2014, various news outlets announced that China had surpassed the United States as the leading world economy and superpower. Although in 2015 new outlets partially retracted this statement, expressing it had yet to be accomplished and now the United States was scared as to their decreasing dominance in the world economy. According to Times Magazine (2014), one of the major areas the United States continues to lead the world in is that of innovation. Part of continuous innovation stems from the Science, Technology, Engineering, and Mathematics fields.

For the United States to maintain its global standing, it must strengthen the workforce within engineering. While engineering, along with science, employment has grown nearly 40 percent in the last decade only 6 percent of its workforce are from underrepresent minority groups (URMs) (Strayhorn, 2010). The engineering field is greatly lacking representation from the largest growing minority group, Latinos, in the United States (National Science Foundation [NSF], 2013). To continue to innovate and grow as a nation, it is vital to consider the effects a product has on the population as a whole. Diversifying the group of innovators provide distinct perspectives required in the developmental phase to represent the consumer population, in particular that of the United States (Camacho & Lord, 2011).

The field of engineering lacks considerable diversity, in particular at the academic level and even greater strain at the graduate level. Within the URM population, the
largest sub-group and the fastest growing ethnic group are Latinos. In 2002, 57 percent of Latinos aged 25 or older have not graduated from high school in comparison to the White graduation rate of 88.7 percent (U.S. Census, 2003). The low presentation of Latinos has carried onward towards undergraduate degrees and graduate degrees. In 2013, of the total 83,263 undergraduate engineering degrees awarded, only 8.6 percent was earned by Latino students compared to 62.9 percent awarded to their white counterparts according to the NSF (NSF, 2013). On the graduate level, 4.6 percent of engineering master degrees and 2.2 percent of engineering doctoral (Ph.D.) degrees were awarded to Latinos, by comparison 37.1% of master degrees and 29.2% were awarded to Whites (NSF, 2013). Although the Latino population is the fastest growing ethnic group in the United States, the rate at which Latinos are obtaining graduate degrees is not reflective of this fast pace (Chapa & De La Rosa, 2006).

Fewer than half of all STEM undergraduate students continue onward to graduate programs (Strayhorn, 2010). It is documented well URMs tend to come from low social economic status (SES) communities that make access to the higher education pipeline significantly difficult, this is even more exaggerated when considering engineering programs (Arbona & Nora, 2007; Contreras & Gandara, 2006). Once within higher education, aspiration to obtain a graduate degree is low for Latino students. The enrollment of Latino students attending a graduate is less than that of other minority groups (Gurin, Dey, Hurtado, & Gurin, 2002). Barriers preventing Latino students from aspiring to attend graduate programs are multifaceted and include social and cultural capita issues (Camacho & Lord, 2011). Furthermore, graduate recruitment and outreach
tend to target high achieving students only and information regarding the graduate admissions process is relatively difficult for Latinos to obtain (Ramirez, 2011). Latinos, unlike other ethnic groups, rely heavily on familial interaction in decision-making, initial aspirations and environmental adaptation (Castellanos & Jones, 2003). During the undergraduate career, the institution will play a greater role in becoming the students’ cultural and social capita. Various entities: staff, faculty, peers, and organizations have shown to have a large impact on student aspirations to attend a graduate degree during their undergraduate academic career (Hurtado et. al., 1996). While Latino enrollment to graduate programs remains exponentially low, in comparison to the overall population, Latino aspirations to attend graduate programs relies heavily on institutional culture.

**Statement of the Problem**

The purpose of this study was to understand better graduate program choice and aspiration of engineering students at a research institution. The study examined the interactions and perceptions of Latino engineers in regards to family influence and institutional influence in their decision making process to obtain a graduate degree. The specific questions addressed were:

1. What factors at a public research institution affect the choices of engineering students’ to aspire to continue their education in a graduate program?

2. What are the roles of ethnicity and generation in the choice of engineering students’ to aspire to continue their education in graduate programs?
**Definition of Terms**

*Aspiration*

Aspirations refer to an idealistic attainment of a student’s educational goals (Bohon et al., 2006).

*Expectations*

Expectation refers to the likelihood or realistic attainment of educational goals. Expectations are considered a more realistic assessment of the individuals’ educational future (Bohon et al., 2006).

*Extended Family*

Extended family members include cousins, godparents, ex-stepparents, and in-laws. Another group that can be included in extended family are those “perceived as extended family members, though they are not related by blood or law” (Schmeeckle & Spreacher, 2003, p. 350).

*First Generation Students*

For the purpose of this study, first generation refers to students whose parents were born out of the United States, and who was born in the United States. In addition, first generation refers to students whose parents have had no college or postsecondary experience (Saenz, Hurtado, Barrera, Wolf, & Yeung, 2007). The student may have siblings who have or have not enrolled in higher education.

*Immediate Family*

For this study, immediately family refers to parents, siblings, and grandparents.
The immediate family is considered the family the individual was raised with.

**Institutional Agent**

Individuals who can transmit information and institutional resources (school programs, academic tutoring, mentoring, admissions, advising/counseling, and assistance with career decision making) (Stanton-Salazar & Dornbusch, 1995). Generally referred to faculty, academic advisors, counselors, staff and school peers.

**Latino**

For the purpose of this study, Latino refers any student of Latin American descent. There is a vast amount of terms (i.e. Latino/Latina, Hispanic, Chicano/Chicana) utilized to discuss this population; the term, Latino, will be utilized to describe to population as a whole. “Hayes-Bautista and Chapa (1987) introduced the term Latinos, restricting the name to persons residing in the United States whose ancestries are form Latin American countries in the Western Hemisphere” (Castellanos & Jones, 2003, p. XX). For this study, students were able to self-identify as Latino or of another ethnic origin.

**Non-Latino**

Non-Latino refers to all other ethnic groups (i.e. Asian American, Black/African American, White, and Native American, or other). Students were able to self-identify as Non-Latino.
Second Generation+

Individuals whose parents were born in the United States and the individuals were also born in the United States (Portes & Zhou, 1993). In addition, second generation+ refers to students whose parents have had college or postsecondary experience.

Socioeconomic Status (SES)

A measure of influence that the social environment has on an individual’s academics. When discussing low socioeconomic status, it falls below high and middle socioeconomic status.

STEM Field

In reference to science, technology, engineering, and mathematics major or occupational field (Brogan, 2009).

Underrepresented Minority (URM)

For this study, underrepresented minority refers to individuals from the following ethnic groups: African American/Black, Hispanic/Latino and Native American. The gap between educational attainments in engineering is greatly significant between URM and Asian and White student (NSF, 2013).

Zero Generation

For the purpose of this study, zero generation refers to students whose parents were born out of the United States, and who was born in the United States (Kao & Tienda, 1995). Includes, but does not exclusively include, students who are Dreamers, DECE or undocumented students.
Limitations of the Study

This study was limited to a masters and doctoral granting research institution located in central California, Central Research University (CRU). The study focused on currently enrolled students within the School of Engineering at CRU and excluded any student intending to change majors in or out of an engineering program. The study was further limited to undergraduate students in the School of Engineering at CRU. It is unclear what percentage of the student population desired to change majors in or out of an engineering program at the time of the data collection. The focus of the study was on the Latino population within the School of Engineering at CRU. The survey portion of the study was distributed to all engineering students, with the majority of respondents being White or Asian American.

Along with these challenges, some bias may have risen from the research being a member of the School of Engineering staff. As the researchers name was included in initial communications, participants may have participated believing it was a requirement rather than a request. The researcher attempted to control for this by requesting other staff members within the School of Engineering to distribute all communications and utilizing the Interim Dean’s name as co-investigator.

Significance of the Study

With such a large population of Latinos in California, the number of undergraduates attending advance degree programs is low in comparison to the overall population (UC Davis, 2015). This study will allow a further discussion on possible
factors students may identify as reasons for intending to apply to a graduate degree programs. In particular, it will allow the public to view what factors contribute to engineering students’ expectations of attaining a graduate degree. By taking a greater look at the engineering student population intentions for graduate degree programs, will be able to utilize this information to build, grow better programs that target this population’s educational aspirations. The following is an in depth look at literature in the context of Latino trends in higher education, familial interaction and the effects on students aspirations to enter graduate programs, department interactions and the effects they have on student aspirations, and the impact a student’s generation may have on their aspirations to attend a graduate programs.

**Organization of Remainder of Study**

The remainder of this study is organized into four chapters. Chapter two will review related literature focusing on the educational discussion making process of Latinos, discussion of relevant frameworks, and familial and institutional influences Latino graduate program aspirations. Chapter three will identify the setting, population, sample, and design of the study. Chapter four will discuss finding from both qualitative and quantitative research conducted, emphasizing the Latino population. Finally, chapter five will provide the researchers suggestions for future research and outline possible practices to increase the number of students who aspire to enroll in graduate programs.
Chapter 2
REVIEW OF RELATED LITERATURE

Introduction

The following literature review focuses on factors that influence Latino undergraduate engineering students to aspire to attend graduate programs. The first portion of the review will discuss Latino trends into higher education. The emphasis will be on engineering programs throughout the educational pipeline from the K-12 system to graduate degree attainment. Next, the review will discuss theoretical framework for the study, including social capital theory, cultural capital theory, and engineering identity although not limited to these specifically. Lastly, the review will discuss how various factors influence student decisions/aspirations to attend graduate programs, such as familial interaction, department interactions.

Latino Trends Leading to Four-year Institutions

Demographic Growth

Research has found a relationship between education and social and economic mobility (Contreras & Gandara, 2006). The higher the educational degree a student earns, the more likely they are to be economically and socially well off. The doctoral degree is the highest academic degree granted by American universities (Gonzalez et. al., 2001). Therefore, the pursuit of a higher level of post-undergraduate education should be the aspiration of all, if not most students in America. According to the National Science
Foundation in 2012, 191 degrees were awarded to Latino U.S. citizens and permanent residents of a total 8,873. The literature review will discuss this further. There are vast amounts of terms (i.e. Latino/Latina, Hispanic, Chicano/Chicana) that are used to discuss this population. For the purpose of this discussion and analysis, the term Latino is describes the population as a whole. It is important to establish the foundational demographic Latino trends in education before discussing the low overall number of Latino student pursuits into graduate degrees (masters and PhD). According to the Department of Education, over the past ten years, there has been an increase in the number of students who are admitted to colleges and universities, but the percentage of those students who are underrepresented minorities (from this point moving forward URM) continues to be low (Fleming, 2014).

**Preparation to Undergraduate Program**

The lack of Latino students in the higher education pipeline stems from the K-12 system. It is important to understand the precollege issues in understanding the larger issue in why there are so low numbers at the graduate level. As of 2015, one of every two children in California under the age of eighteen is Latino, with only 12 percent attaining an undergraduate education compared to the average in California of 31 percent (UC Davis, 2015). Additionally, “Latinos are more than twice as likely as are non-Latinos to live in poverty” (Chapas & De La Rosa, 2004, p. 140). Latinos also possess the second highest high school dropout rates (Bohon, Johnson & Gorman, 2006). According to the U.S. Census (2003), in 2002, 57 percent of Latino’s age 25 or older have not graduated from high school in comparison to the White graduation rate of 88.7
percent. High dropout rates account for a percentage of Latino students who do not directly continue to four-year institutions (Arbona & Nora, 2007), yet other factors still play a role.

Being of low socioeconomic status has distinct barriers for students entering higher education. Typically, these students are the first in their families to aspire to attend undergraduate programs, and who are attending low-performing high schools (UC Davis, 2105; Bohon et. al., 2006). By being first-generation, historically underrepresented and of lower socioeconomic status, Latino students suffer greatly from social and/or cultural capital (Sanez et. al., 2007; McDonough, 1997; Oakes et al., 2006; Bohon et. al., 2006). First-generation students from lower socioeconomic status do not have the network or familial connections, as do their middle-class White counterparts, to assist them in navigating the application process, college admissions criteria, or test-taking strategies. According to Warburton et. al. (2001), a large portion of these Latino students come from households whose first language is not English and whose parents attended a different educational system (as cited in Saenz et. al., 2007, p. 13). Therefore, when these students attempt to navigate applications, high school course selection, extracurricular activities, and college choices, they cannot turn to their parents for assistance, as their parents are not familiar with either the language or educational system (Sanez et. al., 2007; McDonough, 1997; Oakes et al., 2006; Ramirez, 2011). These same issues later arise in the students’ educational pursuits when applying to and enrolling in graduate programs.
Latino students attending high school programs have different aspirations and expectations when it comes to attending four-year colleges all the way to graduate degree attainment. Both aspirations and expectations arise from the socialization theory is further discussed in the next section of the literature review. Aspirations refer to an idealistic attainment of a student’s educational goals, whereas expectations assess the likelihood or realistic attainment of those educational goals (Bohon et. al., 2006).

