PERCEPTIONS OF SOCIAL SUPPORT NETWORKS AND CLIMATE IN THE PERSISTENCE OF LATINAS PURSUING AN UNDERGRADUATE ENGINEERING DEGREE

A Dissertation

by

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ABSTRACT

While an abundance of literature addresses undergraduate students' lack of success in engineering programs, fewer studies examine the persistence of minority females, especially of Latinas in such a male-dominated discipline. This study employed a qualitative method of inquiry to gain insight into the perceptions of social support networks and climate in the persistence of eleven Latinas pursuing an undergraduate engineering degree at two research-extensive universities.

The study, ultimately, concluded that participants utilized various systems of support (e.g., fathers and family, peers, and student organizations) to aid in their sense of belonging, which essentially influenced their decision to persist. Additionally, the study found that Latinas encountered various levels of hostile climates (e.g., institutional, departmental, classroom, student organizations, and internships) throughout their undergraduate experience. Lastly, the study concluded that several participants had to grapple with the idea of gender and what that means within a male-dominated discipline. While the findings from this study added to the literature on the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate engineering degree, further qualitative studies that examine the role of fathers, the conceptualization of gender by female engineers, the coping mechanisms employed to mediate gender discrimination, and the reasons for the lack of entry to the STEM workforce are warranted.

DEDICATION

This dissertation is dedicated to my parents, Juan and Maria Banda and my Aunt, Elida Maria Banda. Their unconditional prayers, support, respect, encouragement, interest, and love in regards to all my educational endeavors and personal matters have made me the woman I am today. I couldn't be prouder to be a Banda. Love you all more than I say, more than I show, and more than y'all could ever know.

I also want to dedicate this dissertation to the Latinas who took part in this study and all Latinas, especially those who come from small towns like mine that we may believe in the true empowerment of education and the influence that it can have on future generations of our people.

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CHAPTER I

INTRODUCTION TO THE STUDY

Hispanics (used interchangeably with Latinas/Latinos/Chicanas/Chicanos) constitute 15% of the U.S. minority population (U.S. Census Bureau, 2009) and also comprise the country's fastest growing, largest and most undereducated minority groups (Brown, Santiago, & Lopez, 2003; Marotta & Garcia, 2003; Niemann, Romero, & Arbona, 2000; Walsh & Heppner, 2006), especially with regard to bachelor degree attainment (Becerra, 2010; Fry, 2002). According to the Pew Hispanic Center (2008), *only* 12.9% of Hispanics compared to 30.7% of Whites held at least a bachelor's degree in 2008. The increase of Latina/o (an abbreviation for Latina and Latino) enrollment at institutions of higher education must focus on more than just access. Rendon (2003) asserts that, "Access must be matched with retention to degree completion" (p. x). Despite educational gains made by the Latina/o population in recent decades, the percentage of degree attainment is not representative of the population (Castellanos & Jones, 2003). Still Latinas have made significant progress in degree attainment since the 1990s (Gonzalez, Jovel, & Stoner, 2004); yet, closer examination of their success in Science, Technology, Engineering, and Mathematics (STEM) fields continues to highlight their underrepresentation.

Even more discouraging is the rate of persistence for women and minorities in STEM fields; more specifically, their success in technology and engineering. Sadker and Sadker (1994) contend that women face multiple barriers at all stages of their

educational and career pursuit in STEM fields. For instance, technology fields are promoted as a competitively driven field that assumes male confidence and female disinterest (Bodzin & Gehringer, 2001). Additionally, Powell, Bagilhole, Dainty and Neale (2004) found the masculine nature of the curricula and profession of engineering benefits male students more than it does female students. Godfrey and Parker (1998) assert that social interaction and the transmission of knowledge in engineering remains masculine in nature. Engineering, according to Stonyer (2002), "is viewed in the public sphere as masculine, competitive, objective, impersonal—qualities that are at odds with our images of what women are" (p. 392). Powell et al. (2004) contend that "while women are not deterred from pursuing their chosen engineering career, the culture and structure of the engineering education system has been designed for a male audience"(p. 21).

Problem Statement

Despite increased enrollment of minority students in postsecondary institutions, they have experienced relatively little success in degree attainment. Their lack of persistence suggests that universities ought to begin considering more effective methods with which to increase not only enrollment of minority students, specifically members of the Latina/o population, but their persistence as well. According to the U.S. Census Bureau (2008), the Hispanic population is expected to nearly triple in the next forty years as projections indicate that 1 in 3 residents will be Hispanic by 2050. Despite the rapid growth of the Latina/o population from 9% in 1990 to 15.5% in 2010 (U.S. Census Bureau, 2008a), there has only been a 2.3% increase in their bachelor degree attainment

from 1998-2008 (NCES, 2010a). In other words, the growth of the Latina/o population is not comparable to their rate of degree attainment which suggests that the percentage of Latina/os who earn a bachelor's degree is not representative of the population (Castellanos & Jones, 2003).

In addition to the shifting demographics and dismal bachelor degree attainment of Latina/os, the growing need for universities to increase the number of undergraduate degree attainment in STEM fields has become an important area of research. Moreover, cultivating minority student success in STEM disciplines has recently been declared to be of national interest (Museus, Palmer, Davis, & Maramba, 2011). The National Academy of Sciences (2007), in their *Rising Above the Gathering Storm* report, deemed it vital to increase the number and proportion of U.S. students, specifically women and minorities, who attain a bachelor's degree in engineering, mathematics, physical and life sciences. According to Walsh and Heppner (2006), "STEM fields are considered to be crucial to U.S. economic growth and are expanding rapidly" (p. 430); thus, the need to create a greater participation in these fields is necessary. Because demographic trends indicate that the largest participants in the workforce will be women and minorities, the need to create a more effective pipeline for minorities and women to successfully participate in STEM fields is vital to the economic growth of the country (Hyde & Kling, 2001; Leslie, McClure, & Oaxaca, 1998; Walsh & Heppner, 2006).

While there is an underrepresentation of women in STEM fields, further disaggregation of demographic data reveals alarming statistics about the number of minority women, especially Latinas, who pursue and persist in STEM disciplines.

Rochin and Mello (2007) assert that there has been scant research that examines Latina/os' ability and success at being scientists and engineers. More often than not, research utilizes a deficit perspective to explain why Latina/os fail to persist in higher education (Comas-Diaz, 1987; Escobedo, 1980; Flores, Eyre, & Millstein, 1998; Reese, Balzano, Gallimore, & Goldenberg, 1995; Valencia, 2002; Trueba & Bartolome, 1997; Weisner & Garnier, 1992). For instance, scholars have partially blamed Latinos for their inability to succeed in college rather than acknowledge the role of climate in their decisions of nonpersistence (Castellanos & Gloria, 2007). Consequently, the assumption is that further studies are necessary to understand the persistence rather than the failure of Latina/o college students. While a multitude of studies and reports address the reasons why Latina/os do not succeed in college (See Huber, Huidor, Malagon, Sanchez, & Solorzano, 2006; Longerbeam, Sedlacek, & Alatorre, 2004; Nunez, 2009), fewer studies provide insight about what contributes to their success. Further examination of the literature suggests that additional research is necessary to understand the persistence of Latina/os in college, particularly about students who persist in their pursuit of a STEM degree (Museus, Palmer, Davis, & Maramba, 2011). The changing demographics and the need to understand persistence in STEM disciplines, specifically engineering suggests that further insight into the persistence of female minorities is necessary, especially as it pertains to the Latina/o population (Rochin & Mello, 2007). It is vital to understand the success of various ethnicities, particularly within members of the largest growing minority population, as they pursue undergraduate degree programs in disciplines such engineering. MacLachlan (2000) contends that data are not further

disaggregated on the basis of sex *and* ethnicity because the data would then become almost nonexistent. Even though the number of females and ethnic minorities who pursue and persist in STEM disciplines remains relatively low, the statistics of female minorities who are successful in STEM disciplines are even more dismal. Some, like MacLachlan (2000), suggest that data on the STEM success of female minorities would reveal a population that barely exists. Leggon (2006) further asserts that the manner in which most data are collected in relation to women and ethnic minorities "reflects and reinforces the invisibility of minority women in science" (p. 325). Because most reports often do not reveal the success of minority women in STEM, the few who do persist in STEM disciplines are reflected to be scarce, even nonexistent, when compared to other populations.

While there is various research that examines the persistence of minority students at universities, fewer studies focus on students who are both gender *and* ethnic minorities in the pursuit of a degree in STEM disciplines. Consequently, this research study is significant as it intends to help universities develop retention programs that seek to improve opportunities for social support networks as well as alter, if necessary, the climate associated with the institution and department for Latinas pursuing an undergraduate degree in engineering.

Purpose of the Study

Because most studies on persistence are quantitative in nature (Ulriksen, Madsen, & Holmegaard, 2010), a qualitative examination to understand the persistence decisions of college students, specifically in this study of Latinas pursuing an undergraduate

engineering degree, warrants further research in the higher education arena. In addition to expanding the research of specific female minority success in, specifically, engineering undergraduate degree attainment, the purpose of this study is to help with programming at universities that seek to increase the retention of Latinas in the highly demanded area of STEM. Ultimately, this study seeks to expand the understanding of the perceptions of social support networks and climate in the persistence of Latinas pursuing undergraduate engineering degrees.

Research Questions

This study seeks to understand the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate engineering degree. The overarching research question for this study is as follows:

1. What are the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in engineering?

Secondary research questions include:

2. What types of support networks are integral to Latinas' persistence in engineering?

3. What effect, if any, does participation in university clubs/organizations have on student persistence in engineering?

4. How are Latinas' perceptions about gender impacted by the male-dominated discipline of engineering?

Methodology

In order to better understand the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in engineering, this study employs a qualitative method of inquiry. With a constructivist framing, the study utilizes a case study (Yin, 2009) approach to better understand the phenomenon of the overarching research question. Criterion of participants, data collection, and method of data analysis, among others, is extensively discussed in chapter 3.

Significance of Study

This study, which seeks to understand the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in engineering, is of significance for multiple reasons. First, the topic itself addresses a timely issue in the postsecondary research arena. The research topic of this study is timely because current and projected demographic trends indicate that there will be a shift in student demography at institutions of higher education. The change in student demography further suggests that universities must do more than simply enroll underrepresented students. Universities must find ways to increase minority persistence to degree completion, particularly Latina/os who are members of the fastest growing population. Second, the topic addresses the critical issues (e.g., reasons for the lack of success, insights into the perceptions of social support networks and climate) pertinent to female minority student persistence in STEM disciplines. Third, the topic addresses the need for further research to simultaneously examine the role of social support networks and the institutional and departmental climate of minority women who persist in their

pursuit of an engineering degree, a discipline that continues to be overwhelmingly male-dominated.

In addition to being a timely research topic, insight into the persistence of Latinas' pursuing an undergraduate engineering degree is also one of critical need. Critical because recent national reports, such as the *Rising Above the Gathering Storm* (National Academy of Sciences, 2007), have created an urgent agenda to increase the degree attainment of women and minorities in STEM fields as a means to increase U.S. competitiveness in the global economy. Hence, the shifting demographics and the need to produce engineering college graduates suggests that this study seeks to add to the wealth of knowledge that is necessary to address the national agenda set forth by the National Academy of Science.

While there are a myriad of reasons that affect the persistence of female minorities in STEM disciplines, the premise of institutional and departmental climate continue to be facets that need further research. Extensive literature addresses both minority students' lack of "sense of belonging" at an institution and the departmental climate in STEM disciplines. Even though research on institutional and departmental climate has shown to influence the non-persistence decisions of many students of color (AAUW, 2010; Glora, Castellanos, Lopez, & Rosales, 2005), little research juxtaposes institutional and departmental climate and the influence, if any, it has on the persistence of minority women's pursuing an undergraduate engineering degree.

Organization of the Dissertation

Chapter 1 provides an introductory overview of the phenomenon being studied, the problem statement, the purpose and significance of the study as well as detailing the research questions that guide this study. Also, key terms such as persistence, social integration, and STEM are defined and situated within the context of this study. A review of literature pertinent to 1) STEM persistence, 2) General persistence, and 3) Latina/o persistence in higher education are detailed in Chapter 2. Also included in Chapter 2 is an extensive review of the STEM literature. Following the review of literature, Chapter 3 outlines the methodology employed in this study. Accordingly, Chapter 3 addresses the research design, participant and site selections, data collection methods, method of data analysis, and trustworthiness of the study. Subsequently, I present the findings from the interpretation of the data analysis in Chapter 4. The final chapter, Chapter 5, presents a brief overview of the study, its respective findings, and conclusions derived from findings. Following the conclusion of the findings, implications and recommendations for future research are explicated.

Definition of Terms

Below is a list of defined terms as they are situated within the context of this study.

1. Academic Integration: In addition to meeting the required academic standards, academic integration refers to a student's level of congruence with the norms of the academic system. The latter suggests that students are intrinsically rewarded for their

grades because they acknowledge their intellectual growth within the parameters set forth by the university (Tinto, 1975).

2. Chicana/o: The term "reflect[s] Mexican Americans' dual heritages and mixed culture" (Jones & Castellanos, 2003, p. xx). However, it is important to note that *all* Mexican Americans do not self-identify as Chicana/o because some believe the term Chicana/o suggests militant activism (Santana & Gonzalez, 2001).

3. Campus Climate: Campus climate refers to the attitudes and perceptions that members of an institution possess (Peterson & Spence, 1990) which ultimately comprises the organizational culture (Hurtado, Milem, Clayton-Pedersen, & Allen, 1999). Hurtado et al. (1999) assert that in addition to structural diversity, the historical legacy of the institution and the types of interactions that occur both inside and outside of the classroom further create a particular campus climate.

4."Chilly" Climate: A "chilly" climate refers to the classroom climate reported by female college students. The landmark study conducted by Hall and Sandler (1982) found that faculty, often inadvertently, convey what constitutes "normal" behaviors, careers choices, abilities, and goals to respective students on the premise of gender rather than on students' abilities and interests. Schulze and Tomal (2006) similarly noted that the small overt and subtle unfair exchanges of faculty and peers, at times, create a negative learning and teaching environment for female students.

5. Departmental Climate: In addition to the personal characteristics of faculty and students, leadership style and department's institutional history, among others, comprise the departmental climate (Austin, 1996). More recently, the departmental climate refers

to the specific climate of science departments, particularly the hard sciences, engineering, and computer science. More specifically, females detail the hostile climate found in science departments (Lederman & Bartsch, 2001).

6. Ethnicity: A classification used to group individuals who "share a unique social and cultural heritage (customs, language, religion, and so on) passed on from generation to generation" (Casas, 1984, p. 787).

7. Hispanic: A person of Puerto Rican, Cuban, Mexican, Central or South American (as well as any other Spanish) origin or culture despite race (National Science Foundation, 2007). While Hispanics share common cultural characteristics and ancestoral language, immigrant history and settlement patterns are considerably different (Jones & Castellanos, 2003).

8. Latina/o: An inclusive term that refers to Latina/os who live in the United States and whose ancestors are from Latin America. More specifically, Latina/os refer to people who are from Latin American countries in the Western hemisphere such as Guatemala, Argentina, and Peru. Also, Latina/o includes people who do not necessarily speak Spanish (Hayes-Bautista & Chapa, 1987).

9. Mexican-American: Refers to people of Mexican descent who, as of the 2000 U.S. Census, comprise the largest ethnic populace of the Latina/o population – 59% to be exact (U.S. Census Bureau, 2000).

10. Minorities: Also referred to as underrepresented minorities, minorities and which groups comprise "minorities" often differ from researcher to researcher and agency to agency. Moreover, in regards to science and engineering statistics, the National Science

Foundation (2010) includes only American Indian/Alaska Native, Black, and non-Hispanics as underrepresented minorities. Asian/Pacific Islanders are not considered to be underrepresented minorities in science and engineering fields.

11. Persistence: A student's ability and likelihood to persist from one semester to another and/or that she/he will attain a college degree (Tinto, 1975).

12. Race: A reference typically associated with ethnic and diverse populations based on social constructions (Jones & Castellanos, 2003).

13. Social Integration: Social integration refers to the congruency between students and their social environment which includes, but is not limited to, interaction with faculty/administrative staff and peer organizations as well as participation in extracurricular activities (Tinto, 1975; 1993).

14. STEM: Although, according to the National Science Foundation, the acronym STEM most commonly refers to the broad categories of science, technology, engineering, and mathematics, the term STEM also includes the behavioral and social sciences such as sociology, economics, psychology, and political science (Green, 2007). However, before the acronym STEM was coined in the early 2000s, the NSF first utilized SMET as a designation for funding education, primarily graduate fellowships for students pursuing degrees in science and mathematics (International Technology Education Association, 2009).

15. Social Support Networks: Social support networks refer to people who offer students social support which can ultimately strengthen student institutional commitment. Family

members, peers, participation in peer organizations, friends, and faculty, to name a few, comprise the social support networks of college students (Tinto, 1975).

CHAPTER II

REVIEW OF LITERATURE

For many students, enrollment into institutions of higher education does not guarantee college degree attainment. Swail, Redd, and Perna (2003) assert that, "Today about half of students with dreams and aspirations based on their future receipt of an earned certificate or degree leave with that dream either stalled or ended" (p. v). This multifaceted area of research is ongoing and reasons that explain why some students persist to degree completion while others do not are under investigation (Johnson, 2000)—one that becomes more complex when examining minority female students who persist to degree completion in disciplines (e. g., engineering) where they remain highly under-represented. A recent report by the National Academy of Sciences (2007), which will be detailed shortly, indicates that success in Science, Technology, Engineering, and Mathematics (STEM) disciplines is imperative for scientific and technological innovation. Equally important to note is the projected estimate that women and minorities will comprise a majority of the future workforce (Hyde & Kling, 2001; Walsh & Heppner, 2006). To understand the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate engineering degree, what follows is a review of the literature in relation to STEM persistence, to persistence theory, and lastly, to Latina/o persistence.

Women in STEM

The detailed urgency of preserving the "vitality" of the American economy was accounted in the *Rising Above the Gathering Storm* report. The vitality of the U.S.

economy "is derived in large part from the productivity of well-trained people and the steady stream of scientific and technical innovations they produce" (National Academy of Sciences, 2007, p. 1). To remain vital and competitive in the global economy, the National Academy of Sciences (2007) detailed hundreds of programs and funding necessary to increase the success of U.S. students in mathematics and science, which is integral to scientific and technical innovations. In 2007, the Trends in International Mathematics and Science Study (TIMSS), supported by the National Center for Education Statistics, revealed that while U.S. fourth graders scored above average in both math and science, they scored lower than fourth graders in Asia (NCES, 2009d). This suggests that U.S. fourth graders begin to lag academically in math and science early in grade school when compared to Asia. Thus, the need to increase student achievement and interest in mathematics and science (from grade school through college) is necessary for innovation, particularly because success in these subjects have shown to be important precursors to interest and success in Science, Technology, Engineering, and Mathematics (STEM). Moreover, because population projections estimate that women and minorities will comprise a majority of the future U.S. workforce, the necessity to increase their choice to pursue and more importantly, succeed in STEM disciplines is essential to the future vitality of the U.S. economy (Hyde & Kling, 2001; National Academy of Sciences, 2007; Walsh & Heppner, 2006).

According to Ehrenberg (2010), *only* about half of the students who initially intended to major in STEM graduated within 6 years, while others who did not persist in STEM either chose to pursue other fields of study or altogether dropped out of college.

Decisions of non-persistence in STEM fields are more often made by women and minorities (National Science Board, 2007). Without a doubt, "Women are greatly underrepresented in scientific fields" (Weisgram & Bigler, 2007, p. 262) at all educational levels. The need to increase women in STEM disciplines and subsequently, their persistence in such degree programs remains an area of research that must be further pursued. Wyer (2003) contends that research on the persistence of female college students in STEM disciplines has been overshadowed with research that examines the reasons why women *choose* to pursue STEM degrees. Still statistics continue to show that few women persist in their quest for a STEM degree, "despite evidence that women and men are equally capable of careers in STEM fields" (Bystydzienski & Bird, 2006, p. 4). Regardless of institutional and federal initiated programs to promote STEM fields as suitable disciplines and career choices for women (Etzkowitz, Kemelgor, & Uzzi, 2000; Ligata & Adamczeski, 2000; Wenneras & Wold, 2001), they continue to be underrepresented in STEM disciplines (Dingel, 2006). Because it is not clear what factors aid in the persistence decisions of women and minorities pursuing STEM degrees, the focus on how to improve their persistence remains ambiguous (Griffith, 2010).

Disaggregation of STEM Statistics

Even though more women enroll and persist to bachelor degree attainment when compared to males (U.S. Census Bureau, 2010b), they continue to be underrepresented in most science and engineering disciplines (e. g., physical science, engineering, and technology) (Amelink, 2009). The National Science Foundation (2008) reports that,

within the last two decades, science and engineering bachelor's degrees awarded to women has increased with the exception of computer science where degree attainment for women declined from 37% in 1985 to 22% in 2005. Similarly, a 2010 report by the American Association of University Women (AAUW) contends that, "Despite the still relatively small percentages of women majoring in some STEM fields, the overall proportion of STEM bachelor's degrees awarded to women has increased dramatically during the past four decades, although women's representation varies by field" (p. 26). Even with the increased proportion of women earning science and engineering degrees, most STEM disciplines continue to be male-dominated. For instance, males were awarded 78% and 77% of all engineering and computer and information science bachelor's degrees in 2006, respectively (NSF, 2008).

For other STEM disciplines (e.g., mathematics, social science), the difference in percentage between female and male degree attainment is not as significant as engineering and computer science; however, differences do indeed exist. Essentially, females earn a larger percentage of bachelor's degrees in biological, agricultural, and environmental life science, psychology, and social sciences and related fields when compared to males (NSF, 2008). With the exceptions of biological sciences and psychology, males earned a larger percentage of science and engineering degrees in 2006 (See Table 1).

Table 1. Percentage of Science and Engineering Bachelor's Degrees Awarded to Females and Males in 2006

Science & Engineering Disciplines	Females	Males
Biological, Agricultural, & Environmental Life Sciences	62%	38%
Computer & Information Science	23%	77%
Mathematics & Statistics	46%	54%
Physical & Related Sciences	44%	56%
Psychology	77%	23%
Social & Related Sciences	55%	45%
Engineering	22%	78%

Source: National Science Foundation (2008). Division of Science Resource Statistics, *National Survey of Recent College Graduates*, 2006.

Women continue to disproportionally attain bachelor's degrees within certain STEM disciplines (Chubin, May, & Babco, 2005). Lederman and Bartsch (2001) posit that the continued underrepresentation of women in STEM disciplines is a reflection of "a much deeper issue associated with norms and expectations of science" (p. 9). Such norms and expectations are prevalent in the college classroom as well as in the STEM workplace (e.g., corporate, university). Still, a proliferation of research studies attributes the lack of female persistence and consequently, STEM degree attainment to various biological and social factors (e.g., intelligence and interest). An American Association of University Women (AAUW) (2010) report found three pervasive themes within the literature that explains the low numbers of women entering and subsequently, persisting in STEM disciplines which include: 1) Cognitive differences between genders, 2) Lack of interest, and 3) STEM workplace issues (e.g., bias and work-to-life balance). In

addition to the three aforementioned themes, there is extant literature that examines the effect of departmental and classroom climate on the persistence of women as well as females' perceptions about their abilities to be successful in STEM disciplines.

Cognitive differences. Despite inconclusive research on sex differences in hormones and brain structure (Ceci, Williams, & Barnett, 2009) and no difference in IQ measures between females and males (Lynn & Irwing, 2004), many continue to maintain that the disparities are evidence of "biologically driven gender differences in abilities and interests" (AAUW, 2010, p. 17). Put another way, many believe that men "naturally" excel in mathematics, specifically in disciplines that include a high demand of math knowledge and application whereas women "naturally" excel in the social sciences, specifically in disciplines that emphasize language skills (AAUW, 2010; Birke, 2001; Varma, 2009). Similarly, Bystydzienski and Bird (2006) further note that "it was assumed that women were 'deficient' in math and science" (p. 3). The premise of labeling women as "deficient" because they do not "naturally" excel in the sciences counters the reality of what remains prevalent in research which finds that women are equally capable to perform both academically and workplace-wise when compared to males (Bystydzienski & Bird, 2006; Clewell & Campbell, 2002).

In addition to the recent increase of female course enrollment in mathematics and science, their achievement in such courses, when compared to males, has become empirically insignificant (Clewell & Campbell, 2002). In other words, not only is there an increase in course enrollment, but the academic performance between females and males in terms of mathematics and science are comparable in nature (Bystydzienski &

Bird, 2006; Clewell & Campbell, 2002). In 2004, for instance, enrollment in advanced science courses was higher for female than male high school seniors at 27% and 23%, respectively (Ingels & Dalton, 2008). Although female enrollment has increased and even surpassed male enrollment in some advanced science courses, it is important to note that males continue to outperform females, though not significantly, in certain subjects such as biology, physics, earth science (Amelink, 2009). Such increases suggest that both culture and learning environments are vital in fostering STEM abilities and interests (Bystydzienski & Bird, 2006; Davis-Lowe, 2006). Birke (2001) claims that any assertions to explicate the differences between females and males (e.g., intelligence, achievement in certain disciplines) have nothing to do with biology but rather how gender is perceived.

Lack of interest. Another theme that is pervasive throughout the literature is the notion that girls are simply not interested in STEM disciplines or careers, specifically computing and engineering. A recent study of 13-17 year olds found that 74% of males identified computing or computer science as a "good" college major, while only 32% of females felt the same way (WGBH Education Foundation & Association for Computing Machinery, 2009). Among many rationales, Varma (2009) asserts that one of the reasons why females are less interested in computers is because they have been exposed to computers at a much later time when compared to their male counterparts. Like computing, primary and secondary female students detail that they are also less interested in choosing engineering as a college major (American Society for Quality, 2009). A poll conducted on 8-17 year olds revealed that 24% of boys indicated interest

in engineering, whereas only 5% of girls reported the same (American Society for Quality, 2009). Even though several studies have found that females are not as interested as males in computers or engineering, Kokkelenberg and Sinha (2010) argue that, "It's the postsecondary education that creates the career path and prepares the student for work in a STEM occupation" (p. 936). They further add that examining the STEM experiences of college students is necessary in order to understand persistence and non-persistence decisions.

Interest and subsequently, what disciplines are of interest to females can be attributed to the beliefs, as well as numerous other factors, that she has about her ability to succeed in a particular task or occupation (Correll, 2001; Eccles, 2006; Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1983). Despite research that finds girls to be less interested in science and engineering, the reality for some females who show interest and who are high achievers in STEM-related courses (e.g., mathematics) is that they *choose* to pursue fields of study that are outside STEM disciplines (Lubinski & Benbow, 2006). The latter suggests that existing gender differences found in relation to female interest of STEM fields are not a result of biological factors but rather of social and environmental factors (AAUW, 2010; Varma, 2009; Vekiri & Chronaki, 2008). For instance, Varma (2009) disputes that "compared with men, women's interest to pursue a career in a computer-related field has been restricted" partially because of "bias in socialization" (p. 38). Girls, Varma argues, are raised to be in "traditional fields", whereas boys are more apt to be raised for careers in STEM. As such, the reported lack of female interest in engineering and technology fields, among many reasons, has more

to do with socialization rather than simply interest. Such socialization, some posit, even follow women once they enter the STEM workplace (Valian, 1998).

STEM workplace issues. The implicit bias that individuals, particularly women, possess about their presence and expected experiences in STEM fields continues to perpetuate negative gender stereotypes about their presence in science and engineering disciplines and careers (Valian, 1998). In other words, females who believe in gender equity may also harness implicit bias about women in engineering and science-related careers and consequently, perceive such disciplines as being "masculine". Rosser (2006) found that female STEM faculty identified that their limited presence in such disciplines resulted in "stereotypes surrounding expectations of their performance" (p. 76). Other participants, within the same study, discussed their inability to be respected by their peers and as a result, were not able to gain credibility in terms of their work (Rosser, 2006). Further research addresses bias in hiring practices (Trix & Psenka, 2003) and in peer review (Wenneras & Wold, 1997). Wenneras and Wold assert that female doctoral applicants are expected to be significantly more productive than their male counterparts.

Even after females in STEM-related fields and careers have proven themselves to be competent and successful they continue to receive biased judgments about their performance (Heilman, Wallen, Fuchs, & Tamkins, 2004). According to Eisenhart and Finkel (2001), more women than men, despite academic success in science or engineering, have more difficulty in locating employment that is both satisfying and rewarding. Some even argue that female STEM professionals must work harder to prove themselves worthy primarily because colleagues view them as being unequal (Etzkowitz,

Kemelgor, & Uzi, 2000). Likewise, Dingel (2006) posits that female students are discouraged by their own failures primarily because of pressure to reach unrealistic expectations.

Still, some research proposes that women leave STEM academic careers because of the inability to find a balance between family and work (Mason, Goulden, & Frasch, 2009; Rosser, 2006; Wasserman, 2000; Xie & Shauman, 2003). A study conducted by Rosser (2006) of Professional Opportunities for Women in Research and Education (POWRE) awardees, recipients of a program funded by the National Science Foundation to provide opportunities for growth of women faculty in science and engineering disciplines, found that the top barrier identified, over each of the four years, was "balancing work with family". Silverman (2001) further argues that women report that a STEM career "may be incompatible with raising a family" (p. 38). This notion is further supported by recent studies that found more women than men cited family related issues as the main reason why they chose to leave engineering as well as other STEM disciplines (Frehill, Di Fabio, Hill, Trager, & Buono, 2008; Silverman, 2001).

The departmental climate. Certainly, there are many factors that explain the reasons why women do not persist in their pursuit of a STEM degree. Research has shown that women are high achievers in STEM-related courses both in high school and college (AAUW, 2010; Seymour, 2001); however, many females choose to abandon their initial choice to major in science and engineering and pursue other fields of study (Seymour, 2001). There are many academically prepared women who declare a STEM major in their freshman year of college but choose to change majors early in their

educational career (Sagebiel, 2003) despite the fact that they are excelling at coursework. Seymour and Hewitt (1997) argue that many women choose to not persist in their respective degree program because they are weary of having to prove themselves. More importantly, high female attrition in STEM disciplines has raised serious questions pertaining to the climate of science departments, particularly the hard sciences, engineering, and computer science. Lederman and Bartsch (2001) note that, "girls and women report that the climate of science is hostile in a multitude of ways and illustrates that recruitment in the absence of retention is ineffective in changing conditions for women in the sciences" (p. 9). In other words, once women experience the hostile climate their recruitment into their respective science program becomes irrelevant if little effort is exerted to change the climate and increase retention.

As previously mentioned, the underrepresentation of women is especially evident in engineering, computer science, and physical science (Rosser, 2006). Layne (1997) contends that, "Engineering is particularly significant, because it is a subject where women are currently catastrophically underrepresented" (p. 41). In 2007, women earned *only* 18.5% of engineering bachelor degrees (NSF, 2009). Sagebiel (2003) asserts that the climate in academia is one of dominant masculinity, which compels women to pursue other fields of study. Furthermore, women continue to encounter gender related barriers in their pursuit of scientific endeavors (Etkowitz, Kemelgor, & Uzi, 2000). Etzkowitz et al. (2000) contend that women continue to be underrepresented due to "weed-out" practices whereby women must survive the coursework found in introductory science courses; women must be successful in a curriculum that was

primarily designed with males in mind. While the overall percentage of women in STEM domains will continue to climb (Steele, Reisz, Williams, & Kawakami, 2007), there continues to be an "erosion in women's representation in academic engineering programs" (Mattis, 2007, p. 334). Despite the advancement of women in STEM disciplines, they continue to face many obstacles, and therefore, remain a "distinct minority in many science and engineering fields" (AAUW, 2010, p. 45).

Climate. Some argue that one of the complex barriers to female success in STEM disciplines can be found in the college climate. According to Schulze and Tomal (2006), a "chilly climate" describes "such a climate as one in which many small inequities as well as faculty and peer behaviors (overt and subtle) created a negative atmosphere for learning and for teaching" (p. 263). More often than not, females on college campuses report a "chilly climate" when compared to male students (Schulze & Tomal, 2006). Although there are many factors that contribute to campus climate, a paramount study first conducted in 1982, and later replicated in 1992, by Hall and Sandler (1982) found that "faculty attitudes and behaviors have a profound effect" (p. 2) on female students. They claim that faculty, often inadvertently, convey what constitutes "normal" behaviors, careers choices, abilities, and goals to respective students on the premise of sex rather than on students' abilities and interests. Consequently, Hall and Sandler (1982) argue that faculty, mostly comprised of males, creates lower expectations for female students by asking them lower level questions when compared to male students. Their more recent report in 1992 also found that female students, not male students, continue to receive less praise and attention from faculty in college classrooms.

Ultimately, the initial report by Hall and Sandler (1982) asserted that women, because of differential treatment in the college classroom by faculty, are educationally disadvantaged.

While women experience the "chilly climate" in various disciplines, Morris and Daniel (2008) hypothesize that one of the reasons why women do not persist in STEM disciplines is because they "do not feel welcome" (p. 257). The perception of not feeling welcome materializes when women feel ignored, sexually harassed, or are simply treated differently than their male counterparts (Morris & Daniel, 2008). While these are overt examples of a chilly climate, female students also claim to experience more subtle messages. Some instances include, but are not limited to, faculty making more frequent eye contact with male students, utilizing gender stereotyped examples in class (e.g., he referring to a doctor), standing closer to male students during lecture, and finishing assignments for female students as to connote that they are not capable of completing the assignment on their own (Hall & Sandler, 1982). Similarly, Dingel (2006) asserts that women in science classrooms are made to feel that they lack knowledge and are out of place. Therefore, some women who feel they are not knowledgeable in their respective STEM courses begin to question their ability regardless of their performance in class.

Female perceptions of self-concept. While some research (Light, Korte, Yasuhara, & Kilgore, 2007) indicates that confidence in the perception of self is crucial to understanding persistence, it is important to note that one's perception of her/his *actual ability* is not an accurate depiction of what her/his *true ability* might entail (Belenky, Clinchy, Goldberger, & Tarule, 1986; Besterfield-Sacre, Atman, & Shuman,

1997; Light et al. 2007; Stetsenko, Little, Gordeeva, Grasshof, & Oettingen, 2000), particularly in regards to women's perceptions about their abilities in STEM-related disciplines. For example, Seymour and Hewitt (1997) and Hawks and Spade (1998) found women reported lower confidence than males regarding their technical abilities in STEM disciplines. Likewise, further research conducted by Busch (1995) and Cassidy and Eachus (2002) assert that, at the university level, male students have more confidence about their computer abilities than female students.

Despite recent studies that have found both females and males value mathematics equally, females' perceived competence in their abilities is often distorted and influenced by cultural gender stereotyped roles (Jacobs & Eccles, 1992). Even though both genders equally value mathematics, women are less likely to pursue a degree in this field. Accordingly, Burke (2007) suggests that even though females are just as capable as males to expand their skills in a STEM field, they lack the encouragement to do so. This lack of confidence in their academic ability, despite their actual academic performance, could perhaps be the reason why women are more likely than men to opt out of a STEM major (Clewell & Campbell, 2002; Seymour & Hewitt, 1997). Brainard and Carlin (2001), in a longitudinal study conducted on females pursuing an undergraduate degree in science and engineering at the University of Washington, found that, as juniors and seniors, participants' self-confidence in science, but not in mathematics, was lower for those who chose not to persist in their respective program when compared to females who persisted in their respective degree program (e.g., science or engineering). They further concluded that, "Despite differences in self-

confidence, comparison at the time of switching showed no difference in actual performance, measured by GPA, between women who persist in S&E (science and engineering) and women who switch to a nonscience major" (Brainard & Carlin, 2001, p. 35). This finding, synonymous to other studies, suggests that women continue to face "numerous barriers that are out of their control" (Bystydzienski & Bird, 2006, p. 5).

Minorities in STEM

While the underrepresentation of women in STEM is problematic, the number of minorities in these fields is at best, troubling. Of the 454,978 undergraduate science and engineering degrees awarded in 2004 *only* 74,834, roughly 16.4%, were awarded to minorities (NSF, 2007). In recent decades, research has sought to provide insight into what contributes to the persistence of underrepresented students in STEM disciplines (May & Chubin, 2003; Rodgers, 2009). Similar to women, ethnic minorities continue to be washed aside via the "leaky pipeline" in education, particularly in regards to their under-preparedness in mathematics and science during critical school years (e.g., primary and secondary schooling) (Tomas Rivera Policy Institute, 2008). Consequently, being academically unprepared for college not only diminishes Latina/os' intent to pursue a STEM degree but ultimately jeopardizes their ability to persist. In addition to the aforementioned barriers that women encounter when they pursue a STEM degree, other factors have additionally been noted to predict the persistence, or lack thereof, of minority students in STEM disciplines. To be certain, there are several factors that can increase the persistence of minority students in STEM disciplines which include, but are not limited to, pre-college preparation (May & Chubin, 2003), support networks (Tomas

Rivera Policy Institute, 2008), and STEM climate (Hurtado, Griffin, Arellano, & Cuellar, 2008). The literature that follows will examine these factors in relation to minority students and, when research is available, specifically address these factors in relation to the Latina/o STEM population.