Various studies (Hanson 1994; Hao & Bonstead-Bruns 1998; Kao & Tienda 1998; Bohon et. al. 2006, p. 208) have found that educational aspirations and expectations have a notable impact on the educational attainment process. Latino students’ aspirations and expectations vary from their White counterparts, since the majority of Latino students are of low socioeconomic status, have language barriers and place high value on the cost of attending a four-year institution (Bohon et. al, 2006). Hurtado et. al., 1997 found that the expectations for Latino students was significantly lower from their White counterparts. Researchers Wassmer et. al., 2004 found this trend to be true among the top Latino high school students, leading them to enter two-year institutions instead of four-year institutions. Transfer rates to four-year institutions remain low across all ethnic lines.

Carnevale and Rose (2003) found that “74 percent of the students at the top 146 highly selective colleges came from families in the top quarter of the [socioeconomic status] scale…[and] 3 percent came from the bottom [socioeconomic status] quartile” (p. 11). Latino students are more likely to attend community colleges, more so then their white counterparts (Arbona & Nora, 2007; Chapa & De La Rosa, 2004; Hurtado et. al., 2007). This is another crucial issue Latino students must overcome because transfer rates
to four-year institutions from community college, are low across all levels. Saenz and Ponjuan (2009) best paraphrased findings from Excelencia in Education (2007b): “For Latino students, starting at two-year institutions, less than 35% attain any degree in six years, whereas almost 55% of Latino students who start at a four-year institution attain a degree within the same time span” (p. 68). Concurring with this statistic, Wassmer et. al. (2004) “found that, holding other factors constant, community colleges that enroll higher proportion of ethnic minorities show lower transfer rates” (as quoted in Arbona & Nora, 2004, p. 265). Students who attend four-year institutions and even more so, students who attend selective institutions have a higher level of attaining graduate and professional degrees (Mullen, Goyette & Soares, 2003). Mullen et. al., (2003) ascertained that students who attend a two-year university are at a disadvantage when it comes to applying to doctoral or first-professional programs due to their lack of knowledge with standardized testing.

Carnevale and Rose’s (2003) findings also identified a correlation with SAT scores and students continuation into graduate programs. This correlation stated that the higher the students SAT score, the higher the probability the student would continue into graduate programs. Carnevale and Rose (2003) further stated that possessing high SAT scores and enrollment in a top selective institution provides students with a greater percentage of likelihood to enroll in graduate programs. Mullen (2003) found that “an increase of 100 points on a standardized test raises the odds of continuation into graduate programs…1.70 times for doctoral programs” (p. 157). As Latino students tend not to apply to top tier institutions and receive lower overall SAT scores, compared to their
White counterparts, their likelihood of enrollment in graduate degree programs decreases. A lot of research conducted was on factors that contributed to students low entrance rates to undergraduate program via the K-12 system and community college transfer track. Once entered into four-year institutions, choice and persistence in engineering programs requires examination.

**Latinos in Higher Education Institutions**

**Retention and Aspirations in Engineering Programs**

As discussed in the previous section, various factors contribute to the low persistence of Latino student’s to four-year institutions. With the growth in population, it is vital to continue to apply new methods to increase Latino student enrollment rates across all programs, with a special focus on the hard sciences. Campbell et. al. (2000) concluded that unlike White and Asian American students, Latinos and other underrepresented racial minorities (URMs) are not persisting through graduation at the same rate, especially in the hard sciences (as cited in Hurtado et. al. 2008). Walpole et al. (2005) identified that the “lack of knowledge leads to underrepresented and low-income students to utilize strategies that may not be successful in gaining access to the college or universities they desire” (p. 331). As identified above, Latino students tend to lack institutional (secondary school, high school counselors) support and familial (lack of experience on parents behalf with educational system) support. Therefore when choosing an undergraduate program, most engineering student’s choice tends to rely on others opinions without truly knowing what the major consist of.
Utilizing practical applications of math, physics, science and technology to solve pragmatic issues by developing, creating and innovating is what engineers are educated to do. To earn a graduate degree in engineering programs, students must first complete their undergraduate degree and aspire to attend a graduate program. To be able to partake in the rigor of an engineering program at the undergraduate level, students are expected to enter the programs with a strong background in the math and sciences. Most, if not all, undergraduate engineering programs plan for students to enter directly into calculus and calculus based physics their first semester. From the previous section, we can determine that the majority of Latino students’ are at a disadvantage, having attended low performing high school programs, being a minority within the larger population and acclimatizing to the environment without prior knowledge (Camacho & Lord, 2011; Desmond & Lopez, 2009; Hurtado & Carter, 1997; Ramirez, 2011).

Researchers have identified that Latinos, like women, and other historically underrepresented student’s sense of identity is hard to find within engineering programs (Johnson, 2007; Tonso, 2007). Researchers also identified that historically engineering programs are a White, male, competitive programs who work in opposition to Latino cultural values (Bix, 2004; Tonso, 2007; Camacho & Lord, 2011; Epstein, 2006). This may later extend to professional careers or graduate programs (Cech, 2015). Identity and a since of belonging are two concepts that students, in particular Latino students, need to possess during their undergraduate program that will extend to their post-undergraduate.

Seymour and Hewitt (1997) identified that the sense of belonging and quality of the educational program (class size, grading systems, and expectations) have a larger
impact than the courses themselves. Similarly, Epstein (2006) noted that the current grading system in the sciences lead to students being more competitive amongst themselves. Hurtado et. al., (1997) emphasized how this grading system negatively affects Latino student’s persistence in their program within the first year. These courses are also known as “weeding out” courses. Initially meant to emphasis the rigor of an engineering program, they became a roadblock for Latino students to continue their engineering education. Camacho and Lord (2011) identified that social interactions and relationships played a large role in student’s persistence in engineering programs. Along with other researcher (Maestas, Vaquera, & Zehr, 2007; Numez, 2009; Stanton-Salazar, 1997) Camacho and Lord stated that at the college level, “students who possess high levels of social and intercultural capital have a greater sense of belonging and ultimately more positive outcomes” (p. 136).

Fenske, Porter and Dubrockn (2000), identified students within Science, Technology, Engineering and Mathematics (STEM) graduate with their bachelor’s degree later than those in the Social Sciences do. Within the study, Fenske et al. found White and Asian students graduate at a faster rate (within four years) than their underrepresented counterparts do (more than four years). Researcher found that unlike other majors, persistence within engineering tends to remain high once students begin the program (Ohland et. al., 2008). Latino retention is equivalent to that of White and Asian students within engineering programs (Lord et. al., 2009).

Sanez and Ponjuan (2009) found that the graduate degree aspirations of Latina’s tend to be higher than that of Latino males. Although, women are highly
underrepresented in engineering programs (see Bix 2004), Sanez and Punjuan (2009) identified the phenomenon as “the vanishing Latino male” in higher education. This phenomenon, states that due to the need or desire to enter the work force during high school or college has led to a large number of Latino males not completing their degrees. This research is important, since engineering is still a male dominated program. Assisting these “vanishing Latino males” in graduating and then continuing their education in graduate programs is necessary. Researchers concluded by stating that Latinos/as have begun to exhibit higher and stronger graduate degree aspirations and suggest institutions should take note as the population continues to grow. Excluding the low amount of Latinas enrolling in graduate program, researchers (Camacho & Lord, 2011) data showed higher persistence once in an engineering program. They concluded, “both men and women have the same likelihood of graduating (within 3%)” (Camacho & Lord, 2011, p. 138).

The largest portion of Latino students obtaining their degrees, at all levels, graduate from Hispanic Serving Institutions (HSIs) (Camacho & Lord, 2011; Fleming, 2014), especially within engineering programs. Chapa and De La Rosa (2006) argued that if “Latino students could begin to attain degrees at the same rate as White non-Latinos, the number of Latino degree holders would increase more than five-fold by the same date” (p. 218). Camacho and Lord (2011) identified “HSIs…experiences a 36% growth in engineering degrees compared to 23% for non-HSIs” (p.139), from 1994 to 2001. They further state, because of this growing graduation rate at HSIs, they hold the promise to graduate more Latino engineers because they may allow familial/cultural
bonds to remain intact (as most HSIs are located near large populations of Latinos), hence lowering the likelihood of a student feeling socially isolated.

The trend from undergraduate to graduate degrees of URMs are underrepresented tremendously at both the master's and doctoral levels (Fleming, 2014; Chapa and De La Rosa, 2006). Researchers estimated that only 24 percent of all URMs complete a bachelor’s degree in science and engineering-related fields (Strayhorn, 2010). The following section will discuss undergraduate student aspirations to attend a graduate program, graduate enrollment and pay special attention to engineering educational aspirations/attainment.

**Graduate Degree Enrollment and Aspirations**

Strayhorn (2010) stated that fewer than half of all STEM (Science, Technology, Engineering and Mathematics) undergraduate students continue onward towards graduate programs. In 2004, Chapa and De La Rosa found Latinos earned 7.2 percent of all bachelors’ degrees, 4.7 percent of all masters’ degrees, and 4.2 percent of all doctoral degrees. The National Science Foundation (NSF) statistical analysis presented “Hispanics” earning 7.8 percent of masters degrees and 5.3 percent of doctoral degrees in 2012 (National Science Foundation, 2015). In 2014, Fleming estimated that only 5.7 percent of doctoral recipients were Latino. Therefore, excluding Flemings work, within the past fourteen years the percent of Latino students’ earning graduate degrees had increased, in comparison to their White counterparts whose numbers remained consistent.

Although the percent of Latino doctoral recipients has increased, they still number in the hundreds (Chapa & De La Rosa, 2006). Both Chapa & De La Rosa (2004) and
Fleming (2014) include both visa holders and non-visa holders in their calculations of Latino degree recipients. Thus addressing the percentage discrepancy between NSF’s finding (2015; who only account for U.S. Citizens and Permanent Residents) and Chapa and De La Rosa (2004) and Fleming (2014). Chapa and De La Rosa (2004) argued that about 40 percent of Latino PhD recipients held temporary visas. This distinction is a vital part in the assessment of recipients of graduate degrees. Some students may identify themselves as Latino, while visiting the United States with the sole purpose of earning their graduate degree and then returning to their home country. Contreras and Gandara (2006) provided the following in-depth estimation of degree attainment for the “Chicano” population: “only 7% of Chicano students who begin school in the United States actually complete a college degree… only 2% will receive some graduate degree, and less than 1% will complete a Ph.D” (p. 92).

The enrollment level of Latino students attending a graduate and professional program, has increased since the mid-seventies, but is still less than that of other minority groups (Gurin, Dey, Hurtado, & Gurin, 2002). In comparison, the number of graduate students of non-Hispanic White ethnicity continues to hold the highest percent of graduate degrees. The NSF (2012) said it best: “Underrepresented minorities; share of [Science & Engineering (S&E)] bachelor’s and master’s degrees has been rising since 1993, but their share of doctorates in these fields has flattened at about 7% for the past 10 years”.

One strong deterrent for students to aspire and attend their graduate degree is that of their undergraduate grade point average (GPA). To be a competitive applicant,
students should demonstrate thorough knowledge of material based on their GPA (Mullen, 2003). As many Latinos do not possess the knowledge of what factors are required to apply to graduate programs (Ramirez, 2011), they tend to obtain this knowledge (such as GPA) latter on in their academic career. This lack of knowledge, in graduate program admissions criteria, are a significant barrier and further discourage students from applying to graduate programs (Ramirez, 2011).

Significant research on the Latino choice-making process, has been conducted on high school programs to community college and/or undergraduate programs, issues faced before and during their undergraduate career, the lack of support from institutions. Relatively little is known about the Latino graduate school choice making process. Ramirez (2007), conducted interviews on 24 Latino PhD students and recipients. During her study, Ramirez identified four common barriers interviewees revealed: lack of knowledge, lack of guidance and support, intuitional abuse and the GRE. The percentage of students applying and taking the GRE’s has decreased since the 1980’s (Gonzalez et al., 2001), in a time where more Latino students are, being encouraged to attend a college/university and obtain a graduate degree.