Pre-college preparation. Many researchers suggest that adequate pre-college preparation of minority students remains a significant predictor of persistence in STEM (Bonous-Hammarth, 2000; Simpson, 2000). According to Cole and Espinoza (2008), "Skill development and academic performance prior to in enrolling college, not race or ethnicity, serves as an indicator of how well or how poorly a student will perform in a science-related field" (p. 286). More specifically, Swail, Cabrera, Lee, and Williams (2005) posit that for Latina/o students academic preparation for college begins with their first mathematics course. Eamon (2004) makes a similar assertion about the importance of pre-college mathematics and science experience. Additionally, pre-college entry test scores (Barton, 2003), such as SAT scores related to mathematics have been associated with persistence decisions of Hispanic students pursuing STEM degrees (Bonous-Hammarth, 2000). While the importance of pre-college preparation, particularly in mathematics, has been linked to Hispanic students choosing to pursue and more importantly, succeeding in a STEM major, the reality is that many Hispanics remain tracked in lower level science and mathematics courses while in high school. Such tracking, Crisp, Nora, and Taggart (2009) argue, "negative[ly] influence Hispanic students' academic experiences in mathematics and science" (p. 929). As such, their

inadequate preparation in mathematics and science in high school often becomes, for some Latina/os, evident in their academic performance in college.

Support networks. Much like persistence in non-STEM disciplines, support networks, beginning at primary and secondary school, remains to be effective for Latina/os pursuing a STEM degree (Tomas Rivera Policy Institute, 2008). In a qualitative study of Latina/os in STEM professionals, the Tomas Rivera Policy Institute found that outreach statewide programs such as the Mathematics, Engineering, and Science Achievement (MESA) program, an initiative that encourages underrepresented students to continue to do "well" in secondary school while at the same time preparing them for college, was repeatedly shared to be beneficial by participants. Within the same study, participants also noted that, like MESA, the Society for Hispanic Engineers (SHPE) also served as a support system throughout the difficult times that students encountered. Grandy (1998) found that the availability of female or ethnic role models who were advisors or advanced graduate students were also identified as sources of support for underrepresented students pursuing a STEM degree. Still, several other people comprise important support networks for minority students. While Bonous-Hammarth (2000) found that peers and mentors constituted support, Leslie, McClure, and Oaxaca (1998) asserted the importance of faculty. Members of their social support network, primarily faculty and peers, remain integral to the persistence of Latina/o students (Gloria, Castellanos, Lopez, & Rosales, 2005; Hernandez & Lopez, 2004) even those pursuing STEM degrees.

STEM climate. In addition to unwelcoming and chilly college and classroom climates in certain STEM disciplines, Hurtado, Griffin, Arellano, and Cuellar (2008) describe the presence of a psychological climate, particularly in STEM programs. Hurtado et al. (2008) maintain that even though some underrepresented students do not feel welcomed, they continue to enroll and pursue some STEM disciplines. There is no doubt that the STEM climate promotes characteristics that are often associated with male students. In a study conducted by Johnson (2007), Hispanic, African American, and Native American graduate female students shared that the "science culture" equated success with one's ability to be seen and to be heard. The premise of "success" in the "science culture" Johnson argues, contradicts the manner in which females are socialized to be seen and not necessarily heard. As a result, participants shared, they were unable to build meaningful relationships with professors. Another characteristic that is often associated with success within an engineering climate is one's ability to be competitive in the classroom which positively favors male students and decreases the performance level of female students (Gneezy, Niederle, & Rustichini, 2003; Seymour, 1995).

Latinas in STEM

Minorities, like women, continue to comprise a smaller percentage of STEM undergraduates when compared to their counterparts. Even though statistics indicate that women and minorities remain underrepresented in STEM disciplines, "when gender and minority status are compounded, the scales are especially unbalanced" (Rodgers, 2009, n. p.). Put another way, the actual percentage of ethnic minority females who pursue and persist in STEM disciplines remain to be almost nonexistent (MacLachlan, 2000).

Hence, data collection pertinent to ethnic minority female success in science simply reinforces the "invisibility" of this demographic (Leggon, 2006). Though limited, there are women of color who pursue and persist in their quest for a STEM degree.

As such, many in academia are quite aware that women who earn degrees in the STEM disciplines are in short supply in general and even more so for Hispanic women (National Science Foundation, 2009). According to the NSF (2008), of the 249,389 science and engineering degrees women earned, Hispanic females, defined here as females of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish descent regardless of race, earned approximately *only* 10.8% of those degrees. Science and engineering bachelor's degrees awarded in 2008 were dismal for women and even more startling for Hispanic females (See Table 2).

Table 2. Science and Engineering Bachelor's Degrees Awarded to Females and Hispanic Females in 2008

Disciplines	Females	Hispanic Females	% of Hispanic Females
Science & Engineering	249,389	23,051	10.8%
All Sciences	236,471	21,824	10.8%
Agricultural Sciences	9,453	601	15.7%
Biological Sciences	49,257	3,744	13.2%
Computer Sciences	6,883	551	12.5%
Earth, Atmospheric, & Ocean Sciences	1,755	84	20.9%
Mathematics & Statistics	6,956	421	16.5%
Physical Sciences	7,283	548	13.3%
Psychology	71,664	6,969	10.3%
Social Sciences	83,220	8,906	9.3%
Engineering	12,918	1,227	10.5%

Source: National Science Foundation (2008). Division of Science Resources Statistics, Special tabulations of U.S. Department of Education, Integrated Postsecondary Education Data System. Table C-14. *Bachelor's degrees, by race/ethnicity, citizenship, sex, and field: 2008.*

In addition to attaining fewer bachelor's degrees in STEM disciplines, women and minorities are less likely to choose to major in a STEM field and are more likely to leave early in their college careers if they do declare a STEM major (AAUW, 2010; NCES, 2009). While there is a plethora of reasons that women and minorities choose to pursue other fields of study, Eisenhart and Finkel (2001) argue that "science discourages women and minorities because its theoretical stances tend to privilege white male standpoints" (p. 20). Yet, despite the manner in which data is ascertained and reported, few will dispute that women of color, more than males and female White counterparts,

often face additional barriers in their pursuit of a STEM degree. While women and minorities encounter obstacles in relation to the departmental and classroom climate, "the climate for women of color is frequently even more damaging than for majority group women" (Bystydzienski & Bird, 2006, p. 9). Bystydzienski and Bird (2006) surmise that despite their interest and involvement in science disciplines, their interest decreases as time progresses because of the "chilly climate" that often alienates women of color who are marginalized for being female *and* belonging to an ethnic minority. Because of the limited research that investigate the experiences of minority females, specifically Latinas, little is known about the factors that influence the persistence of this demographic in STEM fields. Still, understanding persistence decisions is central to understanding student success in STEM disciplines. To gain a better understanding of student persistence in STEM, an examination of the literature pertinent to persistence must be discussed. Appropriately, the section that follows details the theoretical framework which is primarily drawn from Tinto's (1975; 1987; 1993) work on persistence.

Theoretical Framework

Understanding why some students persist while others do not has compelled researchers to examine the factors that influence persistence decisions (Johnson, 2000; Tinto, 1975; Nora, 2002; Pascarella & Terenzini, 1980). Swail, Redd, and Perna (2003) contend that, "Although gaining entry to college is still a dramatic accomplishment for some, persisting to degree is what really matters in the postcollege world" (p. 1). A recent study of degree completion by the U.S. Department of Education reveals that after

six years of college, *only* 31% of students earned a bachelor's degree while 36% of students did not persist (Adams, 2010). A majority of students who choose to drop out of college do so voluntarily (Leppel, 2002). Despite various assertions made by researchers, *exact* explanations about persistence and non-persistence decisions of college students remains convoluted (Johnson, 2000). What follows is an explanation of the theoretical framework utilized in this study to better understand the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate STEM degree.

The theoretical framework utilized for this study is taken from the body of literature on persistence. Persistence, defined as a student's ability to attain a college degree, has been an area of research that has been extensively explored (Astin, Tsui, & Avalos, 1996; Berger & Braxton, 1998; Cabrera, Nora, & Castaneda, 1993; Elkins, Braxton, & James, 2000; Ethington, 1990; Hu & St. John, 2001; Kuh, 2002; Lohfink & Paulsen, 2005; Pascarella & Terenzini, 1980; Nora, 2002; Pascarella, Smart, & Ethington, 1986;Paulsen & St. John, 2002; Oseguera, Locks, & Vega, 2009; Rendon, Jalomo, & Nora, 2000; Rogers & Menaghan, 1991; Stage & Hossler, 2000; Titus, 2004). Scholars such as Astin (1984), Tinto (1975, 1987,1993), Pace, (1979,1990), Pascarella (1985), and Cabrera, Nora, and Castaneda (1993), to name a few, have offered different perspectives on the various factors that impact student persistence. Some models focus on the "fit" between person and institution (Bean, 1985; Tinto, 1975), while other models focus on the "quality" of student fit (Pascarella, 1985). Cabrera, Nora, and Castaneda (1993) offer a comprehensive model of college student persistence that

considers socioeconomic status, environmental, and institutional as well as academic and social integration, among other factors, to explain the persistence of college students. Peltier, Laden, and Matranga (1999) assert that, "Persistence is now viewed as a part of the total educational process by many scholars" (p. 357). Despite the differing perspectives that exist, scholars have found broad similarities associated with student persistence such as demographic/individual characteristics, student commitment, student involvement, and institutional characteristics.

Demographic/individual characteristics. Few scholars would argue that demographics are not important to consider when studying the persistence of college students. Peltier, Laden, and Matranga (1999) assert that personal characteristics are advantageous for some while disadvantageous for others, particularly in relation to ethnicity, age, and gender. Amongst other student characteristics, completion rates of students who persist to bachelor degree attainment differ by race, ethnicity, and sex (NCES, 2010; Stoecker, Pascarella, & Wolfe, 1988). In the academic year of 2007-2008, for example, Whites, Blacks, and Hispanics earned 71.8%, 9.8%, and 7.9% of bachelor's degrees, respectively (NCES, 2010a). While the discrepancy of degree attainment between race/ethnicity is considerable, the percentage between female and male bachelor degree completion is more comparable as females earned 57.3% of degrees in 2007-2008 (NCES, 2010a). Differences in degree completion, whether via race/ethnicity and gender further complicate studies of persistence.

As the average age of the college student has increased in recent years (Peltier, Laden, & Matranga, 1999), the lack of persistence of older students might be attributed

to the fact that many are "more likely to have significant work or family responsibilities which constrain their involvement in the life of college" (Tinto, 1987, p. 73). The premise of work responsibilities, according to Torres, Gross, and Dadashova (2010), is also becoming more prevalent in undergraduate students under the age of 21. Torres, Gross, and Dadashova (2010) found that 96 out of their 159 full-time student sample worked anywhere from 21 to more than 41 hours per week. The combined workload and full time school responsibility jeopardizes students' ability to attain a college degree (King, 2002). Consequently, students who work more hours are more apt to have a lower collegiate GPA than their counterparts who work fewer hours (Torres, Gross, & Dadashova, 2010). Increased work and/or family responsibilities for students suggests that they will have less time to dedicate to the various aspects of college life such as studying and socializing, which are integral to academic and social integration.

Moreover, family background, specifically socioeconomic status, also affects college student persistence. Families who earn less income minimize their ability to "plan, save, and invest for future security" (Swail, Redd, & Perna, 2003, p. 5). In this case, future security is achieved with degree attainment. Students are more apt to be involved in college if their parents have a higher level of education and earn more income (Tinto, 1987). Many researchers surmise that involvement indirectly influences students' ability to persist in college (Astin, 1975; Braxton, Sullivan, & Johnson, 1997; Tinto, 1987). Similar studies have also indicated that there is an inverse relationship between socioeconomic status and persistence decisions (See Astin, 1964; Chase, 1970). The more education and more affluent the parents the less likely students will drop out

of college and vice-versa. Despite studies that establish a link between socioeconomic status, degree attainment, and student involvement in college, other studies have found that students from lower socioeconomic backgrounds emphasize the importance of college attendance and are more apt to perceive that they are doing well in college. For instance, Ethington (1990) found that, in conjunction with other factors (e.g., higher socioeconomic status, high educational aspirations), "higher values relative to college attendance directly enhances the likelihood of persistence" (p. 289). The latter part of the preceding statement suggests that values associated with college attendance can also shape persistence decisions of students who come from a lower socioeconomic status.

In addition to demographic factors such as race, ethnicity, age, and socioeconomic status, individual characteristics are also important to consider when addressing issues of student persistence. Characteristics such as a student's ability to perform academically also have been examined (Tinto, 1975; Wegner & Sewell, 1970). Tinto (1975) argues that students must academically integrate into their respective college if they wish to increase their ability to persist in their degree program. In addition to GPA improvement in their first year of college, students who also had GPAs that met their expectations or who academically adjusted to college are more likely to persist (Kennedy, Sheckley, & Kehrhahn, 2000). Pre-college grade performance, Astin (1972) further notes, is a better predictor of success in college when compared to standardized scores primarily because the student has proven to be successful in an educational setting that is similar to a collegiate setting.

Another individual characteristic that has been associated with student persistence is the level of student expectation and motivation to meet a goal (Tinto, 1975). Tinto contends that, "an individual's educational goal commitment…is an important input variable in the model of dropout because it helps specify the psychological orientations the individual brings with him into the college setting" (p. 93). Put another way, researchers should maintain an awareness of students' level of motivation or the goal commitment that they may or may not bring with them prior to attending college. While there are multiple demographic factors and individual characteristics that can influence the persistence of college students, by no means can these factors be the *sole* reasons why students choose to persist or drop out from college as student commitment, student involvement, and institutional characteristics remain critical components of the holistic view of persistence decisions.

Student commitment. As previously noted, certain individual characteristics such as student expectations and motivations to meet a goal are also important to consider when examining persistence decisions. In addition to goal commitment, the level of commitment to the institution is also integral to student persistence decisions. College students' commitment to goals and to the institution, Tinto (1993) posits, influence performance as well as persistence. Cabrera, Nora, and Castaneda (1993) similarly assert that students are more likely to attain a college degree when they display a greater commitment to both their goals and their institution. The level of students' commitment to their goals and institution, Tinto (1993) argues, help influence the manner in which they transition to college. While some students who lack commitment to their goals and

to their institution are often not likely willing to accommodate to the pressures associated with college transition, other students, who have greater goals and institutional commitment, "are so committed that they will do virtually anything to persist" (Tinto, 1993, p. 47). Students who exhibit a high level of commitment to their goals and institution, in other words, seek out ways to successfully adjust both academically and socially to college.

In addition to the research that links students' goal and institutional commitment to persistence, students' choice of major has also been found to influence persistence decisions. Astin (1982) proposes that students' choice of academic major or career are not a random act, rather such decisions rendered "considerable influence on the student's long-range career development" (p. 92). In a recent study, Georg (2009) found that students with a weaker commitment to their course or to their specific field of study were more likely to drop out of college. While this may be true for some students, Carter (2006) noted otherwise. She found that White students who declared majors were more likely to persist, whereas it was the opposite for African American students who declared majors in certain disciplines such as computer science, business, health, and education. The latter part of Carter's finding suggests some majors are more successful at maintaining certain demographics of students. As such, conflicting research findings indicate that persistence does not occur in isolation of student characteristics. Despite research that continuously indicates the importance of student goals and institutional commitment, nuances remain that further complicate understanding persistence decisions. Consequently, Tinto (1993) cautiously notes that students who withdraw from

college do not always lack goal or institutional commitment. Rather, they lack the coping skills needed to successfully adjust to the various academic and social aspects of college life.

Student involvement. Tinto's (1975, 1987) seminal work, which he later revised in 1993, posits that the nonpersistence of college students are outcomes of a "longitudinal process of interactions between the individual and institution (peers, faculty, administration, etc)" (1975, p. 103). As such, the interaction and level of involvement between students and their respective college environment varies from the individual to the characteristics of other students on campus. Tinto and Astin (1999) make similar assertions about the concept of student involvement. Tinto describes student involvement in terms of social and academic integration via group association, interaction with faculty, and involvement in extra-curricular activities. Likewise, Astin (1999) notes that student involvement refers "to the amount of physical and psychological energy that the student devotes to the academic experiences" (p. 518), which is primarily indicative of time spent studying, time spent on campus, active participation in student organizations, and interaction with faculty and students.

Student involvement, particularly with peer groups, influences individual growth during college (Astin, 1993). Jones, Castellanos, and Cole (2002), in a study where they analyzed students' perspectives about college cultural centers, found that, "quality co-curricular experiences assist students in developing personally and academically, adjusting to the environment, and affiliating positively with the institution" (p. 33). Moreover, student involvement has been noted to be of particular importance for

minority students. Ortiz (2004) surmises that Latino Greek and academic organizations are also important social systems that encourage student involvement. Student involvement, particularly with peers and in organizations of the same ethnicity as the student, has found to be a source of support that increases college adjustment (Ethier & Deaux, 1994) and subsequently, college persistence. However, Schneider and Ward (2003) assert that ethnic peer support or ethnic specific organizations are not always found on college campuses and as a result, according to their findings, general peer support is also effective in helping minority students become adjusted to college. The contradictory findings of the type of peer support necessary for students to become better acclimated to college suggests that the premise of peer support, whether ethnic specific or not, fosters student involvement which indirectly influences students' persistence decisions.

Institutional characteristics. A student's ability to persist or decision to drop out of college is a multidimensional process and is not always the sole result of individual success or failure. Tinto (1975) posits that,

> It is the characteristics of the institution—its resources, facilities, structural arrangements, and composition of its members—that place limits upon the development and integration of individuals within the institution and that lead to the development of academic and social climates, or 'presses,' with which the individual must come to grips. On the one hand, this is true with regard to achievement with the academic system if only because institutions of different quality maintain different standards of academic achievement. On the other hand,

> this is also true with respect to the social system for the college since much dropout appears to result largely from a lack of congruence between the individual and the social climate of the institution rather than from any specific failure on the part of the individual. (p. 111)

In other words, Tinto asserts that a central component of the dropout process that impedes some students to persist resides in the characteristics of the institution. Despite the importance of institutional "fit", "campus climate mediates undergraduates' academic and social experiences in college" (Swail, Redd, & Perna, 2003, p. 57). A student's inability to integrate either academically or socially can also be attributed to the institution rather than simply the individual is also known as institutional fit.

Incongruence between the institution and student often leads students to question whether or not they belong at their respective university. Like Tinto (1975, 1993), several researchers (Astin, 1984; Hurtado & Carter, 1997; Johnson et al. 2007) stress the importance of students' sense of belonging and particularly acknowledge its influence on student persistence in college. Hausmann, Schofield, and Woods (2007) contend that, despite the various labels, the construct of "sense of belonging" appears in many persistence theories. Hurtado and Carter (1997) assert that, "studying a sense of belonging contains both cognitive and affective elements in that the individual's cognitive evaluation of his or her role in relation to the group results is an affective response" (p. 328). In other words, incongruence between institution and student is not only a result of student behavior but also, if students do not feel they belong, affects students psychologically. Regardless of demographics and academic integration, first

year college students who reported interaction with peers and faculty, coupled with parental and peer support, described feelings of belonging on their respective campus when compared to their counterparts who did not report similar interactions (Hausmann, Schofield, & Woods, 2007). Consequently, students' lack of sense of belonging can negatively influence their commitment to their respective institution.

Still, the academic and social climates found on college campuses are not perceived the same by different people. Several studies found that students of color report a lower sense of belonging on their respective college campuses than their White counterparts (Hausmann et al., 2007; Johnson et al., 2007; Locks et al., 2008). As such, Tinto (1975) notes that, "persons of varying characteristics may hold differing perceptions of apparently similar situations" (p. 98). Adjustment, membership, and persistence of minority students into their colleges' respective cultures, Museus and Quaye (2009) suggest, is a result of a collaborative effort between individual (e.g., peers, faculty) and campus organizational agents (e.g., organizations, cultural centers), particularly when there is a validation of students' culture and heritage. A more recent study by Museus and Maramba (2010) found that Filipino American students, who felt connected to their cultural heritage, positively predicted a "greater sense of belonging in college" (p. 250). Despite universities' attempt to create a sense of belonging for students, specifically ethnic and racial minority students, some efforts remain ineffective.

Institutional leaders often create cultural centers to illustrate the inclusiveness of minority students; however, students recognize that, more often than not, these centers

are located on the "fringes of the campus." The location of some cultural center connotes, to some students, to mean anything but inclusion. While cultural centers help acclimate some students to their campus, the impact remains small (Brown, Santiago, & Lopez, 2003). Still, ethnic specific organizations have found to aid college adjustment for Black and Asian students (Museus, 2008). Other studies on campus climate conducted by Hurtado and Ponjuan (2005) and Nora and Cabrera (1996) found that perceived prejudice or bias impedes social, cognitive, and emotional growth which can influence students' decision to depart college. In other words, perceptions of academic and social climates, despite what the institution has in place, differs from individual on the basis of various demographic and developmental characteristics.

Latina/o Persistence in Higher Education

Despite Latina/os' acknowledgement of the importance of education for success in life, only 48% claim they will pursue a college degree (Pew Hispanic Center, 2009) and of this percentage, few will attain a college degree. After reviewing U.S. Bureau of Census (2000) data, Huber, Huidor, Malagon, Sanchez, and Solorzano (2006) concluded that for every 100 Latina/o primary school students, only 54 Latinas and 51 Latinos will graduate from high school and of those 54 and 51, only 11 Latinas and 10 Latinos will graduate from college. According to the Pew Hispanic Center (2008), in 2008 only 12.9% of Hispanics held at least a bachelor's degree. While progress has been made in the enrollment of Latina/os into institutions of higher education, the rate of persistence and subsequently, graduation rates for Latina/os remain dismal (Fry, 2002) especially in regards to bachelor's degree attainment (Becerra, 2010). In 2006, 11.1% of Hispanic

students were enrolled at degree-granting institutions (National Center for Education Statistics, 2009a). Yet, in the same academic year, only 7.5% of degrees were conferred to Hispanics (National Center for Education Statistics, 2009b).Therefore collectively, Latinas/os, as a group, are gaining enrollment at institutions of higher education but are not persisting through to graduation (Miller & Garcia, 2004). As a result, increasing Latina/o degree attainment at all levels of education (e.g., associate, bachelor's, graduate, professional, terminal) presents a vital and multifaceted challenge for institutions of higher education (Miller & Garcia, 2004).To be sure, there is a plethora of factors that influence the persistence of Latina/os pursuing a college degree which include, but are not limited to, the following: familial influence, academic self-concept, finances, social support networks, faculty/mentors, and campus climate.

Familial influence. Like most collectivists cultures, the family is an integral component of cultural heritage (Torres, 2004). The premise of familialism is a critical and influential aspect for the Latina/o community. Marin (1993) defines familialism as "that cultural value which includes a strong identification and attachment of individuals with their nuclear and extended families, and strong feelings of loyalty, reciprocity, and solidarity among members of the same family" (p. 184). Hence, the important role of family, within the Latino culture, reflects a strong bond and value commitment between family members (Vega, 1995). For many Latina/os, the family provides support, emotional security (Hernandez, 2002), and strength (Rendon & Taylor, 1990). Despite persistence models that suggest the necessity of relinquishing ties with family in order to academically and socially integrate into college, Nora and Cabrera (1996) found that

connection to significant others and especially parents (Nora, 2003) are crucial for not only Hispanic's successful transition to college but also impacts their decision to persist in college.

Scholars suggest that Latino family expectations often influence the achievement (Escobedo, 1980; Weisner & Garnier, 1992) of their children in educational settings and motivation (Kimura-Walsh, Yamamura, Griffin, & Allen, 2009) in regards to college aspirations. According to Rodriguez, Guido-DiBrito, Torres, and Talbot (2000), Latina mothers play an important role for daughters' educational goals and success. Cammarota (2004) found, in a qualitative study, that Latinas were encouraged by their mothers to take the initiative to successfully pursue education. In addition to the role of mothers, other studies maintain that family influences the value commitments and often predicts the level of motivation or success a student has with regard to school performance (Duran & Weffer, 1992; Goldenberg, Gallimore, Reese, & Garnier, 2001). Similarly, Ortiz (2004) asserts that, "family influences college choice, motivation, and integration of students into campus communities" (p. 91). Because of family influence, Hernandez (2002) suggests that family plays an integral role in the retention of Latina/o students in college.

More importantly, family members, according to Gloria and Rodriguez (2000), can also serve as role models and/or mentors for Latina/o students. They further contend that siblings and peers serve as role models primarily because of the low number of Latina/o faculty at institutions of higher education. As a result, the need to remain close to family and siblings remains critical for the adjustment and success of Latina/o college

students. The importance of family is further noted by Hurtado and Kamimura (2003) who found that "students [also] tended to identify the support of family members during college as important" (p. 144). Interestingly, the importance of family does not diminish across generations for Latina/os as third generation students' value family just as much as first generation Latina/os (Hayes-Bautista, Hurtado, Valdez, & Hernandez, 1992).

Academic self-concept. Outside the construct of family, another important factor in the persistence of Latina/os in higher education resides in one's academic self-concept. While self-concept is defined as a "composite view of oneself" (Bong & Skaalvik, 2003, p.2), academic self-concept pertains to perceptions and knowledge that individuals hold about their abilities in terms of academic achievement (Byrne, 1984; Gordon Rouse & Cashin, 2000; Wigfield & Karpathian, 1991). Research indicates that students' academic self-concept, or self beliefs about their ability to be successful academically, influences the behaviors they choose to engage in as well as which goals to pursue (Gordon Rouse & Cashin, 2000). Further, students' academic self-concept, according to Felner, Aber, Primavera, and Cauce (1985), is positively related to their perceptions about their classroom involvement and support they receive from instructors. Moreover, Rodriguez (1996) found that Mexican American students who had greater academic self-concept were more likely to attain higher grades than those who did not exert such confidence in their academic abilities. In a more recent quantitative study, Longerbeam, Sedlacek, and Alatorre (2004) found that Latina/os are "more likely to indicate lack of academic ability as a reason to leave school than non-Latino students" (p. 546).

Sedlacek (1989; 2003) contends that academic self-concept is an important factor, particularly in relation to the academic success, for all students of color throughout the various levels of their educational journey. For instance, grade point average (GPA) can influence a Latina/o's self-concept; thus, a high GPA leads to a greater sense of self-confidence in one's academic ability (Rodriguez, 1996). Given the significance of academic self-concept, researchers suggest that academic advisors find ways to not only foster academic self-concept (Hernandez, 2000) but also to reaffirm their academic ability, particularly if they are working with first generation college students or with students who have not been adequately prepared for college (Rendon, 1994). Rodriguez, Guido-DiBrito, Torres, and Talbot (2000) assert that, "For Latina college students, there appears to be an overall feeling of insecurity regarding their academic preparation" (p. 517). Often times, they are argue, their insecurities are further confounded by negative cultural stereotypes ascribed to them. While academic self-concept is important for the academic success of Latina/os, other self-beliefs, such as self-efficacy and self-esteem, are also crucial to student academic success. Ultimately, Hernandez (2000) found that Latina/os with a positive sense of self were more likely to be successful in school when compared to Latina/os who did not view themselves favorably.

Finances. In addition to cultivating academic self-concept, finances continue to play a major role in Latina/o's ability to persist (Nora, 2001; Tinto, 1993). In 2007-2008, Hispanics were awarded grants and loans at a rate of 74% and 49.2%, respectively (NCES, 2008). Despite the percentages, NCES (2008) reports that other than American

Indian/Alaska Natives, Hispanics were awarded the least amount of combined aid ($11,400), in forms of grants and loans, when compared to Blacks ($13,500), Native Hawaiians/Pacific Islanders ($13,400), Whites ($12,900), and Asians ($12,600). The rising cost of tuition and limited amounts of financial aid awarded to students often effects decisions to remain in college. For this reason, Tinto (1993) argues that finances shapes student persistence. Likewise, Nora (1990, 2003) contends that a family's or student's ability to finance college is a decisive barrier for whether or not some Latina/os *can* continue to attend college, primarily because they reevaluate finances yearly (St. John, 2000). Hence, financial aid influences Latina/o students' decision to remain in higher education (Nora, 2003).

Several studies have examined the role that finances play in Latina/o persistence in college (Arbona & Novy, 1990; Cabrera, 1992; Cabrera, Nora, & Castaneda, 1993; Hernandez, 2000; Nora, 1990; Padilla, Trevino, Gonzalez, & Trevino, 1997; Swail, Redd, & Perna, 2003). For many students, their "…ability to pay for college expenses and financial aid difficulties can prove to be an added source of stress" (Hurtado & Kamimura, 2003, p. 143). As a result of financial stresses, Latina/os often are more likely to work and work longer hours, which interferes with their studies and partially explains why many Latina/os, more than their non-Latina/o counterparts, are unable to persist in higher education (Hernandez, 2000; Sedlacek, Longerbeam, & Alatorre, 2004). Nora, Cabrera, Hagedorn, and Pascarella (1996) similarly found that minority students and minority females who work and who had family responsibilities, specifically in this study Hispanics and African Americans were 36% and 83% more apt to leave college.

In addition to alleviating financial stress, many researchers posit that financial aid affords students the opportunity to spend more time on their college campuses if they do not have to work (Nora, Barlow, & Crisp, 2006). Cabrera, Castenada, Nora, and Hengstler (1992) suggest that financial aid, or the lack thereof, indirectly affects students' ability to academically and socially integrate to their respective campus life, which ultimately influences decisions to persist. More recently, Nora et al. (2006) contends that, "students can become fully integrated into the social realm of their institutions by providing them with the time to interact with peers and participate in campus social functions" (p. 1642). In short, if students spend less time working then they have more time to participate in the academic (e.g., attend study groups/instructional sessions, increased opportunities for student-faculty interaction) and social (e.g., become active members of campus organizations) aspects of college—indirectly influencing their ability to persist. Still, other factors, such as social support networks, also influence Latina/os decisions to persist in college.

Social support networks. Research suggests that Latina/os become disheartened about education when they encounter educational barriers (Matute-Bianchi, 1986). Because many Latina/os are socially excluded from their respective college campuses once in college (Gloria, Castellanos, & Orozco, 2005; Hurtado & Ponjuan, 2005), their need for support is integral for their adjustment to college (Schneider & Ward, 2003) and ultimately, postsecondary success. As previously mentioned, family support, specifically from parents, has been found to be a crucial source of support for many Latina/os in college (Arellano & Hurtado, 1996; Gandara, 1995; Gloria & Rodriguez, 2000;

Hernandez, 2000; Rendon, 1994). Also, siblings and members of the extended family (e.g., cousins) are vital sources of support for Latina/os college students (Gloria & Castellanos, 2003; Gloria & Segura-Herrera, 2004). However, Zambrana, Dorrington, and Bell (1997) posit that in addition to family support, Latina/o college students must find other systems of support on campus. Hence, another important source of support for Latina/o students, which will be explored in the next section, comes from faculty/mentors (Hernandez, 2000). While family and faculty/mentors have been empirically found to be positive sources of support for Latina/os, the role of peers, though less researched, and participation in campus organizations are also systems of support that can influence Latina/o decisions to persist.

Attinasi (1992) argues that students often find other students to create a network of support to mitigate the psychological, social, and physical aspects of the campus environment. Arellano and Padilla (1996) found that Latina/o affiliation with other Latina/os was also an important resource. As such, Latina/os' affiliation with other Latina/o college students plays a crucial role in their motivation to succeed academically, especially in predominantly white university settings (Ethier & Deaux, 1990), particularly if they do not feel they are being supported by other aspects of the institution (Schneider & Ward, 2003). Likewise, Hurtado, Carter, and Spuler (1996), for instance, found that students often referred to friends or peers as sources of support in their transition to college. In a recent study, Gloria, Castellanos, Lopez, and Rosales (2005) found that in addition to perceptions about the campus environment, academic nonpersistence decisions of Latina/os were a result of a lack of perceived support from

friends and mentors. While some Latina/os did not perceive a strong sense of support from friends, others who did were found to have increased self-efficacy (Gloria et al. 2005). As a result, Latina/os who perceived strong social support via friends and mentors also reported higher levels of self-efficacy which ultimately favorably predicts their decisions to persist.

As such, the importance of peer support systems is crucial for students of color, especially Latina/os. Hurtado and Kamimura (2003) assert that Latina/o student organizations and peer mentor systems are a few associations that can foster systems of support. Gloria et al. (2005) argue that, "Implementing formalized peer-mentor programs by collaborating with student organizations that are Latina/o specific would assist students to develop strong internal and external university connections…" (p. 216). Additionally, Rodriguez et al. (2000) emphasize the importance of cultural centers as a means to promote social and academic interaction between students. However, it is important to note that, according to Schneider and Ward (2003), the *actual* role of peers and Latina/o student involvement in organizations has yielded inconsistent results in studies. While some studies have found that students have a higher adjustment to college when they both perceive support from peers and are involved in organizations (Mayo, Murguia, & Padilla, 1995; Suarez, Flowers, Garwood, & Szapocznik, 1997), other studies maintain that peer support does not predict academic performance (Mayo et al., 1995) or psychological adjustment (Kenny & Stryker, 1996) of Latina/o college students.

More recently, Schneider and Ward (2003) found that general peer support *not* Latina/o peer support significantly predicted Latina/o adjustment to college. The authors dispute that their findings and conflicting findings in previous studies is predicated on the demographic composition of each university. According to Schneider and Ward (2003), "when Latinos are vastly underrepresented in the institution, Latino peer support may not be enough to buffer highly identified Latinos from the lack of support they feel from other sources on campus" (p. 552). The role of peers and student involvement in Latina/o campus organizations is contingent on the ethnic make-up of students and the amount of ethnic specific organizations found on respective college campuses. Clearly, these two aforementioned compositions of universities might limit Latina/o college students' ability to create and join social support networks that are only comprised of other Latina/os. Despite the contradictory results of studies pertinent to the role of peer and student involvement of Latina/os college students' psychological adjustment to college, besides family, faculty and their interaction with Latina/o college students continuously has been found to be a paramount piece linked to their decisions to persist (Oseguera, Locks, & Vega, 2009).

Faculty/mentors. The interaction between students and faculty has been an area that has been and continues to be extensively researched (Astin, 1993; Bean, 1985; Feldman & Newcomb, 1969; Gloria et al. 2005; Hernandez, 2000; Kuh & Hu, 2001; Lundberg & Schreiner, 2004; Mayo, Murguia, & Padilla, 1995; Pascarella & Terenzini, 1976; Tinto, 1993; Umbach & Wawrzynski, 2005). Anaya and Cole (2003) note that, "Professors are an integral aspect of the college environment, as are their interactions

with students" (p. 96). Meaningful student-faculty interactions, assert Kuh and Hu (2001), are crucial to both student learning and personal development. Similarly, Astin (1993) concluded that frequent interactions with professors inside and outside of the classroom result in greater student satisfaction. In addition to recurrent interactions between student and faculty, the nature of the conversation is also critical. For example, faculty and students who converse about career goals and intellectual topics (e.g., course content) has shown to have the greatest influence on the personal and academic development of students (Pascarella & Terenzini, 1991). Despite the plethora of research that examines student-faculty interactions fewer studies examine the impact of student-faculty relations for minorities (Anaya & Cole, 2003). However, research has been conducted in recent years to not only address the need for diverse faculty but what influence they have on minority students' persistence in college (Castellanos & Jones, 2003; Hernandez, 2000; Mayo, Murguia, & Padilla, 1995; Osegura, Locks, & Vega, 2009).

In fall 2007, minorities comprised roughly 18% of faculty with Hispanics accounting for 4% (NCES, 2010c). Despite the dismal percentage of Latina/o faculty, the presence of diverse faculty, though limited, sends students a "message of inclusivity" (Osegura, Locks, & Vega, 2009, p. 37). Further, the presence of ethnically diverse faculty on college campuses positively affects minority student retention (Castellanos & Jones, 2003; Hernandez, 2000). Minority students who interact with faculty outside of the classroom are more apt to persist to degree completion (Schuh & Kuh, 1984). Mayo, Murguia, and Padilla (1995) found that a significant predictor of social integration lies in

the quality of the relationship students have with diverse faculty. A year later, Hurtado, Carter, and Spuler (1996) found that students who had higher levels of interaction with faculty adjusted to college more easily than students who did not. Ultimately, "faculty interaction can influence a student's sense of belonging by making complex environments feel more socially and academically supportive" (Johnson, Soldner, Leonard, Alvarez, Inkelas, Rowan-Kenyon, & Longerbeam, 2007, p. 527). In short, faculty interaction with students can help them feel less marginalized and embraced in an environment where students feel they are supported. Even more so, quality interaction with faculty has found to positively affect the GPA of Latina/o students (Anaya & Cole, 2001). Retention of Latina/o students, as a result, increased when they perceived that faculty genuinely cared about them as individuals, their welfare (Hernandez, 2000), and their success in college (Swail, Redd, & Perna, 2003).