Aspirations of Latino students to attend graduate programs consist of various factors, researchers have yet to come up with a specific equation that will quantify which students do or do not attend graduate programs. Some factors, as with attaining an undergraduate degree have to do with familial and institutional interactions. We will further discuss these two interactions and their possible influence on students further in the literature review.
Theoretical Framework

This section focuses on the theoretical framework that lead to this researcher’s project. The first framework reviewed, is intersectionality and how that assists with identity development. The next section will review the framework of social capital, followed by cultural capital. The last section of the theoretical framework will cover the vanishing Latino male phenomena. After covering these theoretical frameworks, the literature review will continue to discuss familial interactions followed by institutional interactions and their influence on student aspirations.

Intersectionality

The mode of how individuals deal with intersecting identities forms initial concepts of this theoretical framework. The theory of intersectionality came about in 1989 by Crenshaw to describe the Black women experience of race and gender as forms of marginalization and oppression (Mitchell et. al., 2014; Ramirez 2013). This theory has since been used to describe different intersecting identities in explaining and providing solutions for social concerns, in particular within higher education. Within engineering, the theory of intersectionality can be utilized to study how social constructs (such as gender, race, ethnicity, and social status) influence student identity (Anderson & Collins, 2001; Camacho & Lord, 2011; Lord et. al., 2009). For underrepresented students, such social contracts can affect the student perspective of self, major choice, persistence in engineering and more.
Social Capital Theory

The bulk of research pertaining to student retention within higher education contains two similar forms of capital, social and cultural capital. Social capital refers to how an individual’s social relationships potentially provides the individual with resources, network, and support (Stanton-Salazar & Dornbusch, 1995). Stanton-Salazar & Dornbusch (1995) examined the influence institutional agents had on the students’ social capita, stating that students from low SES have lower levels of social capital than their White, middle class counterparts. Within the educational level, social capital can lead to the addition of social ties to help better understand the intuition and identifying valued resources. In reference to graduate programs, social capita refers to the knowledge ties the individual is able to utilize to understand admissions process or the purpose of a graduate degree. Feels of lack of social integration into the campus culture can greatly influence students graduate degree aspirations (Pascarella & Terenzini, 2005).

Cultural Capital Theory

Cultural capital refers to the “intergeneration transmission of status among the privileged classes operates largely through cultural capital” (Stanton-Salazar & Dornbusch, 1995, p. 120). A student’s cultural background provides them with the initial exposure to familial ties, knowledge on how and when to apply to educational programs (Walpole et. al., 2005). Ramirez (2011) utilized cultural capital in understanding how access to knowledge about Latino graduate admissions process shapes their experiences in applying to graduate programs.
**Social Cognitive Career Theory (SCCT)**

“Career aspirations, and the steps taken to attain them (e.g., earning graduate degrees), are primarily due to the dynamic interaction of personal factors (i.e., personal self-efficacy, outcome beliefs, and personal goals) and the person’s environment” (Fleming et. al., 2014, p. 2). Student interaction and involvement on the campus can have a large impact on the student aspirations and expectations. Fleming et. al. (2014), utilized SCCT to explore university factors that influenced Latinos to aspire to obtain graduate degrees while in an undergraduate program.

**Vanishing Latino Male**

With the focus of this study pertaining to the Latino population, one model utilized is that of the vanishing Latino male. In 2009, Saenz and Ponjuan presented the pressing matter that Latino males are less likely than Latina females to attend universities. The women in engineering programs, are significantly underrepresented more due to historical discrimination of female and URMs. Thus, engineering is largely a male dominant field, understanding and combating the low attrition rates of Latino youth is vital (Camacho & Lord, 2011).

**Familial Interaction and Influences**

The family is considered the most important institution for Latino students when making decisions (Castellanos & Jones, 2003). Álvarez Jr. (1994) discussed the importance of the Latino family by stating it is the “central thread that connects a multitude of strands that make up [students] social world” (p. 147). Family becomes the
vehicle through which students learn develop values and connections (student’s social capita). Some studies (Saenz et. al., 2007) have shown a direct link between parental educational attainment and their child’s completion high school and enrollment into an undergraduate education program. Other studies (Boho, 2006) do not show the same direct link within all subgroups of Latinos (i.e. Mexican, Cuban, Salvadorian, etc.). Familial interaction has yet to prove a direct influence on students’ attitudes towards their post-undergraduate degree attainment.

Mullen et. al., (2003) research identified a correlation between certain post-undergraduate degree attainment and parental education. For example, Mullen et. al., (2003) identified “parental education has the strongest effect on the enrollment in doctoral programs” (p. 161), but found no effect on master program enrollment. Similarly, Boho et. al. (2006) identified as Mexican parental education increases, the expectation for students to continue their education increases. Thus strengthening the theory that parental educational attainment may have an indirect influence on applying to and attending a graduate program. Desmond and Lopez (2009) noted that the same rise in educational aspirations for White students (as parents education increases, offspring educational attainment increases with it), is not the same in Latino students (also see Bohon et. al. 2006). Although parental education has yet to be proven as a direct influence on a student’s educational attainment, social economic status (SES), familial background, familial educational expectations all play an indirect role in a student’s decision to attend a graduate program or not.
Fleming (2014) examined Latino student’s educational aspiration into graduate programs by conducting interviews at a Hispanic Serving Institution (HIS) and found that student’s academic aspirations were indirectly correlated to familial interactions. One major finding Fleming (2014) argued was that students who had parents or relatives in an engineering field were likely to choose engineering as their major and more likely to aspire to attend graduate programs. Similarly, Ramirez (2011) interviewed Latino graduate students and identified an indirect link between familial input and graduate educational options. Although Fleming (2014) found this to be an initial influence on students’ majors and aspirations, it was noted this initial influence lessened with the student’s time at the university and their personal experiences. Fleming’s findings agree with previous literature, which states that parental support for students career plans may lead to greater amount of students attending post-bachelor programs (Hearn, 1897; Ethington and Smart, 1986; Mullen, Goyett & Soares, 2003). Whereas, Ramirez (2011) identified study participants relied on family (in particular sibling) input for information on and guidance with graduate program choices.

**Familial Educational Expectations & Guidance**

While previous literature has not fully investigated the value placed on family within the Latino community, studies have argued these values may deter students from aspiring to continue into graduate programs (Museus & Quaye, 2009). Part of the Latino family cultural values reciprocity, children are expected to contribute to the familial value (Álvarez Jr., 1994). Saenz and Ponjuan (2009) studied the effects culture has on Latino males and discovered that Latino males are more likely than Latino females to feel
familial pressure to assist in the support of their families directly after graduation. This, Saenz and Ponjuan (2009) argued, pressure to contribute to the household income can become a deterrent for Latino males to continue in their educational aspirations. This leads to high dropout rates at the high school, community college and four-year institution levels. Álvarez Jr. (1994) also discusses how pressure to conform to “tradition roles” causes conflict between second-generation and later Latino and parents. For many Latino children, the choice between familial expectation and personal desire causes great internal debate; in this case, on whether or not to attend a university/college or even later on attend graduate programs.

Initial research investigated whether students' parental socioeconomic status (SES) influenced students' aspirations to attend bachelor programs and beyond. Research found that parents' SES was an indirect influence on students’ aspirations (Ethington & Smart, 1986). Ethington and Smart (1986) found that parental SES had a direct influence on a student’s choice of university and in turn had an influence on the student’s plans for the future. They further stated that students with higher educated parents were more likely to earn higher grade point averages during their undergraduate career, making them more likely to apply to graduate programs. Stolzenber’s (1994) research suggested that student’s social economic status and parental education had no influence on student’s ambitions to attend graduate programs. A limitation to Stolzenber’s research was the inclusiveness of all students within this statement (no ethnic variation) and the fact it focused on MBA’s with an inclusiveness to other graduate programs. Stolzenber (1994) also noted a small effect on student’s likelihood to take graduate entrance exams arose
from student’s grade point average. Although Ethington and Smart (1986), and Stolzenber (1994) approached to topic SES distinctly, both find an indirect link between family background and student’s decision to attend graduate programs.

Students whose parents have earned higher than a high school education are more likely to apply to, enroll and persist in higher selective undergraduate programs (Mullen et. al., 2003). This in turn, increases the students’ likelihood of continuing their education into a graduate program. Parental educational attainment has shown to expose students to higher expectation of educational attainment. As parents’ educational attainment increases, the expectation of their child to earn a post-undergraduate degree increases (Fleming et. al., 2014; Muller et. al., 2003; Ramirez, 2011). Mullen et. al., (2003) concluded that students whose parents were highly educated were three times more likely to enroll in doctoral programs, but did not find the same link between student applications to master’s degree programs.

Parental or familial education provides students with a form of social capital. Social capital works on the premise that the people who surround you provide you with knowledge base and a network you can utilize. Parental encouragement and support plays a significant role on student’s college choice process (Arrellano & Padilla, 1996 & Flores, 1992). It is import in higher education to understand how a student’s social capita affects their choice to attend a four-year institution, choose an engineering program and then aspire to attend a graduate program.
University Interaction and Influences

Institutional Agents

Although Latino students earn their place at a university, many arrive from communities that improperly prepare them for an undergraduate or engineering program. Feeling of insecurity, homesickness, confusion or isolation tend to grow for Latino students at predominantly white institutions (Hurtado et. al., 1996). To assist students in understanding and combating these emotions, a variety of entities have been identified. Some of the institutional agents who interact with Latino students are administrators, staff, faculty, career advisors, program coordinators, etc. The following evaluates current researcher on these institutional agents and their effects on student’s aspirations to apply and attend a graduate program. Anaya and Cole (2003) condensed the effect an institutional agent has on students: “Student development and learning are in part a function of the motivation and effort of the individuals…linked to students’ college experience” (p. 96).

Staff and administration. As Latino students enter four-year institutions, their accomplishments from high school tend to not prepare them for the life of a college student; especially since the majority come from high schools with little or no advance placement courses or curriculum. Staff and administrators at the university become the link between the student and the campus, since they work with the student from recruitment to graduation (Haro & Lara, 2003).

Since staff and administrators become the main point of contact for students, they serve as the largest body of knowledge, assisting students in navigating the new
educational system they are in (Arbona & Nora, 2007). Some universities utilize Latino staff as a means of attracting, socializing, and assisting the new student matriculate (Haro & Lara, 2003). In particular, staff at HIS’s may be more sensitive to the academic needs and cultural values of Latino students (Camacho & Lord, 2011). The campus culture (climate) plays a crucial role on Latino student’s persistence through graduation and their aspirations afterwards. Part of the role staff and administrators play is to provide academic support, academic advise, mentorship services and outreach support all of which assist a student in building confidence in their abilities and the community surrounding them (Arbona & Nora, 2007). Furthermore, the culture of the campus can greatly influence a student to attend graduate programs (Ramirez, 2013). Yosso (2006) states that the campus can create a culture in which students are encouraged to attend graduate programs or hinder the student by not providing any access to information.

Various researchers (Arbona & Nora, 2007; Herrera, 2003; Nesheim, Guentzel, Gansemer-Topf, Ross, & Turrentine, 2006; Ramirez, 2011; Yosso, 2006) have conducted qualitative studies examining factors that contributed to graduate enrollment. As part of these studies, researchers have identified the benefits staff and administrators provide and their limitations. Ramirez (2011) interviewed 24 current and graduated Latino Ph.D. students at a public institution. One major factor, Ramirez discovered was the lack of information available to students. Subjects of the study responded they were unable to access information on the requirements for graduate programs from institutional agents and at times had to rely on the knowledge of faculty and staff. Participants stated a lack of resources to explain and examine graduate programs and admissions process, and lack
of support and guidance (Ceja, 2006). Santon-Salazar (1997) also identified staff and faculty as serving contradictory roles. For examples, academic advisors can encourage their students to attend graduate programs, but at the same time identify them as “low preforming” students.