Such faculty, Osegura, Locks, and Vega (2009) surmise, serve as role models to students who might doubt their ability to be successful in their college environment. In an attempt to become role models and give back to their respective community, many faculty of color spend time mentoring minority students (Stanley, 2006). For many students, the presence of faculty of color not only indirectly communicates information about their own future prospects (Zirkel, 2002) but serves as a reminder of how people—like them—have been able to successfully navigate the educational system (Gloria & Rodriguez, 2000). Yet, another valuable dimension of diverse faculty is their ability to mentor students, which Tinto (1993) argues is integral to student persistence in college. Sedlacek (1989) and Gloria and Castellanos (2003) assert that minority students are

more inclined to succeed in school if they have mentors/role models. Hence, "locating and establishing mentoring relationships with Latina…female faculty is also a relevant concern for women of color" (Gloria & Castellanos, 2003, p. 83). Similarly, Arellano and Padilla (1996) found that the importance of Latina/os' to have an influential person, outside of family members, privileged them to access information pertinent to college (e.g., financial aid, study habits, nuances within classrooms, etc) that they could not otherwise obtain. In addition to providing Latina/os' access to information, the quality of faculty and student interaction can positively mediate a student's sense of belonging on a campus whereby otherwise they might feel isolated.

Campus climate. Even though universities have increased the number of minority students and faculty on respective campuses, this does not ensure that the climate will reflect one of inclusion (Gurin, Dey, Hurtado, & Gurin, 2002). As such, the acknowledged need and subsequent attempts by universities to create a "welcoming" climate has resulted in limited success (Swail, Redd, & Perna, 2003).Consequently, some Latina/os feel unwelcomed (Gloria, 1997) and alienated (Ponterotto, 1990) on their respective college campuses. Swail, Redd, and Perna (2003) note that, "Lack of diversity in student population, faculty, staff, and curriculum often restricts the nature and quality of minority students' interactions inside and outside the classroom, threatening their academic performance and social experiences" (p. 58). Put another way, a campus climate that is not perceived by some students as inclusive can negatively affect their ability to integrate into the academic and social aspects of the college experience which ultimately jeopardizes their ability to persist. As such, Hurtado, Milem, Clayton-

Pederson, and Allen (1998) argue that Latina/os' perceptions of their college environment influences the academic and social aspects of collegiate life.

Oseguera, Locks, and Vega (2009) contend that, "As Latina/os navigate the many facets of higher education, they are confronted with institutional customs that do not reflect their own traditions and assumption-based practices about students who do not apply to them" (p. 35). Latina/os on college campuses, in other words, often experience incongruence between their home culture and school culture (Castillo, Conoley, Choi-Pearson, Archuleta, Phoummarath, & Van Landingham, 2006; Torres, 2006). Cultural congruity is, defined here as, the extent in which students' values match the values of the institutional environment (Gloria & Robinson Kurpius, 1996). Torres (2006) suggests that dissonance occurs for Latina/o college students when they feel that they must choose one culture over the other (e.g., home vs. school). Consequently, Latina/o college students, as a result of culture shock, begin to question their ability to be successful in their respective college environment (Castellanos & Jones, 2003; Gloria, Castellanos, & Jones, 2005; Hurtado & Ponjuan, 2005; Jalomo & Rendon, 2004).

Ultimately, studies have found students' perceptions of biases and prejudices on the premises of race and ethnicity, to name a few, makes it difficult for them to socially and emotionally adjust to their respective college campus (Hurtado & Ponjuan, 2005; Nora & Cabrera, 1996). As a result, some students feel isolated on campus on the premise of either race or culture (Padilla, Trevino, Gonzalez, & Trevino, 1997). Nora and Cabrera (1996) found that Hispanic students who perceived discrimination and prejudice on campus and in the classroom affected their ability to perform academically,

their relationships with faculty, and among others, their commitment to the institution. As a result, their decision to persist was also indirectly influenced. Similarly, Hernandez and Lopez (2005) contend that, "It is possible that students will not adjust academically or socially if the campus racial climate allows these students to feel like outsiders. This feeling of marginality will affect a student's sense of belonging with the institution and can ultimately influence one's intent to persist" (p. 43). Hence, some students' dropout or feel that they are "pushed out" of higher education when they feel unwelcomed on campus (Gloria & Castellanos, 2003).

Despite the many factors that influence, either directly or indirectly, Latina/o persistence at institutions of higher education, it is vital to remember that *no* single aspect of the student experience, whether it be academically, psychologically, or socially, accounts fully for their decision to persist. Hurtado and Kamimura (2003) assert that, "In order for Latina/o students to succeed in college, we must understand that retention is contingent on numerous structures of institutional support and student experiences in college" (p. 139). As such, understanding the persistence decisions of Latina/o students is a multi-layered issue that remains as complex as ever. For example, the role of peers and student involvement in specific race/ethnic campus organizations may continue to yield contradictory findings as Latina/os' decision to persist are situated in numerous individual, social, and academic aspects of their college experience. Nora (2003) contends that, "true access cannot be reduced to guidelines that merely open the doors for Hispanic students but do nothing to provide those experiences vital for them to remain enrolled until graduation" (p. 64).

Rationale for Examining Social Support Networks and Climate

While this chapter details literature pertinent to the various factors (e.g., familial influence, demographic/student characteristics, finances, faculty role models, etc) that influence persistence and non-persistence decisions of college students, it is appropriate to elaborate on why, for the purpose of this study, only social support networks and climate are examined. In no way does the exclusion of other factors and the sole focus on social support networks and climate account for the entirety of persistence or non-persistence decisions of students. Rather, an emphasis on social support networks and climate seeks to add to the limited understanding of how successful minority female engineers utilize social support networks and navigate the climate in their respective degree program.

Social support networks. As noted in the literature, Latina/os experience social exclusion on college campuses (Gloria et al.2005; Hurtado & Ponjuan, 2005) and support is integral for their acclimation to college (Schneider & Ward, 2003). Few researchers dispute the role that social support networks (e.g., family, friends, faculty, student organizations, etc) play in students' decision to persist (Attinasi, 1992; Cavazos, Johnson, & Sparrow, 2010; Gloria & Castellanos, 2003; Gloria & Rodriguez, 2000; Hernandez, 2000; Rendon, 1994; Zambrana et al. 1997). While the importance of family, siblings, and friends as support networks has been continuously found in research (Gloria & Castellanos, 2003; Gloria & Rodriguez, 2000; Hernandez, 2000; Rendon, 1994), Zambrano et al. (1997) maintain that students need other systems of support. The need for students, especially minorities, to have other systems of support is not disputed

in the research arena. Discrepancies, however, reside in whether Latina/os benefit more from general support networks (Schneider & Ward, 2003) or from their affiliation to other Latina/os (Ethier & Deaux, 1990; Hurtado & Kamimura, 2003). Nonetheless, social support networks remain critical for Latina/os' decision to persist.

Research on how Latina/os utilize social support networks to mitigate their social exclusion on college campuses is necessary to better understand how Latinas utilize systems of support to combat the social and gender exclusion they (and other minorities) encounter in engineering. While literature addresses the importance of social support networks, fewer studies examine who or what *actually* comprise the social support networks of female minorities pursuing undergraduate engineering degrees. Indeed, Latinas create and utilize social support networks to navigate their respective engineering degree, but what do their social support networks entail? Who or what is involved and to what capacity are individuals, organizations, faculty, or centers utilized? Such questions warrant further examination as Latinas, who earned only 10.6% of engineering undergraduate degrees in 2008 (NSF, 2008), continue to be underrepresented in engineering.

Climate. The social exclusion of Latina/os at universities (Gloria et al. 2005; Hurtado & Ponjuan, 2005) speaks to the climate found on college campuses. Incidents of bias and prejudice threaten students' social adjustment to college (Hurtado & Ponjuan, 2005; Nora & Cabrera, 1996) and consequently, make students feel like outsiders (Swail et al. 2003). In an attempt to make students feel more inclusive, universities have increased student and faculty diversity (Gurin et al. 2002) but such measures have

yielded limited success (Swail et al. 2003). Such changes to student and faculty demography do not ensure that a climate that promotes inclusion for *all* students will result.

In addition to an exclusion climate on the premise of race/ethnicity, research has also shown that female students also feel a "chilly climate" on college campuses (Schulze & Tomal, 2006). A "chilly climate", as previously noted, refers to a climate whereby faculty and student behaviors create an unfavorable and negative opportunity for learning and teaching (Schulze & Tomal, 2006). A landmark study by Hall and Sandler (1982) found that faculty, often inadvertently, create and promote gendered perspectives about students' goals, career choices, among others, on the basis of sex rather than abilities. Women, more often than men, attest to a "chilly climate" on college campuses (Hall & Sandler, 1982; Schulze & Tomal, 2006).

The lack of social inclusion felt by Latina/os and the "chilly climate" felt by women on college campuses certainly examines climate at the macro-level of the institution. Probing into the micro-levels of the institution, particularly the climate of science and engineering departments, have documented similar assertions in regards to race and gender. Women of color in STEM, according to some researchers (Johnson, 2001; Smyth & McArdler, 2004; Sosnowski, 2002), have experienced a negative climate in regards to their race. Dingel (2006) similarly found that women in science classrooms are made to feel out of place and that they lack knowledge. Such studies have either examined students of color in STEM *or* women in STEM. Certainly this research is vital to better understand the experiences of minorities and women in STEM. Researchers,

however, must begin to consider and examine both race *and* gender of female minorities who pursue and persist in engineering disciplines. This study, which focuses on Latinas, seeks to add to the limited research on how female minorities navigate climate as they pursue undergraduate engineering degrees.

The Future of Latinas in STEM

While years of research on Latina/o persistence has provided some insight into their college experience and subsequently has offered institutions practical recommendations to improve college graduation rates of this student population, further research is necessary to understand their persistence within certain disciplines (e.g., science, technology, engineering, and mathematics, STEM) where they remain almost nonexistent. Some disciplines, specifically technology and engineering, remain male-dominated as women are found in limited numbers and minority women, specifically Latinas, are found in even fewer numbers. Since women and minorities are projected to comprise a majority of the workforce, effective programs must be designed not only to attract women and minorities to STEM disciplines but to ensure their degree attainment (Hyde & Kling, 2001; Walsh & Heppner, 2006).

While there has been a proliferation of research in recent years that addresses the retention and persistence of both women and minorities in STEM disciplines (AAUW, 2010; Chubin, May, & Babco, 2005; Cole & Espinoza, 2008; Rittmayer & Beier, 2009; Tomas Rivera Policy Institute, 2008; Varma, 2009; Wyer, 2003), fewer studies have examined the factors pertaining to minority women's persistence in STEM, particularly research that focuses on females from a specific ethnicity. In addition to differences in

the experiences of females from a specific ethnicity, it is also vital to note that only those pursuing an engineering undergraduate degree take part in this study primarily because many researchers argue that factors and experiences that influence persistence decisions vary across STEM fields (Kokkelenberg & Sinha, 2010; Ost, 2010; Rask, 2010).

To be fair, there is a plethora of factors that can influence college student persistence, regardless if they pursue a STEM or non-STEM undergraduate degree, and any attempt to address *all* of the factors is nearly impossible. What is not in doubt is the fact that racial and ethnic minorities are more apt to leave institutions of higher education (Carter, 2006). The certainty of the preceding statement and previously noted literature in this chapter about Latina/os in STEM suggests that further inquiries into the persistence of ethnic minorities must be pursued. Because of the impossibility to address *all* of the factors, this study sought to focus *only* on the perceptions of social support networks and climate of Latinas' pursuing an undergraduate technology or engineering degree. Both aspects are integral to college students' decisions to persist. Data gathered brought insight into the perceptions of Latinas' social support networks of familial support, organizational participation, and faculty interaction as well as the departmental and classroom climate.

Certainly, there are different methods of inquiry that can shed insight into why some students persist while others do not. While a majority of the research conducted on student persistence has been quantitative in nature, Attinasi (1989) and Tierney (1992) agree that student persistence must be examined through a qualitative method of inquiry.

Such method of inquiry was implemented in this study, and a thorough explanation of the processes, rationales, and findings are detailed in the following chapter.

CHAPTER III

METHODOLOGY

Research is a systematic form of inquiry that produces knowledge and subsequently, expands the knowledge base that people have about a particular topic or issue (Gay & Airasian, 2003; Merriam, 1991). The method of inquiry employed in a study is often dictated by the research problem and more specifically, the manner in which the researcher has decided that knowledge is constructed (Merriam, 1998). Because one's way of knowing is shaped through distinct and personal lenses, the manner in which knowledge is acquired also differs from researcher to researcher (Gravetter & Forzano, 2006). On the one hand, researchers who possess a positivist view of the world support the quantitative method of inquiry which suggests that knowledge and experiences can be quantified mostly through statistical data. Constructivists, on the other hand, utilize a qualitative approach in research because they believe that knowledge is value-bound (Lincoln & Guba, 1985) and exists within the contextual meaning of multiple realities (Merriam, 1998). Denzin and Lincoln (2011) further add that "Qualitative research is a situated activity that locates the observer in the world" (p. 3). Still it is vital to acknowledge that researchers who come from different paradigmatic views of the world can take the same research problem and examine the issue how they see fit.

My research study sought to gain a better understanding of the perception of social support networks and climate in the persistence of Latinas pursuing an undergraduate technology or engineering degree. The problem statement and literature

review revealed that Latinas, members of the largest growing U.S. population, remain understudied in relation to their success in higher education and more specifically, in regards to their success in STEM fields. With the research question in mind, the intent of the proceeding sections is to first explain the research design, specifically the method of qualitative research employed. Second, criterion for participants and rationales for each site selection is detailed. Third, method of data collection and data analyses are described. Fourth, trustworthiness of the study is established. Fifth, the limitations and delimitations of the study are explored. Last, researcher positionality is discussed.

Research Design

Essentially, the research design is a "sufficient blueprint for your study" (Yin, 2009, p. 36). When choosing a particular model researchers must decide if their research problem and the method of inquiry that they will employ to find knowledge "fit" their paradigmatic view of the world. Merriam (1998) contends that:

> Choosing a study design requires understanding the philosophical foundations underlying the type of research, taking stock of whether there is a good match between the type of research and your personality, attributes, and skills, and becoming informed as to the design choices available to you within the paradigm. (p. 1)

In essence, researchers must determine if their paradigmatic world view fits the method of inquiry in which they wish to examine their research problem. My paradigmatic view of the world aligns with the belief that humans are accurate and effective research instruments (Lincoln & Guba, 1985). As such, humans, as research instruments, are

necessary to understand a phenomenon which cannot be captured by statistical data. Hence, "the questions raised and methods [employed in a study] are functions of the researcher's worldview" (Merriam, 1991, p. 43).

In addition to the importance of the researcher's worldview, the research design of a study "requires theoretical assumptions" (Yin, 2009, p. 36). Theoretical assumptions are derived from both theory and literature. Boeije (2010) posits that, "theory refers to coherent frameworks that try to describe, understand and explain aspects of social life" (p. 21). While theory is constructed frameworks that explain phenomenon, literature available on the issue, in turn, provide the knowledge that already exists on the issue (Boeije, 2010). When examining a phenomenon, researchers must review the literature that already exists on the issue in order to design a research study, specifically construct research questions, which ultimately seek to expand the knowledge base of the phenomenon being investigated. Yin (2009) asserts that, "the complete research design will provide surprisingly strong guidance in determining what data to collect and the strategies for analyzing the data" (p. 36). In sum, a research design is framed by the paradigmatic view of the researcher and an extensive review of the literature pertinent to the phenomenon being examined. Only then can "questions, propositions, units of analysis, logic connecting data to propositions, and criteria for interpreting the findings" (Yin, 2009, p. 36) be achieved—all necessary components of any research design.

Constructivism. Constructivists believe that multiple realities exist (Lincoln & Guba, 1985; 1989) and therefore, that there is no one single truth in the world. They believe individuals can only be understood in holistic terms; hence, participants

construct their own realities (Lincoln & Guba, 1985). Unlike positivists, constructivists believe that the inquirer and knower are inseparable (Lincoln & Guba); one cannot work in isolation of the other. Ponterotto (2005) adds that, "Only through this interaction can deeper meaning be uncovered" (p. 129). Additionally, constructivists assert that cause and effect relationships do not exist in the pursuit of knowledge because there are multiple variables in any given context (Lincoln & Guba). In short, "The constructivist seeks to explain how human beings interpret or construct some X in specific linguistic, social, and historical contexts" (Schwandt, 2007, p. 39).

Several qualitative research studies have been employed in an attempt to better understand the essence of Latina/o shared experiences in higher education (See Rivas-Drake, 2008; The Tomas Rivera Policy Institute, 2008). Qualitative methods of inquiry are "more adaptable to dealing with multiple (and less aggregatable) realities" (Lincoln & Guba, 1985, p. 40). In brief, constructivists believe that an individual's reality is contingent on her/his worldview (Patton, 2002). As the researcher, a constructivist approach to this study suggests that I must recognize the core of each participant's experience in order to understand the phenomenon of the perceptions of social support networks and climate in the persistence of Latinas pursuing a technology or engineering undergraduate degree.

Case study. Despite the increased use of case studies as a research tool in many situations and throughout various disciplines, the premise of what constitutes a case study differs among researchers (Schwandt, 2007; Yin, 2003; 2009). As a result, several definitions of case study exist. Case studies, according to Yin (2009), address the how or

why questions of a particular phenomena. Yin further asserts that a researcher would utilize a case study method if they "wanted to cover contextual conditions—believing that they might be highly pertinent to the phenomenon of study" (p. 13). For the purpose of this study, "case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2009, p. 18). Put another way, a case study method enables me, as the researcher, to take into account the contextual conditions of the phenomenon being studied. As such, the researcher's belief is that context is crucial to better understanding the phenomenon. Yin further contends that:

> [T]he case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis. (p. 18)

In essence, recognizing the comprehensive and holistic research strategy that is the nature of a case study approach (Merriam, 1998; Yin, 2003; 2009) allows me to better understand the phenomenon of the perception of social support networks and climate in the persistence of Latinas pursuing a technology or engineering undergraduate degree. What follows is the criterion for participants, and the rationale for the chosen site selections of this study.

Participant and Site Selections

In order to answer a research question(s), strategies for choosing units (e.g., people, locations, organizations, etc) to participate in the study must be employed (Schwandt, 2007). Researchers, Thorne (2008) posits, "need to find ways of thinking about the sample [subsets] we create for the purpose of answering any research question, come up with rational arguments about why they are worth attending to, and estimate what angle of opinion or perspective they are likely privileging or silencing" (p. 88). To put it differently, researchers are intentional about, among other things, the participants and site selections utilized in a study for many reasons. First, researchers want to ensure that their research question(s) will be answered. Second, researchers must provide a logical reason for choosing particular units to take part in the study. Third, researchers must recognize that their choices of participants and site selection(s), for instance, will elicit specific perspectives.

As such, inherent in every research study is the selection of participants (Gravetter & Forzano, 2006). Sampling approaches, Patton (2002) suggests, is where the distinction in terms of logic lies between qualitative and quantitative methods of research. Participants, within the context of qualitative studies, are comprised of a small group of individuals (Gravetter & Forzano, 2006). Known as a sample, participants in qualitative studies refer to a "set of individuals selected from a population and usually is intended to represent the population in a research study" (Gravetter & Forzano, 2006, p. 117). The small sample size, Patton (2002) asserts, enables qualitative researchers to focus in depth on the participants. The following sections explain the sampling of units

(e.g., participants and site selections) for this study as well as establish the logic for why such units were chosen.

Participant sampling. Participants for this study were comprised of a purposeful sample. Marshall (1996) contends that with a purposeful sample, "The researcher actively selects the most productive sample to answer the research question" (p. 523). Because the number of participants in qualitative studies is small, a purposeful sample enables the researcher to examine and understand the phenomenon in depth (Patton, 2002). The purposeful selection of participants, typically a result from the criterion established by the researcher to answer the research question(s) of the study, often leads to "information-rich cases" (Patton, 2002, p. 230) whereby participants impart thorough information about the phenomenon under study. Schwandt (2007) similarly notes that purposeful sampling is more concerned with the relevance of participants to the research question(s). In short, the point of purposeful sampling is to *purposefully* choose participants who will provide the most in-depth information pertinent to the research question(s). Ultimately, the researcher establishes criterion for participants in order to create the purposeful sampling that is warranted for the phenomenon of the study. While it is important to note that purposeful sampling was primarily utilized to determine and locate initial participants, other participants were found and contacted via a snowball sampling technique (Boeije, 2010).

Before detailing the criterion of participants for this study, it is noteworthy to restate the overarching research question. The question is as follows: What are the perceptions of social support networks and climate in the persistence of Latinas pursuing

an undergraduate degree in technology or engineering? As such, in order to answer the research question the following criterion is necessary for the 12 participants: 1). Must self-identify as Latina; 2). Classified as a senior; and 3). Engineering major. The preceding criteria, which will be further explored next, are necessary in order to solicit a purposeful sample that enabled me to answer my overarching research question. What follows are an explanation and the rationales of why the criterion set are necessary and crucial to the study.

While the initial intent of the study was to interview 12 participants, I only interviewed 11 Latinas. I must admit that I have a new appreciation for finding participants for a study. All of these Latinas were insanely busy with school work, midterms, projects, internships, among other commitments, which made it difficult to gain access to individuals because of scheduling conflicts. While I rescheduled some participants' interviews multiple times, other potential Latinas who met the criterion simply were not interested in participating in my study. Still, other Latinas who were interested in participating simply did not have any available time to meet for an interview despite my complete flexibility with scheduling.

Race/ethnicity. Although the Latina/o population is heterogeneous in nature, it continues to be overwhelmingly researched as a homogeneous population. Hence, it is important to note that the umbrella term of "Latina/o" encompasses various ethnicities. The Latina/o population was purposefully chosen for this study for three reasons. First, the U.S. Census Bureau (2008b) reported that 45.5 million, or an estimated 15.1% of the U.S. population, were Hispanic. Second, bachelor degree attainment remains dismal for

Hispanics as they earned only 8.1% of *all* bachelor degrees awarded in 2008-09. Third, the low bachelor degree attainment for Latina/os in science and engineering, which will be further detailed shortly, remains to be under-examined in the research arena (Rochin & Mello, 2007).

Senior. A major focus of this study is to examine Latinas who persist in their pursuit of a technology or engineering undergraduate degree. Tinto (1996) contends that 57% of college students drop out before their sophomore year in college. Additionally, Brainard and Carlin (2001) found that retention rates for women in STEM dramatically increase after their sophomore year because "students have persevered through the hurdles of the lower-level prerequisite courses…[and] the cost of switching, in terms of lost time and effort, increases as time goes on" (p. 33). While students classified as juniors are also suitable participants for this study, they were primarily excluded because seniors are more apt to have the highest rate of persistence. As such, in an attempt to understand the persistence of students, participants must be classified as a senior as their chances to persist to degree completion increases.

STEM majors. The last integral criterion that is necessary in order to answer the research question is that possible participants must be declared undergraduate technology or engineering majors. It is important to note that while the acronym STEM refers to science, technology, engineering, and mathematics, participants for this study were *only* engineering undergraduate majors primarily because of their continued underrepresentation in the aforementioned discipline. Even though females continue to be underrepresented in the hard sciences (i.e., physics, chemistry), they have advanced,

and even in some cases even surpassed, males in the social and life sciences (i.e., psychology, agricultural, biological) (NSF, 2008). However, females continue to be vastly underrepresented in engineering. In 2006, females earned *only* 22% of engineering degrees (NSF, 2008). Further disaggregation of data in 2008 indicated that Latinas were awarded *only* 10.6% of engineering degrees (NSF, 2008). As such, the intent is to examine Latinas who persist in their quest for an engineering undergraduate degree as their rate of degree attainment remains dismal.

Table 3. Participants' Demographics

Name	Parental Occupation	Advanced Courses in HS?	Ethnicity of HS population	Hometown	Institution	Expected Date of Graduation
Sarah	Restaurant Owner (F)* & Housewife (M)*	Yes	White & Mixed	Madisonville, TX	UT	May 2013
Dre	Civil Engineer (F) & Housewife (M)	No	Hispanic	El Paso, TX	UT	Dec. 2013
Alicia	Landscaper (F) & Housewife (M)	Yes	Hispanic	Mission, TX	UT	May 2013
Chilanga	Insurance Broker Firm Owners	No	Mexican	Mexico City, MX	UT	May 2012
Clara	Retired	Yes	White--Minorities	Austin, TX	UT	May 2012
Cristina	Registered Nurses	Yes	Hispanic	Victoria, TX	UT	May 2012
Liliana	Small Business Owner (F) & Housewife (M)	Yes	Hispanic	El Paso, TX/Juarez, MX	UT	May 2012
Marcie	Materials Manager (F) & Teacher Assistant (M)	Yes	Hispanic	Del Rio, TX	UT	May 2012
Sophie	Civil Engineer Technician (F) & Counselor (M)	Yes	White & Mexican-American	Corpus Christi, TX	UT	Dec. 2012
Esperanza	Engineer (F) & Banker (M)	Yes	African-American	Long Beach, CA	UCB	May 2012
Sara	Driver (F) & Homemaker (M)	No	Latino	Pomona, CA	UCB	Dec. 2012

* (F) denotes father; (M) denotes mother.

The preceding table details the participants' demographics. Based on the demographics, participants were mostly born in the United States. Interesting to note is the highly selective nature of this sample which, based on their responses on the demographic sheet, show that parents, for the most part, had high salaried occupations. The nature of their socioeconomic status suggests that finances were not an additional stressor for participants. This suggests that a large number of participants came from economically privileged backgrounds. Also, the fact that many participants took Advance Placement (AP) courses in high school speaks to the rigor of the curriculum in their pre-college preparation which serves as an important indicator of student success in college especially in STEM related disciplines.

Site selections. The study was conducted at two universities: The University of California at Berkeley (Berkeley) and The University of Texas at Austin (UT). In addition to both being flagship universities of their respective states, California with 36.6% and Texas with 36.2% are the top two states in which the U.S. Hispanic population resides (Pew Hispanic Center, 2008). Also, both Berkeley and UT have been members of the Association of American Universities since the early 20th century. What follows are demographic descriptors of Berkeley and UT in terms of female to male enrollment, and further disaggregation of student demographic data, particularly in relation to the Hispanic/Chicana/o/Latina/o population. Subsequently, a brief engineering profile of both Berkeley and UT are discussed. The section then concludes with a comparison of recent national rankings between Berkeley and UT.

Berkeley. According to the Berkeley Office of Student Research and Campus Surveys (2010a), the total student enrollment was 35,838 with 25,540 students comprising the undergraduate population in Fall 2010. Of the 25,540 undergraduate student population, women constituted 13,513 or 52.9 % of enrolled undergraduates (Berkeley Office of Student Research & Campus Surveys). Further disaggregation of enrollment data on the basis of demographics indicates that Mexican/Mexican-American/Chicana/os constituted approximately 7.15% of the total student population in the fall of 2010 with 2,561 Mexican/Mexican-American/Chicana/os enrolled at Berkeley (Berkeley Office of Student Research and Campus Surveys, 2010b).

Engineering at Berkeley. According to the Berkeley Engineering website (n.d.), engineering programs were first offered in 1868, the same year the university was chartered. The website also reports that 23% of engineering students are women, though it does not specify if this percentage includes both undergraduate and graduate engineering students. Additionally, the department website (n.d.) reveals that 74% of undergraduate engineering students at Berkeley receive financial assistance (e.g., scholarships, loans, or other financial monies) to help offset the cost of tuition. Table 4 below indicates the number of students per engineering department in Spring 2011 (Berkeley Engineering website, n.d.).

Table 4. Number of UCB Undergraduate Students by Department: Spring 2011.

Department	Number of Students
Bioengineering	396
Civil & Environmental Engineering	352
Electrical Engineering & Operations Research	119
Materials Science & Engineering	548
Mechanical Engineering	548
Nuclear Engineering	54
Engineering Others*	283

Source: *Berkeley Engineering Website* (n.d.). * Includes engineering mathematics and statistics, computational engineering science, engineering physics and environmental engineering science.

The numbers in the table indicate that there were 2,870 undergraduate engineering students enrolled at Berkeley in Spring 2011.

The small engineering population, a mere 11% of the total undergraduate population, and the revelation that approximately 23% of engineering students are women illustrates that there are more male engineering students at Berkeley. This statistic also mirrors most, if not all, engineering colleges throughout the country. Literature (See Cech, Rubineau, Silbey, & Seron, 2011; McLoughlin, 2005) has well documented the instances of sexism within engineering departments. Berkeley's College of Engineering is no exception. Details of sexist incidents involving a female senior mechanical engineering and material sciences major surfaced in late October (Perez,

2011). The female engineer, who is white and has blonde hair, claims she has been called the "Barbie engineer" by many of her male classmates on numerous occasions (Perez, 2011). Moreover, she shared that, at times, during group work she has been accused of having PMS. Sexist comments, according to this engineer's experience, did not only come from male classmates. One of her male professors, who had just returned from a trip to Saudi Arabia where women are not allowed to drive, jokingly shared with his class that women not being allowed to drive "wasn't a bad idea." While her classmates laughed at the professor's joke, many also looked at the female engineer in order to "gauge her reaction." Such displays of sexisms, though recently surfaced at Berkeley, continue to be sources of contention for many female engineering students remains prevalent.

Another recent controversy is the decline of minority student enrollment into Berkeley's College of Engineering. In 2009, the Center for Underrepresented Engineering Students (CUES) was eliminated by the college and replaced with the Engineering Student Services (ESS). Since then the numbers of minority students accepted into the engineering school has decreased. In 2008, three African Americans, two Native Americans, and thirty-three Hispanics were admitted, out of a freshmen class of 563 students, to Berkeley's engineering school. The numbers became more dismal in 2010 as, out of a freshmen class of 474, only two African Americans, three Native Americans, and ten Hispanic freshmen were accepted into the engineering school (Perez, 2011, Nov. 17, n. pg).

Concern over the sexist comments of the reported incidents shared by the senior female engineer and the decline in minority student enrollment into Berkeley's College of Engineering has sparked outrage from student organizations. Presidents of eight student groups claimed in a letter to the college dean and to the college executive committee that the sexist incidents accounted by the senior female engineer are 'emblematic of other students' experiences' (Perez, 2011, Nov. 21, n. pg.). In late November, the dean and the executive committee were also presented with a list of recommendations from the Coalition of Underrepresented Engineers (CUES) to improve diversity and equity. Some of the recommendations, among others, include a January 2012 deadline to make engineering student enrollment of women and minorities to be disseminated via the university website. Additionally, CUES recommended that by March 2012 funding be provided to hire additional staff in the Engineering Student Services (ESS) in order to create and implement a recruitment and retention plan for women and minorities. The additional staff will also actively recruit women and minorities into the college of engineering at the bachelor's, master's, and doctoral levels. The dean of the College of Engineering expressed support for a diversity plan that "create[s] a recruitment and retention plan for women and underrepresented minority students" (Perez, 2011, Nov. 21, n. pg.).

UT. In 2010, females constituted 50.5% of the student population. The total student enrollment for Fall 2010 was 51,195 with undergraduate students comprising 38,420 of the student population (UT Office of Information Management and Analysis, 2010). Diversity-wise, the Hispanic population numbered 8,720 students, which

comprised 17% of the total student population (UT Office of Information Management and Analysis, 2010).

Engineering at UT. UT's undergraduate engineering enrollment, similar to Berkeley's, is comprised mostly of men. According to the Cockrell School of Engineering website (n.d.), men account for 78% and women 22% of the 5,548 undergraduate engineering student population in Fall 2011. Unlike Berkeley, UT's College of Engineering website details the ethnic demographics of engineering students. The table below indicates the ethnic breakdown of undergraduate engineering students.

Table 5. UT Undergraduate Enrollment by Ethnicity.

Ethnicity	**Percentage**
White	50%
Asian	22%
Hispanic or Latino	17%
Foreign	7%
African American or Black	2.5%
*Other	1.5%

Source: *Cockrell School of Engineering Website* (n.d.). * Includes multi-race (except African American or Hispanic), American Indian or Alaska Native, Multi-race (one being African American), Native Hawaiian or Pacific Islander.

As indicated in the table above, minorities (does not include Asians as they are not considered a minority in STEM disciplines) comprise only 23% of the undergraduate engineering student population.

National rankings. Moreover, recent program rankings reported by *U.S. News and World Report* (2010) indicate that Berkeley and UT are comparable institutions when it comes to their respective engineering program areas. While Berkeley has a total of nine engineering programs ranked in the Top 10, UT has six engineering programs ranked in the Top 10.

Table 6. National Rankings in Undergraduate Engineering Programs Between UCB and UT in 2010

Program Area	Berkeley	UT
Chemical Engineering	2nd	5th
Civil Engineering	2nd	4th
Electrical/Electronic/Communications	4th	NR
Computer Engineering	5th	7th
Engineering Science/Engineering Physics	4th	NP
Aerospace Engineering	NP	8th
Environmental/Environmental Health	*1st	4th
Industrial/Manufacturing	*4th	NP
Materials (Engineering)	3rd	NP
Mechanical	2nd	*9th

Source: *U.S. News and World Report* (2010). * Indicates a tie in the ranking with another university. NP indicates that there is no program. NR indicates no ranking.

Table 6 above indicates the comparable nature between Berkeley and UT when it comes to national program rankings and consequently, suggests that the rigor of STEM-related

programs at each respective university would provide comparable context-specific institutions in which to bound the phenomenon of the study.

IRB Approval

Before data collection could begin, an ethics committee, also known as the Institutional Review Board (IRB), first had to grant approval for the research study. According to Denzin (2009), "IRBs are institutional apparatuses, regimes of truth and systems of discourse that regulate a particular form of ethical conduct" (p. 277). In addition to obtaining permission from my home institution, I contacted officials at the IRB offices at both Berkeley and UT to inquire if there were any protocols that I had to file with each respective university. Electronic communication with officials at Berkeley and UT assured me that unless agents of each respective university were going to be involved as co-investigators in my study that no further approval would need to be sought. Thus, the approval of my study was only warranted from my home institution.

Data collection. Data collection is premised on individuals, their respective settings, and how such settings affect them (Patton, 1990). Determining what constitutes data is not an easy feat in qualitative work. Rather, "what constitutes data depends upon one's inquiry purposes and the questions one seeks to answers" (Schwandt, 2007, p. 128). The purpose of this study was to gain a better understanding of the perception of social support networks and climate in the persistence of Latinas pursuing an undergraduate technology or engineering degree. Within the context of this study, data were gathered via interviews, demographic sheets, and online guided questions. The preceding methods of data collection are further described in the following sections.

Before detailing the methods of data collection, gatekeepers for this study are addressed. Lastly, the latter part of this section focuses on member checking, peer debriefing, researcher reflexivity, and assurance of confidentiality.

Gatekeepers. Before participants could be recruited, relationships with gatekeepers or key informants had to be established. "The rationale for key informants", Thorne (2008) posits, "is that some members of a community will be better equipped than others to provide you with access to what is happening and why it is happening" (p. 91). Thorne further adds that key informants are integral for a researcher's ability of 'entering the field'. Establishing relationships with gatekeepers who could provide access to possible participants for this study was, at times, frustrating and certainly time-consuming. Initial electronic communications were sent the first official week that students at both Berkeley and UT returned for the Fall 2011 semester. In addition to contacting key informants provided by personal contacts, possible gatekeepers were also identified via the public online directories of both universities. Email correspondences were sent to academic and social organizations' advisers as well as to student officers of, what I deemed as, key student organizations found on each respective campus. For instance, officers of the Society of Women Engineers, Women in Computer Science, Girls in Tech, Hispanic Engineers and Scientists, to name a few, were contacted requesting assistance in finding participants for my study.

Interviews. Upon IRB approval and assistance from gatekeepers who helped me identify and contact participants, the data collection for my study moved forward. For the 11 participants in my study (nine participants at UT and two at UCB), data were

primarily collected through audio-taped, semi-structured, face-to-face interviews. Even though 11 is a small number of participants, Rubin and Rubin (1995) assert that, "People who live or work together or have similar racial, ethnic, or religious backgrounds developed shared understandings that are communicated to others in their group and constitute their culture" (p. 3). Hence, these 11 participants constituted a similar ethnic group who shared a comparable experience in their pursuit of either a technology or engineering undergraduate degree. Patton (1990) contends that, "We interview people to find out from them those things we cannot directly observe" (p. 196). As a result, interviewing was necessary to gain insight about "how people interpret the world around them" (Merriam, 1998, p. 72).