Part of the effort staff and administrators is to assist students in the “settling in” process. Many institutions have introduced preparation programs to assist students from disadvantaged communities to become aware of the campus resources through summer bridge programs and targeted programs (Hurtado & Kamimura, 2003). Once such program that focuses on minority students in the STEM majors is the CAMP (California Alliance for Minority Participation) program. The CAMP program is “dedicated to supporting underrepresented minorities along the degree pathway, including admissions into master’s and doctoral programs” (UC Merced, p. 1). The CAMP program specifically targets underrepresented students into graduate programs by providing: Summer bridge programs, faculty mentorship, graduate school preparation, research opportunities and assistance in coursework. Such program staff and administrators assist students through the graduate application process, producing well-informed applicants (Ramirez, 2011). These staff and administrators provide students with a culturally aware program that allows for the interaction at a more comfortable level. Students are able to discuss aspirations with staff who are more sensitive to their cultural environment; this is particularly true for Latino students (Camacho & Lord, 2011). Further, in the literature review, the investigator will examine the effects of research programs on Latino students’
graduate aspirations. An examination of faculty interaction and its effects on student aspirations.

**Faculty Interaction.** Research has shown that faculty interaction has a grand impact on student aspirations either career or graduate based. Much research has focused on the impact faculty interaction has on student educational performance and aspirations (Anaya, 1999; Astin, 1993; Pascarella & Terenzini, 1980). While these researchers focused on the implications of faculty-student interactions, few researchers have focused on interracial impacts of faculty-student interaction. In the early 1980’s, researchers (Fleming, 1984) began to examine this interracial impact. Since then various researchers in psychology have examined the effects of predisposition background has on the approach and effects between interracial interactions. Anaya and Cole (2003) synthesized this body of knowledge: “college student and faculty experiences may vary as a function of differences in race-related experiences, awareness of race, ability to deal with racial diversity, and differences in understanding of racial issues” (p. 99).

A lot of research on the impact a Latino faculty member can have on the student’s educational aspirations provides useful information. Ramirez (2011) stated the lack of Latino faculty negatively influences a Latino student’s social capital within the university. Gloria (1998) also found Latino students feel less represented by the lack of Latino’s within the faculty or administrative levels. Ramirez’s (2011) study consisted of interviewing graduate students and interpreting the factors, which influenced them to continue their education from undergraduate to graduate programs. Ramirez found, Latino students felt they could only relate to a handful of faculty and they were the ones
students approached for mentorship or advice. Similarly, Griffin et. al., (2010) found that underrepresented students tend to seek role models within their cultural group. Griffin et al. (2010) also identified students developed a deeper connections with these faculty because of cultural shared experience. This deeper connection will allow students to view faculty as proof that it can be done, and in the process gain valued assistance in understanding the graduate school admissions process, deciding what colleges or universities to apply to (Camacho & Lord, 2011; Griffin et. al., 2010; Ramirez, 2011). In increasing the number of Latino faculty who interact with undergraduate students, the greater potential growth in the number of undergraduate students who persist in engineering programs and apply to graduate programs.

One method of increasing the integration of Latino culture to that in higher education is to increase the number of faculty who are Latino. Although this would be ideal, Haro and Lara (2003) synthesized how this is less likely:

Studies (Hispanic Border Leadership Institute, 2002) done in several states with large and expanding Hispanic populations reveal that the number and percentage of Latino faculty (here are included only those in tenure track, fulltime teaching positions) are increasing at the two-year colleges, barely gaining ground at four-year regional universities, and almost stagnant at the most selective research universities in the country. (p. 155)

The stagnant growth of Latino faculty in the private and Ivy League universities and the slow growth in public four-year institutions is another reason why it is vital to understand graduate school aspirations of Latino undergraduate students.
Brazziel and Brazziel (1997) studied several institutions and what factors contributed to higher graduation rates of historically underrepresented minorities. Researches discussed how the increase of degrees attained by minority students is in part due to an increase in faculty member’s recruitment of students at an earlier stage in the educational pipeline. They discuss faculty mentorship at several institutions had a high impact on a student’s aspiration to attend doctoral programs. Inshiyama (2002), found students who participated in research programs lead by faculty member to be able to adapt and think analytically on their own (cited in Strayhorn, 2010, p. 87). In the next section, we will focus on undergraduate research programs.

The studies used on participation in undergraduate research opportunities show its effects on student’s aspirations to attend graduate degrees. Research has thus shown that faculty engagement outside of the classroom greatly influences student’s educational abilities and expectations. Along with interaction with faculty and other entities on campus, it is important to explore what role peers have on student’s educational aspirations.

**Undergraduate Research Programs and Student Groups**

The last section of the literature review will explore the influence of undergraduate research programs and peers on Latino student aspirations to attend graduate programs. Research has noted positive impacts of participation in these groups to attending graduate programs (Jiang & Loui, 2012; Lamport, 1993; Strayhorn, 2010). Although, participation in research programs may lead students to decide against graduate program participation. After participation in research, students who have a
negative experience will opt to enter industry after completing their undergraduate degree rather than attending a graduate program (Jiang & Loui, 2012).

**Undergraduate research programs.** Although faculty and staff compose a large portion of direct student interaction, students also interact with these entities through undergraduate research programs or targeted programs. The main purpose of these programs is to stimulate student interest in pursuing advanced degrees (Strayhorn, 2010). Undergraduate research programs (hereafter, URPs) can target students through major choice, educational aspirations or through various other criteria, for the purpose of this study focus will be given to STEM specific program. As previously mentioned, once such program is the CAMP program. It provides students with targeted orientation, research opportunities and graduate admissions process assistance. Such outreach services and mentoring programs allow the student to gain more insight as to requirements for graduate studies through the personal relationship (Clark and Garza, 1994).

Vast amount of research has shown URPs to have positive effects on students aspirations after graduation (Hunter, Laursen, & Seymour, 2006; Strayhorn, 2007; Adedokun, et al., 2012). There are various forms of outreach programs, some government-sponsored (as that of the CAMP program), others university-based (conducting research with a faculty in a lab), and some who target students by their academic year (first-year programs), whose purpose is to attract and retain students in their engineering program. Research has consistently shown research experience during undergraduate programs effectively expose and aspire students to continue their degree
programs into graduate programs and research careers (Nnadozie, Ishuyama, & Chon, 2001; Lapatto, 2004). Although it is unclear if participation in URPs raises aspiration or simply reinforces students initial aspirations. Additionally, research has shown that participation in URPs is linked to student acculturation to campus environment (Camacho & Lord, 2011; Hurtado et. al., 2008), increased academic achievement (Strayhorn 2010), increased esteem in abilities (Adedokun et. al., 2012; Hakim, 1998), and higher levels of satisfaction with major choice and future career goals (Strayhorn & Terrell, 2007).

Targeted URPs that track students towards doctoral degrees have shown an increase in student aspiration and attendance in graduate programs (Seymour, Hunter, Laursen, & De Antoni, 2004; Russell, 2006). Studies focused on the impact of URPs (as that of Strayhorn, 2010) on underrepresented students found URPs strongly influence student aspirations for graduate programs. Participation in URPs provides Latino students with support, encouragement, mentorship and increased social and cultural capita (Camacho & Lord, 2011; Hurtado et al., 2008). Latino participants in these programs state they assist in understanding the purpose of a graduate degree, requirements, and aspires they to continue their degree onward while providing them with the foundational to develop their professional self-confidence (Ramirez, 2011). Yet again, little is known, as to what portion of URPs specifically aspire students to attend graduate programs. Since most studies focus on the inclusivity of URPs and their benefits to aspire students into graduate studies, very few focus on the student initial thoughts of attending graduate programs (Villarejo et. al., 2008).
**Student group.** Fleming (2014) found student group involvement has an impact on undergraduate student’s future aspirations (Wallace, 1965). There are a number of organizations, such as Latino engineering undergraduate students, in which students can become involved. Such organizations are Latinos in Science and Engineering (MAES) and Society of Hispanic Professional Engineers (SHPE). Involvement in these organizations develop an inclusive culture for Latino students, especially within a White and Asian dominant field such as engineering (Camacho & Lord, 2011; Ramirez, 2011). Participation in professional organizations within engineering assists students in narrowing their future aspirations either towards graduate degrees or the work force by providing students with collective learning opportunities, support system, shared knowledge (social capital), and shared experiences (Camacho & Lord, 2011). For example, participation in SHPE or MAES may expose students to other organizations or programs on campus that can assist with graduate application. Furthermore, alumni or current students, can outline for lower classmen the requirements for and application process to graduate programs. Researchers have noted that developing these close bonds ultimately assist students in persisting in their program (Flores, 1992).

For college success, it is important that students integrate on their campus and feel a sense of support and community for positive success while at the institution. Subsequent studies conducted to understand the mindset of Latino doctoral students (Clark & Garza, 1994) discovered that the Latino students possess a fragile and vulnerable characteristic throughout their studies. In some cases, Latino students opt to forgo graduate and professional programs to enter into the workforce, unaware that the
longer students postpone graduate study, the harder it is for them to return to it (Harvey, 2003). With such a large population of Latinos in the United States, the number of undergraduates attending graduate or professional programs is very low. The development of relationships with faculty and staff, participation in culturally based organization and research programs, along with inclusion of familial/cultural values will increase the number of Latino engineering students desiring to attend graduate programs. The research conducted here will help shed some light on the subject. It will allow the public to view what factors contribute to engineering students’ expectations of attaining a graduate degree.

**Rationale for the Study**

Work by Chapa and De La Rosa (2006) provided much needed insight into graduate program admittance and persistence of Latino students in STEM programs. Over the past two decades, researchers have focused on the decline of U.S. graduates from masters and Ph.D. programs and begun to pay close attention to the fastest growing population, Latinos. Few researchers have conducted specific analysis on what contributions affect students graduate program aspirations specifically in engineering. The intention of this study is to examine the encouragement and aspirations of engineering students to apply to graduate programs with a focus on the Latino student population. To study engineering student’s encouragement and aspirations to attend graduate programs, the research will examine main areas that influence student’s aspirations: Familial interactions and university interactions.
Summary

Familial interaction provides students with initial cultural and social capital, which affect student development of identity, educational values, and expectations. Once enrolled at four-year institutions, these social and cultural capita expand to include university entities. Institutional entities can greatly affect student development of identity, integration into campus culture, and awareness of self. Various entities at university campuses that influence student aspirations to attend graduate programs are staff/administrators, faculty, research programs, and student organization. For Latino students incorporating familial values into retention and recruitment process for graduate programs may assist to increase the number of students who aspire to attend graduate programs.
CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study is to examine what factors at a public research institution contribute to Latino engineering students to aspire to attend a graduate program while in their undergraduate program. This study includes participants from all ethnic/racial groups, sexual orientation, generations and years, but shows specific interest in Latino student’s responses. The information provided through this research will provide both undergraduate and graduate programs insight knowledge for recruitment and retention in graduate programs in engineering. The following research questions lead this study:

1. What factors at a public research institution affect the choices of engineering students’ to aspire to continue their education in a graduate program?
2. What are the roles of ethnicity and generation in the choice of engineering students’ to aspire to continue their education in graduate programs?

Research Design

The design of the students was an exploratory research design. A mixed method study includes both a quantitative and qualitative information. The quantitative portion of the study included an electronic survey to gather information. The qualitative portion of the study included face-to-face interviews. The design is to explore the student’s perspectives of what factors contribute to their aspirations to attend graduate programs.
The study focused on the student’s perspectives on how various interactions (institutional, department and familial) influence and affect their aspirations to attend a graduate program. The researcher created the data collection instruments based on influential information emphasized in the literature review section of this document. The questions that were asked, were then formatted and refined by the assistance of experienced researchers and colleagues.

**Site/scope.** The site for this research study was a young public research institution in the central region of California, which will hence, be regarded as Central Research University (CRU). CRU is both a masters and doctoral granting institution. Doctoral programs focus on intensive interdisciplinary research programs; whereas masters programs vary between research programs and comprehensive exam options (Central Research University, n.d.). CRU grants both masters degrees and doctoral degrees within their engineering programs. The university consist of approximately 6,300 students, with approximately 6,000 students within the undergraduate level (Central University, n.d.). The student population of CRU consist approximately of 6% African-American, 25% Asian/Pacific Islander, 46% Latino, <1% Native American and 14% White, 4% Nonresident Alien, 4% Two or More Races, and <1.0% Unknown/Declined to State (Central University, n.d.).