Accordingly, semi-structured protocol questions (See Appendix A) were developed and utilized as the primary method of data collection. Merriam (1998) asserts that, "Less structured formats [of interviews] assume that individual respondents define the world in unique ways" (p. 74). A strength associated with semi-structured protocol questions is that such interviews allow the interviewer to further probe or ask for clarification about any ideas the participants choose to share (Olson, 2011). Ultimately, the intent of the protocol questions was to empower participants to share their experiences within the context of their own reality.

Demographic sheet. Data were also collected via a demographic sheet (See Appendix B) that participants filled out prior to the interview. In addition to inquiries regarding parental birth place, occupation, and highest level of education completed, participants were also asked questions about any siblings and advanced courses taken in

high school, among other questions. The demographic sheet allowed me to ascertain basic information about each participant in hopes of better understanding who my participants were and where they came from (Thorne, 2008).

On-line guided questions. Three online guided questions (See Appendix C) were solicited as another source of data primarily because discussion boards, according to Meloni (2010), provide an opportunity for the enhancement or clarification of content. Bye, Smith, and Rallis (2009) assert that, "the use of asynchronous discussion forums may increase communication between students and the facilitator/instructor" (p. 843). In other words, an online discussion board, with private exchanges between each participant and me (the researcher), created another venue in which to gain insight about their experiences as Latina undergraduates pursuing an undergraduate technology or engineering degree. In this study, the online questions requested participants to reflect on group work in their courses, relationship with professors, and sense of belonging on campus (or lack thereof).

Member checks. Member checks took place during and after the interview process. Member check is a process, "whereby data, analytic categories, interpretations, and conclusions are tested with members of those stakeholding groups from whom the data were originally collected" (Lincoln & Guba, 1985, p. 314). In other words, my interpretation of the data was shared with participants in order to ensure that my analysis was a result of the experiences each participant shared rather than my own biases or lenses. Within the context of this study, member checks were conducted in two different ways. First, throughout the interview, I repeated the information shared by each

participant in order to make certain that I clearly comprehended statements that were made. Second, after the interview, participants were sent a copy of their respective transcript and encouraged to give feedback and/or to clarify any ideas that I might have misinterpreted.

Peer debriefing. In addition to member checks, peer debriefing was also implemented in this study. A debriefer "is essentially a noninvolved professional peer with whom the inquirer(s) can have a no-holds-barred conversation at period intervals" (Lincoln & Guba, 1985, p. 283). The purpose of a peer debriefing is fourfold (Lincoln & Guba): 1). To challenge the researcher with tough questions that the researcher might otherwise not ask her/himself; 2). To probe the initial hypotheses the researcher holds in order to see if the researcher can defend her/his explanation; 3). To probe any other methodological choices that might be possible or needed for the study; 4). To separate the researcher's feelings and emotions from her/his interpretation of the data. The peer debriefer I chose for this study was a former officemate and current assistant professor who has continuously challenged me to question the very core of who I am as a person and as a researcher.

Researcher reflexivity. An analytic tool employed in this study is that of researcher reflexivity. Olson (2011) surmises that reflexivity focuses on the intersection of the researcher as an individual and the researcher as representing data; a process that ultimately monitors the researcher's point of view throughout the duration of the study. For instance, researcher reflexivity can be achieved via a reflexive journal kept by the researcher throughout the study. A reflexive journal, Lincoln and Guba (1985) contend,

is “a kind of diary in which the investigator on a daily basis, or as needed, records a variety of information about *self*…and *method*” (p. 327). I kept reflexive journals, both in regards to “self” and to methods, throughout the longevity of this study. The “self” reflexive journal provided me with an opportunity to chronicle my responses to, among other, questions such as: “Who am I in relation to this study?” “What right do I have to study this research question?” and last, “To whom do the data belong?” (Olson, 2011, p. 17). While the “self” reflexive journal focused on me as a researcher in relation to this study, the methodological reflexive journal kept an account of the decisions regarding the design of my study. The latter journal notes the methodological choices of my study and documents the rationales for choosing each method (Lincoln & Guba, 1985).

Assurance of confidentiality. The assurance of confidentiality is achieved when multiple forms of data (e.g., interviews, field notes, etc) collected are handled in a manner that protects the privacy of the participants (Boeije, 2010). Within this study, several measures were implemented in order to assure confidentiality of the participants. First, prior to agreeing to participate, possible participants were given an informed consent form that disclosed how information shared would remain confidential. For example, only the chair of my dissertation committee and I would have access to the data. Second, participants created their own pseudonyms to be used throughout the study in order to protect their respective identity. I did, however, change pseudonyms only in instances where participants either did not provide a pseudonym, chose a pseudonym that coincided with the name of another participant, or used their own first name as pseudonym. Pseudonyms were utilized in the transcribing, coding, and reporting of data.

Third, participants' disciplines were only identified as engineering or computing rather than divulging their specific majors. This last measure to protect participants' confidentiality was implemented because Latinas, even though members of two large undergraduate populations, remain underrepresented in technology and engineering disciplines.

Data Analysis

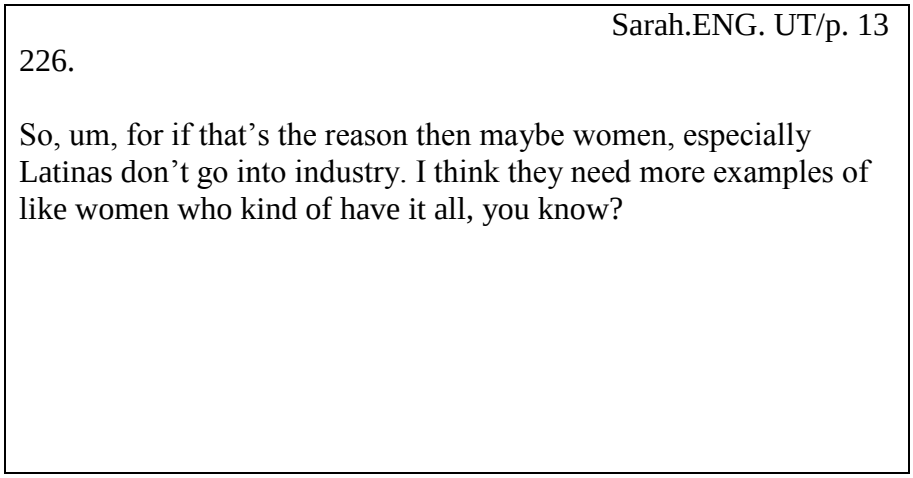
Data analysis entails a systematic process in which data collected are thoroughly examined and analyzed in order to increase the researcher's understanding of the phenomenon being studied (Bogdan & Biklen, 1992). According to Bogdan and Biklen, "Analysis involves working with data, organizing them, breaking them into manageable units, synthesizing them, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others" (p. 153). As such, one must not enter into data analysis haphazardly; rather the researcher must be engaged with the data. Ultimately, the analysis in qualitative research "transforms data into findings" (Patton, 2002, p. 432). Because data analysis is paramount to the findings of the study, the following sections will further explicate the process that aided in my identification of the categories that emerged from the data. More specifically, I address the process of how I unitized, coded, categorized and discovered patterns, identified themes, and lastly, developed and labeled categories via my data analysis.

Unitizing data. After data collection via the interviews, the demographic sheet, and the responses to the three online questions, analysis of data ensued. Interview data were transcribed verbatim removing only non-verbal language (e.g., "hmm," "uh," etc).

Once data were transcribed, a unitization of data followed through a process known as content analysis (Lincoln & Guba, 1985). Unitization of data is a process in which I, as the researcher, dissected the data from idea to idea. More specifically, unitization of data occurs when ideas can stand by themselves and can no longer be parsed (Lincoln, personal communication, March 31, 2011).

Coding. Following the unitization of data, I began the process of analysis which is referred to as coding. Schwandt (2007) asserts that, "Coding is a procedure that disaggregates the data, breaks them down into manageable segments, and identifies or names those segments" (p. 32). Lewins and Silver (2007) add that coding consists of segments of data that are examples of ideas, instances, themes, or categories that are later examined holistically in relation to the entirety of the dataset. Within the context of this study, data were coded and formatted to fit note cards (See Figure 1).

Figure 1. Example of Coded and Formatted Data



Categorization and discovering patterns. In data analysis, the goal is to decipher the "general idea about the main ideas discussed" (Olson, 2011, p. 72). Because participants in this study were purposefully chosen (e.g., Latinas, senior, technology or engineering undergraduate major), there were often similar catch phrases or experiences shared by each respective interviewee. Such similarities in describing an experience, Auerbach and Silverstein (2003) suggest, are *repeating ideas* that can be found in the data, whereby "research participants often used the same or similar words and phrases to express the same idea" (p. 37). As a researcher, it was important for me to take notice of the patterns found in data throughout my analysis. Finding such patterns throughout the data analysis further helped me identify themes and ultimately, develop and label the categories.

Identifying themes. When patterns are discovered in the data, themes are then identified. A theme, according to Auerbach and Silverstein (2003), is defined as "an implicit topic that organizes a group of repeating ideas" (p. 38). As noted in the previous section, once patterns of phrases were found to describe similar ideas, then such patterns are grouped and the identification of themes ensued. Within the context of this study, units of data were formatted and printed on note cards. I sorted and re-sorted note cards multiple times on the basis of patterns noticed during my data analysis. Essentially, I utilized a constant comparative method (Glaser & Strauss, 1967) whereby I took data on one note card and compared it to data on another note card. The goal of sorting and re-sorting the data on the note cards, ultimately, is to find data that are thematically similar

(Lincoln, personal communication, March 31, 2011). As a result, themes were identified in the data which led to the development and labeling of categories.

Developing and labeling of categories. Categories are not mechanically predetermined; "rather which categories are generated is mainly decided upon during the analysis process on the basis of what appears in the data" (Boeije, 2010, p. 76). After thorough data analysis, the following categories, which will be extensively discussed in the next chapter, were developed: 1). *Maintaining and Cultivating Systems of Support*; 2). *Connecting to Others Like Them*; and 3). *Positioning of Multi-Dimensional Gender Identities*.

Establishing Trustworthiness

In order to increase the validity and credibility of the study, several methods were employed to assure the trustworthiness of the findings. Lincoln and Guba (1985) contend that:

> The basic issue in relation to trustworthiness is simple: How can an inquirer persuade his or her audiences (including self) that the findings of an inquiry are worth paying attention to, worth taking account of? What arguments can be mounted, what criteria invoked, what questions asked, that would be persuasive on this issue? (p. 290)

Lincoln and Guba contend that researchers must take into account the "truth value", applicability, consistency, and neutrality of findings. Truth value refers to the manner in which one establishes "truth" of the findings in relation to participants and context in which the study was conducted. Applicability refers to the extent in which the findings

of the study are applicable to other contexts. Consistency refers to the ability to replicate similar findings in similar contexts with similar participants. Neutrality refers to the findings of the study being a result of the participants rather than of the biases or interests of the researcher. What follows are a detailed explanation of truth value, applicability, consistency, and neutrality.

Truth value. Guba (1981a) suggested the following techniques to increase the credibility of a study: "prolonged engagement and persistent observation, triangulation, peer debriefing, negative case analysis, and member checking" (as cited in Lincoln & Guba, 1985, p. 219). Researchers can engage in any, or all, of the techniques mentioned as a way to increase the credibility of a study. As previously noted in this chapter, I employed member checking and peer debriefing as methods in which to ensure the credibility of the study. In addition to member checking and peer debriefing, triangulation was also utilized. Triangulation represents a systematic process in which researchers examine fieldwork notes from observations, interviews, and documents pertinent to the phenomenon of the study. For the purpose of this study, triangulation of data was ascertained primarily through data collected from interviews, information from demographic sheets, and responses to three online questions.

Applicability. Because the purpose of qualitative research is to make findings transferable in nature, it was vital to ensure that findings were applicable to other settings. This was achieved through thick description (Geertz, 2002) of participants primarily through the interview data, information on the demographic sheet, and background information pertinent to Berkeley and UT. By further contextualizing the

background, experiences, and educational settings of my participants, a clearer description of the participants make findings of this study applicable to similar contexts and participants with similar characteristics.

Consistency. Consistency is a question of process. Consistency asks the questions pertinent to whether or not the methodological procedures in this study are dependable or if not dependable, can the procedures be tracked? (Lincoln, personal communication, March 31, 2011). Several strategies were employed to ensure the consistency of the findings. The ongoing process of data analysis was chronicled in biweekly research memos to the chair of my dissertation committee. In addition to writing research memos, I created an extensive audit trail (Lincoln & Guba, 1985) to account for the necessary documentation of my study. As previously discussed, I kept a reflexive and methodological journal that detailed information for the longevity of the study. By establishing a clear audit trail, the findings were confirmed as being accurate accounts of the participants and not simply the construction of my perception of the experiences of the participants. This not only confirmed the findings of the study but also increased the external validity of the study.

Neutrality. Several measures were employed in order to ensure the neutrality of my study. Even though preliminary interpretations of data were made throughout the data collection process, follow-up interviews, with each participant's permission, were conducted as needed to clarify statements, to further probe into responses from participants, and to modify initial interpretations of data. Additionally, I electronically provided each participant with a copy of their respective transcribed interview and gave

each individual an opportunity to add or clarify any content. Lastly, my analysis was peer debriefed in an attempt to ensure that my analysis was not biased.

Researcher Positionality

Olson (2011) suggests that, "A person's standpoint is neither right nor wrong. It must be identified and acknowledged, however, because whether we realize it or not, it influences all aspects of our studies…" (p. 13). Hence, researcher positionality, within the context of my study, is particularly important because as a Latina I must acknowledge my biases and remain partial to my analyses despite the similarities that may appear between my own experiences and the experiences of my participants. Yet, it is important to note that even though my participants' ethnicity is equivalent to mine I do not have undergraduate experience in pursuing an engineering degree or an undergraduate degree in any other male-dominated discipline. Despite my lack of undergraduate experience in a male-dominated discipline, the participants and I share some similarities that extend beyond our ethnicity. As a Latina, my journey to a terminal degree shapes my perspective of the experiences of the participants. My age, equally important, shifts my position as a researcher. Our distinction in age where my participants are in their early twenties and I am in my early thirties also influences each of our perspectives in regards to feelings about career, family, and jobs. As a twenty year old, for instance, my perspectives on the aforementioned issues differ greatly now as a thirty-four year old. Such changes in perspectives as participants become older are inevitable to occur. Like most participants, I, too, have a strong family support system

that is close in proximity which enables us to visit our families more often than Latinas who move far away from home to attend college.

Roadblock to Data Collection

As previously noted, gatekeepers, particularly in qualitative inquiry, are integral for the researcher to gain access to potential participants. While some gatekeepers are eager to assist, others are guarded about granting access to an outsider. Understandably, gatekeepers who I encountered throughout my study, specifically at Berkeley, were apprehensive about granting me access to students without further inquiring into the details of my study and the benefits to potential participants. While on my initial visit to Berkeley in late November 2011 to interview two students, I met other potential gatekeepers. As I followed up with one of my contacts in mid-January, she electronically informed me that an associate dean of the college of engineering was not granting me "permission to contact or use our students". Consequently, data collection at Berkeley ceased. Because I was not informed of the specific reason behind this decision, it would be unfair to speculate why I was denied access to engineering students at Berkeley. The design of my study, as a result, changed from a two institution case study to a single institution case study whereby I increased the number of participants at UT from six to ten.

Limitations and Delimitations

There are several limitations associated with this study. First, findings from this study are only transferable to Latinas pursuing an undergraduate engineering degree from UT or similar institutions. Additionally, participants' responses to the demographic

sheet provided a rich description of other characteristics (e.g., generational status, parental level of education, pre-college coursework, etc) that further narrowed the transferability of the findings. Second, participants' responses to the demographic sheet are measures of self-reported data. In some cases, responses might not have been accurate in detail as "participants may [have] report[ed] erroneous information" (Podsakoff & Organ, 1986, p. 532). However, demographic information can be verified with other archival forms of data. Third, the premise of academic integration is not explored in this study because the assumption is that all participants, who must be classified as seniors, have surely found a way to successfully integrate academically in their respective degree programs. Fourth, the theoretical lens of persistence, primarily drawn from the work of Tinto, is also limiting in the fact that the construction of his work was normed on a White, male population.

In addition to the limitations noted above, I encountered delimitations throughout the duration of my study. First, approval for my study was granted approximately two months after I submitted paperwork to my university's institutional review board. While no major changes were required of my study, the process for approval took much longer than initially anticipated. Consequently, recruitment of possible participants was delayed as the summer is a time where most engineering student majors were busily interning at companies/corporations. Second, the criteria of participants self-identifying as Mexican-American also proved to be challenging for the initial recruitment of participants. While some females responded to my electronic invitation to inquire further information about my study, several replied and said they met all but the one criteria of self-identifying as

Mexican-American. While some females self-identified as Mexicans, others self-identified as Latina or Chicana or Hispanic. Thus, the specific terminology in regards to ethnicity also initially delayed the recruitment of possible participants. Ultimately, I decided to expand my initial desire to interview only Mexican-American females. The criteria in regards to race/ethnicity, as a result, were expanded to include females who identified as Latina. Third, data collection ceased at UC-Berkeley after I was denied access to students by an associate dean of the college of engineering. Therefore, only two interviews from Berkeley were obtained and analyzed for the purpose of this study.

CHAPTER IV

FINDINGS

While much literature addresses the Latina/o (used interchangeably with Hispanic) experience in higher education, fewer studies examine the successful experiences of Latinas pursuing undergraduate engineering degrees. In additional to be underrepresented in terms of gender, Latinas also remain underrepresented in engineering on the premise of race/ethnicity as well. In 2008, Hispanic females were awarded only 10.6% of all undergraduate engineering degrees (NSF, 2008).

The reasons why few Latinas attain an undergraduate engineering degree remains as complex and convoluted as ever. Despite evidence, some note cognitive differences as to why some females do not succeed in STEM-related disciplines. Other studies attribute a lack of interest and STEM workplace issues as detrimental to female success in STEM. Further analysis of Latinas' higher education experiences illustrate the importance of familial influence, academic self-concept, finances, social support networks, faculty/mentors, and campus climate, among others, as influential in their success. To be fair, there is a multitude of factors that contribute to persistence and non-persistence decisions.

With that noted, this study specifically examined the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate engineering degree. More specifically, the study employed a qualitative method of inquiry whereby 11 senior Latinas, two from UC-Berkeley and nine from UT-Austin, were interviewed. Participants also completed a demographic sheet and 6 out of 11

anonymously responded to three online guided questions. Data were transcribed and analyzed via content analysis whereby themes emerged. While I briefly mention the themes and subthemes that emerged from data analysis, the rest of this chapter details the experiences of the Latinas in the study.