Of the approximate 6,000 students at the undergraduate level, approximately 1,500 students enrolled in an engineering program for the fall 2015 term (Central Research, n.d.). Additionally, within all engineering undergraduate programs, approximately 79% of enrolled students identified as male, 20% identified as female and
1% declined to state. The engineering undergraduate student population consisted of
<1% Native American, 28% Asian/Pacific Islander, 4% African-American, 40% Latino,
17% White, 6% two or more races, 1% decline to state/unknown, and 4% Nonresident
Alien (Central Research, n.d.). The breakdown of the engineering population is similar
to that of the overall CRU population. There is a significant difference in gender
distribution for the overall university population and that of the engineering department.

**Population.** The population utilized for this study were all engineering students
at CRU, with an emphasis on the Latino ethnic group, including both male and female.
For the purpose of this study, Latino students self-identified. Undergraduate students’ at
all educational levels were included in the population.

**Sample.** The sampling method utilized for this study was convenience sampling
(Bui, 2009; Graustein, 2011) from the school of engineering at CRU. The sample for this
study consisted of 124 undergraduate students at CRU; 17 identified as first year
students, 24 as second year students, 31 as third year students and 52 as fourth year plus
students. The majority of participants, 91.4% entered CRU as first year students and
8.6% entered CRU as transfer students. Data from participants who began but did not
complete the survey were omitted (N=24).

**Collection of data.** The researcher was unable to gain personal contact
information for all students in the school of engineering at CRU. Therefore, the
researcher contacted the school of engineering advising staff and interim dean for
assistance. The Interim Dean of the School of Engineering agreed to support the
researcher by allowing the advising staff to email all engineering students via their
internal list. The advising staff agreed to both send a general email through their general
advising email address (see Appendix A) and follow-up email(s) to their respected
advising population via their email address including the survey link. The email was
approximately sent to 1,200 students within the school of engineering (these students
included a variety of racial/ethnic groups, gender, year, and program within engineering).
Students self-selected to participate in the survey. Once granted permission by the
Interim Dean of the School of Engineering, the researcher gain institutional review board
(IRB) approval from both researchers’ educational institution and CRU. The research
followed ethical research practices. Once students clicked on the survey link, they first
had to agree to participate, through the letter of consent (see Appendix B). During the
survey, students self-identified they were willing to participate in a face-to-face
interview. Prior to participating in the interviews, it was asked of the students to read and
sign a second letter of consent (see Appendix C). It took approximately a month long to
collect the data.

**Description of Methods**

**Quantitative.** An online survey collected the data. The research utilized the
survey site, surveymonkey.com, to collect the data anomalously. The online survey
allowed the research to contact the most students possible, without physically contacting
them. No identifying factors were required of participants. At the end of the survey,
participants had the opportunity to self-select, by providing their email address, if they
wanted contact later to participate in an interview.
The survey (see Appendix D) consisted of multiple sections, totaling 50 questions. The first section consisted of quantifiable data questions targeted at establishing the student’s academic history and demographical data. The second section of the questionnaire consist of Likert-type scales questions to establish the students aspirations and plans, along with where they may have gained experience or aspirations on graduate programs. The third section of the questionnaire consist of Likert-type scales to view student’s perceptions of how much certain factors encourage them to attend graduate programs. The fourth section of the survey consist of Yes/No questions and open ended responses to determine students current/future plans and to provide students with a place to further describe where or who assisted in applying to graduate programs. The last section of the survey asked if students would be willing to participate in a face-to-face follow-up interview. Participates were allowed to skip questions or parts of questions if they chose not to. Surveys not completed up to the fourth section were omitted from the analysis section of the research.

Qualitative. Participants were able to further partake in collection of data by providing their contact information and stating they were willingness to a face-to-face follow-up interview. Of those, who provided their contact information, the researcher emailed and scheduled face-to-face interviews, conducted within two weeks of the end of survey collection. The interview section consisted of five open-ended questions (see Appendix E). The survey was a semi-structured survey that provided the interviewer to ask questions not necessarily written in Appendix E. This questions served to establish where students obtained information about graduate programs, who or what contributed
to their aspiration to attend a graduate program, and where their aspiration may have initiated.

**Data Analysis Procedures**

Quantitative data obtained from the survey data was analyzed utilizing the descriptive statistical process. Major elements such as ethnicity, generational level and academic year utilized filtered areas. The purpose of these filtered areas was to sort between response populations. The researcher used the filters, to identify themes within the population that related to the research questions. Qualitative data obtained from the face-to-face interviews were tape recorded and transcribed verbatim. The researcher read the transcripts several times and translated when needed. Key words and phrases identified, by using common themes described in literature and coded.
Chapter 4
DATA ANALYSIS AND FINDINGS

Introduction

The purpose of this study is to understand better the graduate program choice and aspiration of engineering students at a research institution. To understand:

1. What factors at a public research institution affect the choices of engineering students’ to aspire to continue their education in a graduate program?
2. What are the roles of ethnicity and generation in the choice of engineering students’ to aspire to continue their education in graduate programs?

The main idea of the data analysis focused on the quantitative data from survey responses. The first section of the data analysis described the sample group and stratified it by different subtopics. The researcher will then continue to present different themes raging from undergraduate familial interaction to department interaction and their influences in the student aspirations to attend graduate programs. The themes included demographic and initial thoughts of graduate programs, respondent interactions related to graduate programs with family and various entities on campus, and respondent perceptions of how family and various entities of on campus encourage graduate program aspirations. Then, the researcher presented common themes exposed through in-depth interviews in the qualitative data. The last section of the data analysis reviews the themes presented in both quantitative and qualitative instruments and how they relate to the leading questions of the study.
Presentation of the Findings - Survey

Demographics

The sample for this study consisted of 124 undergraduate students at Central Research University (hereafter referred to as CRU) who completed the survey. For the quantitative portion of the survey, the researcher chose to filter the data based on ethnicity. Participants, whom self-identified as Latino or non-Latino participants defined ethnicity. Non-Latino who defined as participants selected African American, Asian American, Caucasian, Native American, and other. The data presented is mostly in percentages of respondents from the filtered subgroups. Table one presents the total breakdown of respondents on the premise of ethnicity.

Table 1
Survey Respondents included in data filtered by Ethnicity

<table>
<thead>
<tr>
<th>LATINO</th>
<th>NON-LATINO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Latino</td>
<td>African America</td>
<td>Asian American</td>
</tr>
<tr>
<td>N</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>%</td>
<td>40.3%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Notes: Omitted from Ethnic filters: Asian (N=2), Pacific Islander (N=3), and Other (N=2)

Of the total 124 students, approximately, 60% were non-Latinos. The bulk of the data presented will focus on either a comparison between Latino & non-Latino responses or that of Latino responses filtered by interaction and encouragement. Additional demographic information included respondents’ year (Table two), perceived time to degree (Table three).
Table 2

All Respondents – Year in Undergraduate Program

<table>
<thead>
<tr>
<th></th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Fourth Year or Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>17</td>
<td>24</td>
<td>31</td>
<td>52</td>
</tr>
<tr>
<td><strong>%</strong></td>
<td>13.6%</td>
<td>19.4%</td>
<td>25.0%</td>
<td>42.0%</td>
</tr>
</tbody>
</table>

Table 3

All Respondents – Years left to Graduate

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>Up to 1</th>
<th>1-2 years</th>
<th>2-3 years</th>
<th>3- 4 years</th>
<th>4+ Years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>8</td>
<td>33</td>
<td>35</td>
<td>14</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td><strong>%</strong></td>
<td>6.5%</td>
<td>26.6%</td>
<td>28.2%</td>
<td>11.3%</td>
<td>12.9%</td>
<td>8.1%</td>
</tr>
</tbody>
</table>

The majority of respondents indicated they were in their junior year or higher (third year +). The majority of respondents (67.7%) indicated they would be earning their degree within two years of completing the survey. The elevated response rate between upper classmen and lower classmen maybe caused by the period when the survey was actually conducted, as upper classmen may have more thoughts on the subject of attending graduate programs towards the end of the academic year than lower classmen.

Another explanation as to the semi-uniformity between upper and lower classmen was that most students indicated they began their academic career at CRU as freshman
status. Seven respondents indicated they entered CRU as transfer (junior status) student, two of who were non-Latinos and five who indicated they were Latinos. Thus, it would be safe to assume the majority of students will continue in their current program of study. Additional collected demographics included respondents’ self-reported generational information and self-reported grade point averages (GPA), as shown in Table four and Figure one, respectively.

Table 4
Self-Reported Generational Information - Ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Latino</th>
<th></th>
<th></th>
<th></th>
<th>Non-Latino</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zero</td>
<td>1st</td>
<td>2nd +</td>
<td>Zero</td>
<td>1st</td>
<td>2nd +</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>13</td>
<td>27</td>
<td>10</td>
<td>12</td>
<td>23</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>26%</td>
<td>54%</td>
<td>20%</td>
<td>16.2%</td>
<td>31.1%</td>
<td>52.7%</td>
<td></td>
</tr>
</tbody>
</table>

The researcher chose to distinguish students by generational level and allowing students to choose one of the following categories. At least one parent is born outside the US and one was not born in the U.S.; neither parents was born in the U.S. and I was born in the U.S.; At least one parent is born in the U.S. and I was born in the U.S.; other (please specify). The participants were grouped into one of the categories based on their responses. Consistent with research (Chapa & De La Rosa, 2003), the majority of Latinos reported as first generation, in comparison with their non-Latino counters who reported being second generation or more. As student generational linage grow (2nd generation +),
the student familial knowledge (cultural capital) also grows (Ramirez, 2011; Stanton-Salazar & Dornbush, 1995; Walpole, 2005).

Along with the potential affects, generational linage may have on student aspirations to attend graduate programs, is grade point average (GPA). For admission to graduate programs, GPA provides an insight into the student’s academic performance in regards, to their coursework. Most graduate engineering programs at research institutions require a minimum GPA of a 3.0 for admissions (University of California). Self-Reported GPA ranges filtered by ethnicity are shown in Figure 1.

Figure 1  Self-Reported Grade Point Average - Ethnicity

As noted from Figure one, the largest percentage of Latino (56.0%) and non-Latino (44.6%) do not possess the minimum GPA to apply to their own universities graduate programs in engineering. Non-Latinos possess a larger percentage (55.4%) of GPAs higher than 3.0 in comparison to Latinos (44%). Therefore, non-Latinos have a
higher percentage of admittance to graduate programs, solely based on admissions
criteria.

**Attitudes toward Graduate Programs**

Initial attitude of respondent towards attending a graduate program after
completing their undergraduate degree has a great impact on the respondent’s graduate
aspirations. The researched wanted to gauge respondent’s attitudes towards when they
would be attending graduate programs and their initial attitude towards the availability of
information regarding graduate programs. Participants were allowed to select one
response from a response matrix from highly disagree to highly agree. The researcher
decided to question participant’s initial attitude to attend a graduate program directly after
completing their undergraduate degree, student consideration attitude toward graduate
programs in general, if respondents have done any researcher regarding graduate
programs, and respondent’s attitude toward the availability of information. The response
of each subgroup were similar, as shown in Table five.
Table 5

All Respondents - Aspirations toward Graduate Programs

<table>
<thead>
<tr>
<th></th>
<th>Grad school directly after undergrad</th>
<th>Considering Grad school</th>
<th>Researched Grad school</th>
<th>Available information on Grad school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Latino</td>
<td>Non-Latino</td>
<td>Latino</td>
<td>Non-Latino</td>
</tr>
<tr>
<td>Agree</td>
<td>40.0%</td>
<td>24.3%</td>
<td>76.0%</td>
<td>68.9%</td>
</tr>
<tr>
<td>Disagree</td>
<td>24.0%</td>
<td>47.3%</td>
<td>12.0%</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

Notes: Omitted from filters: Neutral and Decline to State

Attitudes towards when respondents’ would attend graduate programs differed significantly between Latino and Non-Latino Students. Latino’s were more likely to consider entering a graduate program (16% agree and 24% highly agree) directly after their undergraduate program than their non-Latino counterparts (14.9% agree and 9.4% highly agree). Although for both subgroups, a significant portion of respondents neither agreed nor disagreed (36% Latino and 27% Non-Latino) about attending graduate programs directly after their undergraduate.

In addition to attitudes towards graduate programs, the investigator chose to identify a baseline on participant’s attitudes towards how graduate degrees would affect their personal and career goals. As the percentage of Latino students who earn graduate degree is less than five percent of the total earning population, it is vital to review potential attitudes as to entering the workforce and respondents thoughts of the effects graduate degrees have on their potential career (NSF, 2015). Table six demonstrates
student perception of the workforce and perception of the effects a graduate degree has on their career plans.

Table 6

Attitude toward Graduate Programs - Ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Directly enter work force after undergrad</th>
<th>Graduate degree provides financial stability</th>
<th>Career requires graduate degree</th>
<th>Graduate program after work force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Latino Non-Latino Latino Non-Latino Latino Non-Latino Latino Non-Latino</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>76% 77%</td>
<td>50% 32.4%</td>
<td>30% 24.3%</td>
<td>44% 29.7%</td>
</tr>
<tr>
<td>Disagree</td>
<td>10% 8.1%</td>
<td>18% 29.7%</td>
<td>26% 36.5%</td>
<td>20% 28.4%</td>
</tr>
</tbody>
</table>

Notes: Omitted from filters: Neutral and Decline to State

In comparison to perception of graduate degree programs, participants were three times more likely to desire to enter the work force than to attend a graduate program after graduation from undergraduate degree. Latinos are more likely to agree that graduate degrees provide financial stability than their non-Latino counterparts. Latinos also have a larger expectation to graduate from their undergraduate degree, enter the work force and then return to complete their graduate degree than their non-Latino counterparts. One possible explanation is the misconception of engineering firms paying employees to earn their graduate degree.

Familial interaction related to Graduate Programs

The respondents were asked to rank their perceptions of knowledge from their families in regards to graduate education based on a scale. Respondents could select from highly agree, agree, neutral, disagree, highly disagree or does not apply for each
question. Figure two shows a combination of highly agree and agree as positive interactions and highly disagree and disagree as negative interactions regarding specific familial interactions on graduate programs in general.

Figure 2 Familial Discussion related to Graduate Study – Ethnicity

[Graph showing percentages of parents, immediate family members, and extended family members for Non-Latino and Latino groups, with categories for positive and negative interactions.]

Latinos had higher percentages of lack of knowledge (or “spoken to about graduate programs”) from family and immediate family. This may stem from Latinos being culturally uninformed since parents tend to have little information (cultural capital) about graduate programs (Desmond & Lopez Turley, 2009). Latinos were about two times more likely to rank disagree (34%) and highly disagree (22%) than their Non-Latino counterparts (disagree and highly disagree, 17.6% and 12.2% respectfully) to
parental communication about graduate programs. Whereas in regards to immediate family member conversation about graduate programs, the same cannot be said.

Although Non-Latinos had more conversations with immediate family members in regards to graduate programs, a high percentage (16.2%) stated a neutral interaction about it. Both Latinos and Non-Latinos had few conversations with extended family about graduate program. Figure three ranks respondents’ positive perception of knowledge from institutional agents in regards to graduate programs.

**Institution and Department Interaction**

Along with familial knowledge, it is important to discover whom, if anyone, played a role in regards to information on graduate programs at the institutional level. Once again, respondents were provided a matrix from highly agree to highly disagree to respond to questions regarding who has “spoken to me about graduate programs”.

![Influential Institutional Agent - Ethnicity](image)

<table>
<thead>
<tr>
<th>Institution/Department</th>
<th>Non-Latino</th>
<th>Latino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career Service Specialist</td>
<td>![Graph Data]</td>
<td>![Graph Data]</td>
</tr>
<tr>
<td>Non-Career Service Specialiston</td>
<td>![Graph Data]</td>
<td>![Graph Data]</td>
</tr>
<tr>
<td>Club/ Organization</td>
<td>![Graph Data]</td>
<td>![Graph Data]</td>
</tr>
<tr>
<td>College Friend(s)</td>
<td>![Graph Data]</td>
<td>![Graph Data]</td>
</tr>
</tbody>
</table>
Both Latinos and Non-Latinos ranked college friends as the highest form of institutional agents to speak to them about graduate programs (see Figure 3). When asked if information was readily available, both Latinos (50%) and non-Latinos (39.5%) stated it was not, but when asked if their campus hosted workshops and fairs in regards to graduate programs both Latinos (and non-Latinos (63.5%) stated that the campus did. Ramirez (2011) examined how institutional policies along with ethnic and gender barriers embedded in the graduate program process and how it greatly influences Latinos’ application inclinations. These barriers may be a possible explanation why direct institutional agents are the least knowledgeable agents for respondents.

**Encouragement**

After the establishment of institutional and familial knowledge, respondents were asked to report on their beliefs of encouragement from familial agents and institutional agents. Respondents were provided a matrix from highly agree to highly disagree to respond to questions regarding who has “encouraged me to pursue a graduate degree”. Figure four focuses on familial agent encouragement for Latino Students. Latino students had higher level of disagreeing with the questions regarding familial encouragement.

The highest ranked (28%) familial agent of encouragement are immediate family members, which include parents, siblings, and grandparents. Ramirez (2011) identified that graduate students utilized siblings as agents of encouragement to aspire to attend graduate programs. Siblings have become agents of knowledge on how and when to apply to graduate programs, along with the purpose of a graduate degree. Non-Latinos had higher percentages of encouragement from family (41.9% vs. 26%), immediate
family (35.1% vs. 28%) and extended family (27% vs. 20%) than Latinos did. When asked about familial attainment of graduate degrees being an inspiration to attend a graduate program, Latinos slightly agreed (26%), more than they slightly agreed non-Latinos (23%), that it did achieve graduate degrees. Curiously enough, 28.4 percent of non-Latinos stated it neither had a positive or negative impact on the graduate aspirations, whereas Latinos stated it at 14 percent.

Figure 4 Perceived Encouragement from Familial Agents - Latino

Various institutional agents identified by previous researchers, are used as agents of encouragement for student aspirations to attend graduate programs (Fleming et. al., 2014; Lamport, 1993; Ramirez, 2011). Figure five presents the impact of how these agents encourage positively (via agree and highly agree) or discourage/have no effect (via
neutral, highly disagree and disagree) on Latino student aspirations. Figure six presents the impact of the same institutional agents via the same format of non-Latino students.

Figure 5  Perceived Encouragement from Institutional Agents - Latino

Notes: Omitted from influence filter: Does Not Apply
Overall, Latinos reported low levels of encouragement from all direct institutional agents and reported high levels of encouragement from peers (56%). Peer encouragement was also the highest level (37.8%) among non-Latino students. The top three institutional entities of encouragement among Latinos by ranking are: peers (56%), faculty (38%), and club/organization (34%). Although the same three were rated as the top three institutional entities of encouragement, non-Latinos ratings were lower than Latinos: peers (37.8%), faculty (21.6%), and club/organization (18.9%). The lowest level of encouragement was from career service personal, Latino at 10% and non-Latino percentage at 6.8%.
Both groups reported the lowest percentage of institutional encouragement (Latino: 66%, non-Latino: 62.2%) from career service personnel. For both groups, the second highest level of discouragement was reported as academic advisors and non-academic advisors, for both groups ranging higher than the 50th percentile. Unlike Latinos, non-Latinos overall reported higher levels of neutrality than their Latino counterparts, averaging in the low twentieth percentile.

Previous research suggests a vital component of integration to the campus is their interaction with faculty and non-faculty members. Research suggests that positive interaction with faculty results in higher levels of encouragement and aspiration of student continuation to graduate degree programs. Latinos rated faculty encouragement (38%) higher than their non-Latino counterparts did (21.3%). For non-faculty mentorship, both Latino and non-Latinos presented low percentage of encouragement from them.

**Graduate Assistance – Open-Ended (Qualitative)**

A total of 46 participants responded to the following open-ended question: “What or who has assisted you in applying for graduate programs?”

Of the respondents, 16 stated that no one has assisted them in graduate program applications and 11 indicated the question did not apply to them. Of these, 13 were Latino and eight indicated no one and five indicated does not apply. In addition, 14 were non-Latino; eight indicated no one and six indicated does not apply.

Nineteen respondents replied to the open-ended questions, ten Latinos and nine non-Latinos. Upon methodical review, five main forms of contact emerged from the
data. Six individuals (3 Latino and 3 non-Latino) indicated they via online resources, self, or perception of their GPA were the only source of information when applying to graduate programs. One zero-generation non-Latino continued onward to say “advisors were useless towards grad program from other schools” and that they were the only form of information they utilized. Four individuals (two Latino and two non-Latino) responded that their family assisted them in the graduate application process. Of the four, three stated that their parents were the greatest assistance, while one stated their sibling was. Three Latino students stated their peers and engineering student organizations assisted them in understanding graduate programs. Eight individuals (four Latino and four non-Latino) sited faculty, graduate students, and institutional research programs as the main agents of information about possible attainment of graduate programs. Lastly, four individuals (one Latino and three non-Latinos) identified other institutional agents (i.e. advisor or presenter) as main source of assistance when applying to graduate programs.

**Presentation of Findings - Interviews (Qualitative)**

To supplement the survey, the researcher decided to survey a small population of survey respondents. Of the 124 survey respondents, 42 individuals indicated they were willing to participate in a face-to-face interview to provide further insight to the graduate aspirations process. The individuals received emails and four responded to schedule a face-to-face interview. Interviews took place within two weeks of closing the survey. The bases for the following four interviews conducted by the researcher are with two
upper classmen, a recent graduate and a lower classmen. All four interviews were with first-generation students. Of the interviews conducted, two main themes emerged as vital resources and influences to their graduate program aspirations.

The first was faculty and graduate student involvement. Three of the four students stated that faculty or graduate students either spoke to them about and/or encouraged them to continue onward towards a graduate degree. Two of the students said that faculty actively took a role in their development while in their undergraduate program. The three discussed how being involved in research or research projects (one was involved via a course) allowed them to gain insight as to what a graduate program consisted of. By being able to speak to faculty and graduate students (or teaching assistants) about the program they were involved with, two of the students felt it to be the best resource in figuring out what program they could apply for or what they might enjoy studying. One student went on to say it would be ideal for graduate students to display their projects for undergraduates to understand what they could study and the programs offered on campus.

All interviewees replied the second resource, an online resource is vital in their decision making process. Two of the four interviews indicated at some point, they had to refer to online resources because CRU did not provide any location that could assist them with graduate applications or program questions. The third interviewee emphasized the fact that although they did utilize many online resources, initially an on campus research opportunities center was available. The fourth interviewee informed the interviewer that a faculty member provided them with the best resource, a website specific to the field
they were interested in studying. Although all four interviewees utilized online resources, their perception of them varied. Two of the interviewees stated that they were difficult to navigate; websites or faculty pages were out of date and at times, reduced to simply “Googling” key terms.

In addition to these two key influential factors, two additional findings that influenced student aspirations were financial constraints and entering the work force. When discussing the likelihood of attending a graduate program directly after completing their undergraduate career, three of the four stated they would prefer to enter the work force rather than continuing their education first. All three stated that attending graduate school would be their second choice. The lower division student’s desire is attending a graduate program, as that would lead them into the industry they desired, since the CRU did not have a major specific to their career goals.

The second discussion topic all four students alluded or discussed was that of finances. Two of the students mentioned that a graduate career would help them “earn more money faster” and three stated that receiving funding would be the only way they would attend a graduate program. Again, the lower division student’s desire is attending a graduate program even if they did not have any funding, but hoped they would.

The following are descriptive excerpts from the aforementioned themes and discussion topics:

My faculty said, I really think you should go that [attend a PhD program]…I really appreciate her saying that. Saying… ‘I see myself in you and that’s the route I took’…that meant a lot to me. Male, graduate.
I was speaking to [a graduate student] and he informed me that “we can receive financial aid, via stipends or being a [teachers assistant] or by doing research, which is really good. I don’t want to be…owing a whole bunch more [in addition to my] undergrad. That’s not going to work for me.” Male, upper-division.

“I have been indecisive for a while…You can just go straight into industry…become a professional engineer…work under people for a long time and move up…[or]…you [go to] grade school…you still work under people and you still work to go up but the thing…I guess it is too early for me to figure out what I want.” Male, upper division

“I honestly think that if current graduate students could talk to current undergraduate students about their thesis and what they do on a daily basis [that] might give [undergrads] a really good sense of what grad school is all about and might inspire them. Because when you get that person to person communication, [it] is the most effective way because a person can really inspire a person rather than a piece of paper.” Male, lower division student

Discussion of Findings

The findings for the research discussed are from the perspective of the respondents, who were current students in engineering programs with positive
interactions and encouragements to aspire to attend graduate programs. Based on the findings for internal structure of CRU, which is both a masters and doctoral granting research public university was included in the discussions.

**Research question #1.** What factors at a public research institution affect the choices of engineering students’ to aspire to continue their education in a graduate program?

Findings from the study showed overall, respondents represented those most interested in graduate studies as respondents. The majority of respondents were within their last two years of graduation, which tends to be the time where students begin to contemplate what their aspirations are after graduation by either entering the workforce or continue their education in graduate programs. Statistical data (see NSF 2013) shows that a low percentage of undergraduate student continue onward towards their graduate degree. Comparable with statistical data and previous research, a significant portion of respondents considered attending graduate programs, but found information pertaining to graduate programs lacking.

When considering what factors at the research institution affect aspirations of engineering students, personal connections with faculty/professor, student organization, and classmates were among the highest ranked institutional agents. Throughout the survey, “college friend(s)” rated the highest level of influence and encouragement for students to aspirations. Additionally through the survey, the “club/organization” category made a large impact on student aspirations. Consistent with previous research (Camacho & Lord, 2011; Flores, 1992; Ramirez, 2011), involvement in student organizations were
creates a culture of inclusivity that links academics and culture. Lastly, faculty/professor involvement rated the second highest levels of encouragement for respondents. Throughout the survey, respondents indicated that faculty were a high source of encouragement and knowledge for graduate programs. During the open-ended portion of the survey, some respondents wrote faculty to be the only source of information as to what graduate school was, what types of programs they should apply for and encouragement for attending graduate programs. During the interviews, participated indicated that faculty and graduate students were the main source of institutional encouragement. Two participants identified specific interactions with faculty as being the main reason why they aspired to attend graduate programs. Stating that participation in their research teams allowed the interviewee to gain more insight as to what graduate student life would be, reasons for attending graduate programs and initial ideas as to what they would like to study in their graduate program.

Although personal connections with non-staff institutional agents (faculty, peers, organizations) rated among the highest levels of knowledge, inspiration and encouragement, it is interesting to examine how many respondents reported disagreeing with faculty encouragement or did not consider it to weigh in their decision making process in regards to graduate programs.

**Research question #2.** What are the roles of ethnicity and generation in the choice of engineering students’ to aspire to continue their education in graduate programs?
In regards to generation, the researcher was not able to completely define what educational generation students were and was therefore not able to assess the effects of generation have on engineering student aspirations. The researcher was able to establish basic generation in the United States. The majority of participants to fall into the first-generation category, having non-US born parents and the participant being born in the US. Latinos were more likely their non-Latino counterparts to first-generation, whereas, non-Latinos were second generation or higher.

Latinos showed higher levels of aspirations to attend graduate programs directly after undergrad compared to their non-Latino counterparts, although both groups displayed high levels of consideration towards graduate programs. With such high consideration or aspiration to attend graduate programs, Latinos reported low levels of having research graduate programs and low levels of graduate program information being readily available to them. Latinos further displayed high belief that graduate programs provide financial stability and are required for their overall career choice. Unlike their non-Latino counterparts, Latinos agreed that they were likely to return to school to earn a graduate degree after entering the workforce. The respondents in this study were similar in that they reported overall high desire levels to enter the workforce directly after completing their undergraduate career. Of those interviewed, the majority agreed they were to utilize graduate school as a “back-up” rather than as their goal. This finding was not a surprise, given the low number of students who graduate with a graduate degree in the US. When formatting their future aspirations, students utilize various entities
knowledge and input in their choice making process, such as family, faculty, peers and other institutional agents/programs.

Latinos showed more difference in perceived encouragement from parents, immediate family, and extended family than non-Latinos did. Non-Latinos reported higher parental encouragement than Latinos report and were less likely to have a relative who attended a graduate program, while Latinos reported higher level of family members attending graduate programs. Compared to non-Latinos, Latinos received less encouragement from parents and extended family than immediate family members did. Latinos rate immediate family members significantly higher for encouragement than any other familial group. An interviewee stated their siblings greatly influenced their aspiration to attend a graduate program. Although Latino familial encouragement is low, siblings being sole encourager to pursue higher education is consistent with Ramirez (2011) in that siblings are becoming agents of knowledge in families, assisting with information gathering and encouragement. However, there is very little research on this topic and to explore this topic further, there is a need for future research.

The amount of encouragement students perceived they received from institutional agents are that of college friend(s), club/organizations, non-career specialist, career specialist, non-academic advisor, academic advisor, non-faculty mentor, and professor/faculty. The perceived encouragement for all categories, are positive encouragement, negative encouragement and neutral encouragement. Both groups reporter the lowest levels of encouragement from non-career service specialist and careers service specialist and the highest level of encouragement from college friend(s).
College friend(s) are rated as the highest institutional agent of encouragement, there is a significant distinction between Latinos and non-Latinos. Latinos perceived encouragement from friends about one and a half times more than non-Latinos do, even though both groups reported high levels of knowledge towards graduate programs. In conjunction with friends, both groups reported high levels of perceived encouragement from clubs and organizations. Latinos, again, perceived encouragement from clubs and organizations about twice as much as non-Latinos. The findings were as expected as students integrate to the campus community. Students, are more likely to approach their peers for guidance than any other individual for help. Further, for Latinos, building communities within the campus that reflect their identity, such as Society of Hispanic Professional Engineers allow students to develop a body of shared knowledge within the institution.

Various researchers in various settings have studied the faculty/student interaction, in particular through a research or program setting. Previous research has shown that positive interaction with faculty can influence a student to continue their education into graduate programs. This study added to the conclusion of previous researchers, as they were the highest rated non-peer institutional agent among both Latinos and non-Latinos. Unlike, previous research, the researcher found that non-Latinos rated faculty interactions more negatively than their Latino counterparts did. This may be due to the institution being a Hispanic Serving Institution and non-Latino students feeling out of place. Several interviewees emphasized the participation in research project to the crucial reason why they aspired to attend graduate programs.
Interviewees stated that by being able to interact within the laboratory setting, they were able to have individual interactions with faculty, gain insight about graduate programs through interaction with graduate students and define what type of graduate program they desired to attend with the assistance of their faculty mentor. These findings were consistent with current research. Another institutional agent, both groups felt encouraged by were academic and non-academic advisors. Latinos felt higher levels of encouragement from both types of advisors than non-Latinos did. This is unique, as very little research is available on the perceived effects advisors have on their students’ graduate aspirations. One interviewee stated that their advisor encouraged them to begin their graduate programs preparation earlier in their career, and exposed them to basic graduate application information; however, one survey participant also noted negative interactions with their advisor.

Summary

At CRU, Latinos are the majority singular ethnic group within the campus and in the engineering programs, representing about 40% of the engineering population, although this is not a standard across all engineering programs in the United States. Latinos reported higher levels of encouragement to attend graduate programs from institutional agents, but reported lower level of encouragement from their family when compared to non-Latinos. The findings in this study remain consistent with previous research, parental involvement and encouragement to continue into higher education is significantly low. It is undetermined to what effect parental encouragement has on
Latino aspiration. It appears, as with research in regards to the transition between high school and undergraduate, parental encouragement maybe substituted by institutional factors and encouragement. Therefore, due to this uncertainty, it is crucial that institutional agents continue to encourage Latino students to pursue a graduate degree while respecting cultural values.
Chapter 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

With the increasing number of Latinos in the K-12 system, it is vital to consider how that translates to the higher education pipeline. Although rates of Latinos graduating with undergraduate degrees in engineering has increased in the past few decades, Latino graduation rates at the graduate level have not increased at the same pace. The number of Latino students earning their doctoral or master’s degree continues to number in the hundreds, accounting for 4.6 percent of master and 2.2 percent of doctoral degrees awarded in the United States in 2013 (NSF, 2013). Aspirations to enroll in graduate programs, for Latinos tend to be less than that of other ethnic groups (Gurin, et Al., 2007).

This study was able to collect information regarding graduate aspirations of Latino students within an engineering program by examining their perceived interaction and encouragement with family members and institutional agents. Through the data, this study was able to compare information provided by ethnicity, either Latino or non-Latino. Relevant familial interaction and encouragement for Latino students came from immediate family members. Relevant institutional encouragement for Latino students arose from peers and faculty interactions. Although peer encouragement rated as the highest level of encouragement for Latinos who took the survey, during interviews faculty interaction was the highest level of encouragement expressed. The data collected
from enrolled engineering undergraduates via a voluntary online survey, in which participant information remained anonymous. The survey was utilized to college quantitative data and provided respondents an opportunity to participate in a face-to-face interview. The second collection agent utilized, was from self-selected individuals who provided their contact information during the survey. The interviews collected anonymously, provided qualitative data to support the overall emerging themes of the study.

Conclusions

The findings in this study were mostly consistent with the literature reviewed (Centra, 1980; Fleming et. al., 2014; Hearn, 1987; Ramirez, 2011). Non-Latino’s reported higher levels of familial knowledge in graduate programs than their Latino counterparts did, although Latinos reported higher levels of aspirations for graduate degrees than non-Latino students did. This finding is consistent with Centra (1980) findings, Latinos and other minorities have higher graduate degree aspirations than their White counterparts do. Although Latino aspiration levels were consistent with past research, the issue of translating aspiration to action is an issue. Latinos reported lower levels of knowledge than non-Latinos did on graduate admissions process, approach and general information, in this study. This is exceptionally consistent with research, which examines Latino student decision-making process to attend an undergraduate degree or a graduate degree (Fleming et. al., 2014; Gonzalez et al., 2003; Ramirez, 2011). The study findings suggest direct link between Latinos familial values,
social and cultural capital do not necessarily affect Latino student’s aspirations to attend graduate programs. Additionally, Latinos were more likely then non-Latinos to report faculty encouragement to be a high level of institutional encouragement.

**Recommendations**

**Encouragement to Attend Graduate Programs**

The focus of this study was to identify what factors might influence/encourage a Latino engineering undergraduate to aspire to attend a graduate program. Like current research, it is unclear what familial factors, if any, may influence student graduate aspirations. In addition, consistent with current research, Latino participants stated encouragement from institutional agents, were useful in understanding and aspiring to attend graduate programs. The study found that for both Latino and non-Latinos, faculty and graduate student played a large role on student aspirations to attend graduate programs. The interviews expressed this view, in which all students reported the knowledge provided by these individuals to be vital in their aspiration formation process. Latinos are highly underrepresented in engineering graduate programs, understanding how students view the support they receive from institutional agents will be useful in changing the approach to recruitment or exposure to graduate programs, the application process, financial assistance options and choice of program of study.

To be able to increase the number of Latinos entering and attaining their graduate degree, the exposure to and process of knowledge sharing at the undergraduate level must change. Exposure to engineering graduate programs should begin earlier in the student
career, rather than within the last two years or by requiring the student to participate in a particular program. This will allow students to gauge if they desire a graduate degree and understand the basic requirements associated with graduate degrees. For example, researchers have noted the significance of GPA as an admissions factor for graduate program. However, Latino students are less likely to know of these factors because of no exposure through familial or social ties (Ramirez, 2011). Therefore, expanding from an interviewee, exposure to graduate programs via current graduate student or faculty conversations should start earlier. If faculty or graduate students expose current undergraduate students at their intuition to the research they are conducting, this will serve two-fold. First, it will reinforce undergraduate decision in their major, by providing them with an understanding as to what their major actually is. Second, this will begin the process of aspiring students to continue their education, possibly by participating in campus programs geared towards graduate study, participation in research or simply becoming more aware of the possibility. Along with this, other institutional agents within engineering programs should provide basic information to all students about admissions criteria to graduate programs and possibly assist in identifying starting points for students to apply to graduate programs. Lastly, incorporating family members in these chats may increase the amount of familial support and/or encouragement students receive, increasing the likelihood a student will aspire to and complete a graduate degree.

Proposed Future Research

This study did not directly identify what specific factors influenced undergraduate students to aspire to attend graduate programs. Future studies should include more
quantitative data, including studies on what factors have influenced current graduate students to attend their particular program, to support current studies conducted on qualitative data being collect (Ramirez, 2011). Future study should also explore more qualitative data, specifically on how family, generational variables and cultural values influence student aspirations to attend graduate school, including support and motivations. For example, a parent who has attended graduate school in engineering, can describe what graduate school is, share their experience, help identify resources and what material are needed or how to apply for graduate programs. Parents who have not attended graduate programs may have little to no information on the process or the experience of attending a graduate program. All participants reported speaking to parents and family about their graduate program aspirations, but more descriptive analysis on what specifically parents state on the subject could be useful information on identifying how much students rely on parental support. Such research as Fleming (2014) and Ramirez (2011) show that there might be a correlation between student aspirations and familial input for Latino students aspirations to attend graduate programs. The focus of this study should be engineering students and their familial support prior to enrolling in graduate programs and during their program.

Educators must address the lack of Latino engineering students attending graduate programs. The methodology of exposure to and recruitment to graduate programs needs confrontation if the overall goal of increasing the percent of Latino students earning graduate degrees is to reflect the population demographic. The purpose of this study was to examine how various factors influence students to aspire to attend a graduate program,
but did not focus on what factors influenced current graduate students to attend graduate programs. Understanding how familial interactions or cultural factors affect Latino engineering student graduate decision-making process may open a new avenue to increasing Latino representation in industry, researchers, and higher education system.
APPENDICES
APPENDIX A

Initial Email

Dear Student,

The Interim Dean of Engineering Erik Rolland and Karla Gonzalez (a Masters student from the School of Education at Sacramento State) would like to invite you to participate in a voluntary research study on what factors contribute to undergraduate engineering students aspiring to attend graduate programs. You're eligible to participate in this study because you are a current engineering undergraduate student. Please note that this is completely voluntary and will not affect your standing at the School of Engineering in any form.

If you decide to participate in this study, please click on the following survey link: https://www.surveymonkey.com/r/grad_aspirations.

Remember, this is completely voluntary. You can choose to be in the study or not. If you'd like to participate or have any questions about the study, please contact Karla Gonzalez at karlagonzalez@csus.edu.

Thank you very much.
Dear Student,

You are invited to participate in a research study about what factors contribute to undergraduate engineering students aspire to or not to attend graduate/professional programs. The Interim Dean of Engineering Eric Rolland and Karla Gonzalez have identified you as a possible participant in this study because you are a current student in an Engineering program at your institution.

If you decide to participate in this study, you will be asked to complete the following survey. Your participation in this study will take about 10 to 15 minutes to complete. Please note that this in no way affects your academic performance or standing on this campus.

Risk: There is no risk to participation in this survey.

If you have any questions about the research at any time, please contact me at karlagonzalez@csus.edu or gcowan@csus.edu. If you have any questions about your rights as a participant in a research project please call the Office of Research Affairs, California State University, Sacramento, (916) 278-5674, or email irb@csus.edu.
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Measures to insure your confidentiality are: (1) the survey is completely anonymous; (2) data collected will be kept on a password-encrypted system. The data obtained will be maintained in a safe, locked location and will be destroyed after a period of three years after the study is completed.

Your participation is entirely voluntary and your decision whether or not to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

By clicking on the link below, you indicate that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

I have read, understand and would like to participate in this survey

○ I agree

○ I disagree
APPENDIX C
Informed Consent Letter - Interview

Thank you for selecting to participate in the second portion of this study. This study explores what factors contribute to undergraduate engineering students aspire to or not to attend graduate programs.

If you decide to continue to participate in this study, the one-on-one interview will take approximately 20 minutes to complete.

Risk: There is no risk to participation in this interview.

If you have any questions about the research at any time, please contact me at karlagonzalez@csus.edu or gcowan@csus.edu. If you have any questions about your rights as a participant in a research project please call the Office of Research Affairs, California State University, Sacramento, (916) 278-5674, or email irb@csus.edu.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Measures to insure your confidentiality are: (1) your participation in the interview process is completely confidential; (2) data collected will be kept on a password-
encrypted system. The data obtained will be maintained in a safe, locked location and will be destroyed after a period of three years after the study is completed.

Your participation is entirely voluntary and your decision whether or not to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

By signing below, you indicate that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

I have read, understand and would like to participate in this interview.

Participant # _______

Signature: _________________________________
APPENDIX D

Data Collection Instrument - Survey

GRADUATE DEGREE ASPIRATIONS OF LATINO UNDERGRADUATE ENGINEERING STUDENTS AT A RESEARCH INSTITUTION

Part A – Demographics

Please select on response per question

1. What is your current class standing?
   a. First - year student (Freshman Status, 0 to 29.9 undergraduate units)
   b. Second year student (Sophomore Status, 30.0 to 59.9 undergraduate units)
   c. Third year student (Junior Status, 60.0 to 89.9 units)
   d. Fourth year student (Senior Status, 90 or higher units)

2. What is your current major in the College of Engineering?
   a. Bioengineering
   b. Computer Science & Engineering
   c. Environmental Engineering
   d. Materials Science & Engineering
   e. Mechanical Engineering
   f. Undeclared Engineering

3. What year did you enter the University?
   a. Fall 2011
   b. Fall 2012
   c. Fall 2013
   d. Fall 2014
   e. Fall 2015
   f. Other (Please Specify): ____________

4. What class did you enter this institution?
   a. Freshman status, first-time in the School of Engineering
   b. Freshman status, first-time not in the School of Engineering
   c. Junior status, transfer student
   d. Other:
5. How many years until you graduate with a four-year degree at the University?
   a. 3 years
   b. 3 ½ years
   c. 4 years
   d. 4 ½ years
   e. More than 5 years

6. How do you identify yourself? (check all that apply)
   a. African American/Black
   b. Asian American
   c. Caucasian/White
   d. Hispanic/Latino/a
   e. Native American
   f. Other (please specify): _____________________

7. Choose the response that applies? (please choose one)
   a. At least one parent is born outside the US and I was not born in the U.S.
   b. Neither parents was born in the U.S. and I was born in the U.S.
   c. At least one parent is born in the U.S. and I was born in the U.S.
   d. Other (please specify): _____________________

8. What was your non-weighted grade point average (GPA) in high school?
   a. Below 3.00
   b. 3.01 to 3.25
   c. 3.26 to 3.50
   d. 3.51 to 3.75
   e. 3.75 to 4.00
   f. Unsure/ Don’t know

9. What was your transfer grade point average (GPA)?
   a. I am not a transfer student.
   b. 2.00 to 2.49
   c. 2.50 to 2.99
   d. 3.00 to 3.49
   e. 3.50 to 3.99
   f. Unsure/ Don’t know
10. What is your grade point average (GPA) in the engineering program?
   a. Below 2.50
   b. 2.51 to 3.00
   c. 3.01 to 3.25
   d. 3.26 to 3.50
   e. 3.51 to 3.75
   f. 3.75 to 4.00
   g. Unsure/ Don’t know

Part B – Aspirations to Attend Graduate Programs

Attending Graduate Programs
*Please select one response per row*

<table>
<thead>
<tr>
<th></th>
<th>highly disagree</th>
<th>disagree</th>
<th>neutral</th>
<th>agree</th>
<th>highly agree</th>
<th>Does not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>I plan to attend a graduate program upon graduation:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>I plan to enter the engineering workforce directly after graduation:</td>
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<tr>
<td>13</td>
<td>I have thought about attending a graduate program:</td>
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<tr>
<td>14</td>
<td>I have starting researching graduate programs:</td>
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<tr>
<td>15</td>
<td>I have enough information about graduate programs:</td>
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</table>

Career
*Please check one response per row.*

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<th>neutral</th>
<th>agree</th>
<th>highly agree</th>
<th>Does not apply</th>
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</thead>
<tbody>
<tr>
<td>16</td>
<td>Going to a graduate program will provide me with financial stability:</td>
<td></td>
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</tbody>
</table>
The career field of my choosing requires a graduate program degree:

For my own benefit attending a graduate program is necessary:

I plan to attend graduate school after I have entered the work force:

### Institutional Interaction

*Please check one response per row.*

<table>
<thead>
<tr>
<th></th>
<th>highly disagree</th>
<th>disagree</th>
<th>neutral</th>
<th>agree</th>
<th>highly agree</th>
<th>Does not apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Information about graduate schools is readily available:</td>
<td></td>
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<tr>
<td>21</td>
<td>A career service specialist has spoken to me about graduate programs:</td>
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<tr>
<td>22</td>
<td>My campus host workshops and fairs on topics related to graduate programs:</td>
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<tr>
<td>23</td>
<td>A non-career service specialist on campus has spoken to me about graduate programs:</td>
<td></td>
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<tr>
<td>24</td>
<td>An club/organization on campus has spoken to me about graduate programs:</td>
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### Department Interaction
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<th>disagree</th>
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<th>highly agree</th>
<th>Does not apply</th>
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<tbody>
<tr>
<td>25</td>
<td>A professor has spoken to me about graduate programs:</td>
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<tr>
<td>26</td>
<td>I frequently speak to professors about graduate programs:</td>
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<tr>
<td>27</td>
<td>A non-faculty mentor has spoken to me about graduate programs:</td>
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<tr>
<td>28</td>
<td>An academic advisor has spoken to me about graduate programs:</td>
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<tr>
<td>29</td>
<td>A non-academic advisor has spoken to me about graduate programs:</td>
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### Familial & Friend Interaction
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<th>neutral</th>
<th>agree</th>
<th>highly agree</th>
<th>Does not apply</th>
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<td>30</td>
<td>A parent has spoken to me about graduate programs:</td>
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<tr>
<td>31</td>
<td>An immediate family member has spoken to me about graduate programs:</td>
<td></td>
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<tr>
<td>32</td>
<td>An extended family member has spoken</td>
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</table>
Part C - Encouragement to attend graduate programs

Institutional Interaction

*Please check one response per row.*

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<th>highly agree</th>
<th>Does not apply</th>
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<td>34</td>
<td>A career service specialist has encouraged me to pursue a graduate degree:</td>
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<tr>
<td>35</td>
<td>A non-career service specialist on campus has encouraged me to pursue a graduate degree:</td>
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<tr>
<td>36</td>
<td>A club/organization on campus has encouraged me to pursue a graduate degree:</td>
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Department Interaction

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<th>neutral</th>
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<th>Does not apply</th>
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<tr>
<td>37</td>
<td>A professor has encouraged me to pursue a graduate degree:</td>
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</table>
A non-faculty mentor has encouraged me to pursue a graduate degree:

An academic advisor has encouraged me to pursue a graduate degree:

A non-academic advisor has encouraged me to pursue a graduate degree:

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**Familial & Friend Interaction**
*Please check one response per row.*

<table>
<thead>
<tr>
<th>Question</th>
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<th>disagree</th>
<th>neutral</th>
<th>agree</th>
<th>highly agree</th>
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<tbody>
<tr>
<td>My parent(s) has encouraged me to pursue a graduate degree:</td>
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<td>An immediate family member has encouraged me to pursue a graduate degree:</td>
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<td>An extended family member has encouraged me to pursue a graduate degree:</td>
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<td>A family member has attended a graduate program and has inspired me to do the same:</td>
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<tr>
<td>My college friends has encouraged me to pursue a graduate degree:</td>
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</table>
Part D - Future Plans

*Please select one response per question*

46. Are you in the last year of your undergraduate education?
   a. Yes
   b. No (please move forward to Part E)

47. As of today, have you applied to one or more graduate program(s)?
   a. Yes
   b. Not
   c. Does not apply to me

48. What or who has assisted you in applying for graduate programs?
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________

Part E - Further Participation

*Please select one response per question*

49. Would you be willing to participate in a follow-up interview?
   a. Yes
   b. No

50. If you would be willing to participate in a one-on-one follow-up interview, please provide:
   a. Email Address: ______________________________
APPENDIX E
Data Collection Instrument - Interview

GRADUATE DEGREE ASPIRATIONS OF LATINO UNDERGRADUATE ENGINEERING STUDENTS AT A RESEARCH INSTITUTION

1. What, if any, factors contribute to you aspiring to attend graduate programs?

2. How have you found information about graduate programs?

3. Where have you found information about graduate programs?

4. Who have you spoken to about possibly attending to apply to a graduate program?

5. Who or what has aspired you to potentially attend a graduate program?
REFERENCES


Ramirez, E. (2011). “No one taught me the steps”: Latinos experiences applying to graduate school. *Journal of Latinos and Education, 10*(3), 204-222.