The first category *Maintaining and Cultivating Systems of Support* addresses participants' perceptions on the necessary systems of support they perceive as crucial to their persistence in engineering. Absent from literature is the role of fathers in the educational experiences of Latinas. However, the first sub-category titled *Role of the fathers and family* addresses how participants viewed the role of their father as important to their initial interest and persistence in engineering. The second sub-category illustrates *Reciprocity of peer relationships* whereby most participants recognize a need to cultivate and maintain mutually beneficial relationships with classmates. The third sub-category, *Student organizations and a sense of belonging* details how student organizations serve as a venue in which participants chose to cultivate necessary systems of support that essentially contributed to their overall sense of belonging in their environment.

The second category *Connecting to Others Like Them* notes how several participants recognize the need to be surrounded with similar individuals who face similar struggles. Whether intentional or unintentional, the first sub-category shares participants' *Identifying with other engineers*. For some participants the rigor of the curriculum and consumption of the engineering culture led to constantly being surrounded with other engineers. Also important to note, which is explored in the second sub-category titled *Working collectively to overcome academic struggles*, is participants'

recognition that the academic struggles they encountered were encountered by *all* participating engineering students and more importantly, that their struggles did not defeat them. The last sub-category *Identifying with other minorities/women* highlights participants' need to either surround themselves or make connections with other minorities/women to better acclimate to their environment.

The last category *Positioning of Multi-Dimensional Gender Identities* details how and in what instances participants positioned the multi-dimensional identities they encompass as female engineers operating in an unfavorable climate. The first sub-category *Proving their intellectual identity* chronicles the various instances where participants had to prove their intellectual capabilities to male counterparts who often questioned their contributions because of their gender. *Ascribing to a gendered desire to help others*, the second sub-category, addresses how several of the participants ascribe to stereotypical gendered characteristics when discussing why they chose their engineering program and also in regards to the utility of their degree. The third sub-category, *Operating outside of gender*, details how participants, despite adverse experiences, chose to operate outside gender when rationalizing their respective encounter of sexist incidents. In the last sub-category, *Negotiating family and work identities* participants share how family and work identities are often in conflict with one another. What follows is a thorough discussion of the themes and sub-categories that emerged from data analysis. This chapter concludes with a summary of the findings.

Maintaining and Cultivating Systems of Support

Every participant in the study discussed to some extent various systems of support that they had to either maintain or cultivate to help them overcome personal, academic, and psychological challenges. More specifically, the participants discussed the role of their father and their family, the reciprocity of peer relationships as well as the importance of student organizations in participants' sense of belonging.

The role of the fathers and family. While most literature (See Cammarota, 2004; Rodriguez et al. 2000) highlights the importance of the mother-daughter relationship in the educational success of Latinas, several participants in this study emphasized the role of their father in their education. Cristina, a senior who is graduating in May and whose stepfather encouraged her to pursue engineering, shared,

> My stepdad is particularly happy because he came here for a little bit pursuing his undergrad[uate] degree. I think that, for him, just seeing that his daughter is pursuing a degree in a male-dominated field; he's really excited to see that. I can be independent and do this on my own and just because I'm a girl I think that just makes him even more proud of the fact that I'm in engineering. (INT #6, UT, p. 1)

For Cristina, she seems to be connected to her stepfather in several unique ways. One, her stepfather also attempted to pursue a degree at UT but did not attain his degree from this institution. Thus, Cristina's imminent graduation suggests that she achieved her goal of a degree from UT, an accomplishment that her stepdad was not able to realize. Second, Cristina also hints at the core of her stepdad's excitement, which is to

successfully and independently attain a degree in a program that is male-dominated. Third, success in a male-dominated program area and Cristina's gender infers that her stepdad is proud that his daughter can make it in a man's world.

Likewise Alicia, a senior graduating in May 2013, shared the influence of her father as she pursues her engineering degree. She disclosed,

> My Dad originally wanted to be a mechanical engineer, but he just couldn't finish his college degree. So he was just really excited when I decided to go into engineering as well because my older sisters went into business—the business route and so engineering…I kind of I was the first one to kind of go somewhere, like the stepping path. (INT #3, UT, p. 1)

Unlike Cristina's stepfather, Alicia's dad wanted to become a mechanical engineer but "couldn't finish" his degree. His inability to finish his degree, regardless of the reason(s), and Alicia's decision to pursue an engineering degree creates an instant connection between the two. The connection is evident in that Alicia reveals that her older sisters pursued a business route and her decision to be the "first one" to create "the stepping path". Alicia's pursuit and imminent attainment of an engineering degree will not only fulfill her goals but perhaps her Dad's own wishes of his once desire to become an engineer himself.

Like Alicia, Sophie's father is an engineering technician. Sophie initially thought she wanted to pursue a civil engineering degree until she decided that her program area was a better fit. She asserted the following about her father, "And so just him saying, 'I'm really proud of you for doing this cause you want to get the degree, like I only got

to be a technician' cause he never finished college" (INT #9, UT, p. 8). Sophie's, like Alicia's, father initially wanted to become an engineer but both were unable to finish their degrees for unknown reasons. Her father is also proud of Sophie choosing a degree that he was never able to attain. She further shared how her father feels about her choice to major in engineering, "'That's really amazing; you don't have to do this but it's really amazing that you want to'" (INT #9, UT, p. 8). Sophie's father seems to be humbled that she chose a similar career path. Like the experience shared by Alicia, Sophie has the opportunity to attain a degree that her father once desired. Not only is her father proud, but Sophie's forthcoming graduation is also an achievement that her father can vicariously experience.

Another participant, Clara, disclosed how she wanted to emulate her Dad. She stated, "So, initially I wanted to be mechanical to be a[n] [auto] mechanic like my Dad" (INT #5, UT, p. 1). Even though Clara did not choose to major in mechanical engineering, her disclosure of wanting to be like her Dad suggests that she values her Dad and what he thinks about her. She further noted,

> And I think now that I'm graduating my Dad keeps telling people 'She's graduating. Did you know she's graduating? She's graduating from engineering.' Like he used to say it before like, 'She's going to engineering school' but now he's like, 'She's going to engineering school and she finished. Can you say that? No, you can't.' (INT #5, UT, p. 2)

The pride that Clara's dad feels about her imminent graduation is evident. The emphasis on "engineering" and the fact that "she finished" creates another level of pride for her

dad. This anecdote illustrates how his pride for Clara from *just going* to engineering school to *she finished* and rhetorically asking others if they can express the same heightens how proud he truly is of his daughter's accomplishment. Therefore, his daughter's success, despite her learning disability, in attaining a degree in a program such as engineering compels him to boast not only about Clara going to engineering school but highlights that she will finish as well.

Dre, a senior engineering major who decided to switch majors in her last semester of undergrad, also discussed the role that her Dad played in her initial decision to become an engineer. She commented,

> Initially, my Dad more than anything. He's an example and I always, I look up to my Dad and I always wanted to be kind of like him. And part of being an engineer came along with trying to be like him. (INT #2, UT, p. 1)

Dre's dad, a recognized engineer in Mexico, was someone she aspired to be like. Like Clara, Dre wanted to emulate her father; someone she looked up to. Clara's desire to be an engineer was, in part, so that she could be like her Dad. Even though her Dad is a recognized engineer in Mexico, in the United States Clara's Dad is a day laborer. The family's decision to move to the United States was to escape the violence of their hometown of Juarez. With the move, respect for her father and what his occupation now entails, might have also aided in Clara's decision to initially major in engineering. Wanting to be like her Dad, particularly wanting to become an engineer, suggests that Clara wanted to pursue an occupation that her Dad once occupied.

Another participant, Marcie, revealed how proud her Dad is of her. She commented, "My Dad is an engineer, too. And, he was pretty happy when I told him I would like to be in engineering and he was like 'Oh, that's so cool'" (INT #8, UT, p. 2). Her father's support of her decision to pursue engineering is transparent as he, himself, is an engineer. Marcie added this about her Dad, "And he finds articles that have to do with buildings and my field and he's like 'Oh, did you look at this? Oh, it's so cool'" (INT #8, UT, p. 2). Not only is Marcie's Dad happy that his daughter followed in his footsteps, he also makes a conscious effort to connect with the type of engineering that is of interest to Marcie.

Liliana, a senior engineering major who graduated in May 2012, discussed her mother's dismay of her recent acceptance into a PhD program but expressed how instead her Dad continues to provide her unconditional support. She revealed, "My Dad has been very, very supportive in that area. My Dad has always said that he's proud of me and just to live my life and continue what I'm doing" (INT #7, UT, p. 2). In this instance, Liliana discusses how her Dad, and not her mother, remains the steadfast support in her family as he verbally and constantly shares how proud he is of her. The latter part of her quote in which her Dad insists that Liliana needs to "live [her] life" and "continue [with] what [she's] doing" hints at friction between him and his wife's views on the choices that Liliana has made and continues to make regarding her education.

In addition to discussing the importance of their fathers, many participants discussed how their parents and respective families were proud of them and detailed the various capacities (e.g., financially or mentally) in which they provided support. Hence,

parents were identified as a crucial source of support for all but one of these Latinas.

For several participants, including Esperanza, a senior engineering major at UC-Berkeley, her parents were the main and only source of financial support. She mentioned the financial role, stating, "My family pays for all of it [education]" (INT #1, UCB, p. 2). Chilanga, a senior engineering major at UT, also revealed that, "Obviously, financially speaking they…my parents have always paid for everything college-wise" (INT #4, UT, p. 2). Cristina similarly commented, "I don't…we don't qualify for financial aid so my parents are paying for 100% of my college tuition, books, everything" (INT #6, UT, p. 2). For a majority of the Latinas in this study, their parents paid for almost everything if not *every* college-related expense. As such, these participants did not have the additional stressor of finances to overshadow their experiences and persistence in their respective degree programs. Such financial privilege, as a result, separates a majority of these Latinas from other Latinas whose parents cannot financial support their education.

For other participants, parents were a source of emotional and mental support. Cristina described how her parents help with her emotional breakdowns: "There's been many times when I've called my parents crying, freaking out about a test or assignments that I don't think I'm gonna get done, and they've always been there to support me" (INT #6, UT, p. 3). Being reassured that everything will work out is an experience that Dre can relate to as well. She explained, "You know if I have a bad day or if I do this or do that I call either my Mom or Dad and whoever answers, you know, I'll talk with them and you, they'll…if I'm wrong, they'll tell me that I am wrong" (INT #2, UT, p. 2). Even though Cristina and Dre both looked to their parents for encouragement, Cristina

sought reassurance while Dre sought guidance.

Likewise, Cristina candidly discussed how she relies on her parents to provide her unconditional support. She expressed, "And being able to go to someone that I know supports me unconditionally and who isn't gonna judge me, um, they [family] definitely support me" (INT #6, UT, p. 2). The need for Cristina to feel she can be supported without being judged is transparent. This implies that Cristina does not feel she can receive the same type of unconditional support from others, which is critical to acknowledge since she spends most of her time with other people in college instead of her family. Even though 10 out of the 11 participants discussed the source(s) of support that their respective families provided, Sara, a senior at UC-Berkeley, highlighted the disconnection she felt between her parents and her experience as a college student. Sara disclosed,

> I feel like I don't really talk to my parents too much about like 'Oh, I had a really hard day in class' or something like that. So I guess they wouldn't really know if I was like, oh…if I was sad one day…I guess I've never been that open like I guess how I feel in terms of…I don't know if they would, I guess, understand how I'm feeling because they didn't really get to like go through this experience so I'm not…I guess I'm not too sure. (INT #2, UCB, p. 2)

Sara's lack of disclosure to her parents about daily experiences reveals that she is unsure of her parents' ability to comprehend the success or severity of her daily encounters. Consequently, Sara must cultivate other systems of support where she can discuss college-related experiences.

As noted above, most parents provide multiple types of support in the educational journey of these Latinas. Moreover, the importance of family cannot be underscored as several participants attributed family support as integral to their persistence. Despite her father's initial reluctance to allow her to leave her hometown to go to college, Sarah had this to say about her family, "Just being able to speak to me and again like I said they're really proud so the fact that they're happy that we're here makes a really big difference for me wanting to stay here" (INT #1, UT, p. 3). The "we" in this quote refers to Sara's twin brother who is also an engineering major. Therefore, her Dad's reluctance to let her leave home perhaps subsided once her twin brother decided to attend the same university. Ultimately, Sarah valued and needed to feel that her parents were happy with her decision to attend UT. The fact that her family is happy and supportive suggests that she can acclimate to her new environment knowing that her family approves of her decision to leave home.

In times of academic challenges, when Alicia feels "Oh, it's just too hard; I'm just gonna switch to something else" (INT #3, UT, p. 2) she thinks about her family. She described, "I just thought well, you know, I would really want to, you know, see their faces when I finish and that they'd be so happy and proud of me" (INT #3, UT, p. 2). Even though Alicia has thought about changing majors, thoughts of her graduation and her family's reaction at her accomplishment help her persist. For Alicia, her family's future reaction of her achievement eclipses those moments of academic uncertainty.

Because she is constantly reminded of her parent's difficulties in the past, Clara recognizes the need to always work hard. She shared the following about her mother,

"She's always telling me 'I had to work three jobs and this and that….I used to sleep two hours, drive you to school'" (INT #5, UT, p. 3). Clara further added,

> …and so I feel, since I'm constantly reminded of all the troubles and problems…all the impediments they've had in their past I know that I'm grateful and so I just keep working hard. I don't let myself slack because of it. (INT #5, UT, p. 3)

Clara, who resides at home with her parents, is driven to continuously work hard because she realizes all the struggles that her parents have encountered in their lives. Because of these constant reminders, Clara continues to work hard in order to take advantage of her opportunity and to avoid any of the same impediments her parents encountered in life. Thus, reminders of her parents' struggles serve as a motivator for Clara to continue to work hard.

While many of these participants discussed how their families were direct sources of support (e.g., financially, mentally, emotionally), Liliana characterized her family's role in her education as "very strange." Since their move to the U.S., Liliana's family has incurred enormous debt that they constantly struggle to pay. Her parents' situation is disheartening to Liliana as she asserted, "It's upsetting but yeah that's one of the reasons [that] makes me keep going, you know? It likes oh, it would be nice to give them something when I graduate, you know?" (INT # 7, UT, p. 2). Liliana's parents' financial situation is a source of distress for her. While she is internally driven to pursue further education, she also recognizes the importance of being in a position to financially give back to her parents. Liliana, in other words, understands the value and the long-term

benefits of continuing her studies not only for her but for her family as well. Families play a crucial role for most of the participants. While families serve as systems of support for financial, mental, or emotional reasons, classmates provide an academic support system.

Reciprocity of peer relationships. All of the participants in this study recognized the *necessary* and reciprocal system of support that exists with peers (used interchangeably with classmates). When asked about who comprises her academic support network Liliana responded, "Well, right now I…there's a lot of peer help" (INT #7, UT, pp. 2-3). Marcie corroborates Liliana's feelings as she, "Since we have a small group [of students] in the [specific program name] engineering, I think we all find ourselves like working on stuff together a lot" (INT #8, UT, p. 3). She further added, that "the group that I have classes with the most" (INT #8, UT, pp. 10-11) is one of the three reasons why Marcie feels she has succeeded and persisted in her degree program. Chilanga stated, "It's always convenient to study with people who are studying the same thing and questions come up" (INT #4, UT, p. 4).

The sentiments shared by Liliana, Marcie, and Chilanga are discussed, to some extent, by all of the participants. The role of classmates from either initially meeting in class or student organizations provided critical sources of academic support. Participants recognized the reciprocal system of support that existed between themselves and classmates. For several participants, some classmates later became their friends. After finding a classmate with whom to study, Dre commented that, "We'll exchange information and from there like a friendship other than just 'study buddies' start[s] or we

just remain ‘study buddies’” (INT #2, UT, p. 3). The participants in this study were cognizant of their need to seek others who were in their same predicament (e.g., same class studying the same material).

A few participants discussed practical measures taken to develop academic relationships with classmates. Dre shared how initial conversations with other students in class focus on academic needs. She explained, “Sometimes I’ll, you know, it comes to the point where sometimes I just sit next to someone and they ask me, ‘Hey, do you want to study together some time?’” (INT #2, UT, p. 3). Sarah also discussed the proactive manner in which she cultivates a system of academic support before the semester even begins. She disclosed, “So, for example, right before we sign up for our classes we talk to each other and we say, ‘So what classes are you taking? Maybe we can take this together and help each other out’” (INT #1, UT, p. 4). Recognizing that an academic support system is necessary, implies that Sarah anticipates challenges with the course material. However, her actions suggest that, at least for Sarah, classmates will be willing to help each other. So, while a classmate will be a source of academic support for Sarah she, too, will be the same source of academic support for her classmate. It is a mutually benefitting system of academic support; one that is reciprocal in nature.

The need to create an academic system of support comprised of classmates is evident. Sarah candidly shared,

> And I remember freshmen year, I had a class where I didn’t know anyone and I didn’t make the effort to meet anyone and it was just really, really hard. And if I

> would've done that for all my classes…if, just been trying to do it on my own, I don't think I would've made it. (INT #1, UT, 4)

The need for peer support is crucial. Perhaps even more telling is Sarah's admission that if she had not made an effort to meet any classmates she, as a current senior in engineering, doubts that she would have been able to persist.

Student organizations and a sense of belonging. In addition to family and classmates/peers, participants also discussed the various types of support (e.g, social and academic) they received from joining student organizations. Many discussed their membership(s) in various organizations such as, but not limited to, Society for Hispanic Professional Engineers (SHPE), Student Engineers Educating Kids (SEEK), Pi Sigma Pi, Kappa Delta Chi, Hispanic Engineers and Scientists (HES), Beta Mu Epsilon, and Tau Beta Phi. While Pi Sigma Pi, Beta Mu Epsilon, and Tau Beta Phi are academically oriented engineering societies, Kappa Delta Chi is a service oriented sorority. Participants highlighted the various academic and social systems of support that membership in such organizations affords them. For eight out of the eleven participants in this study, they gravitated to memberships in race-specific organizations. Alicia commented the following about her membership in SHPE:

> I mean they provide like support, like academic support…and they have like people that are in the same major as you or in the same field as you so you can relate to them. So you meet all your friends there and so it's kind of like social, academic all this kind of support that they have going on. (INT #3, UT, p. 2)

SHPE, for Alicia, has been an organization that satisfies more than social and academic needs but also serves as an avenue in which she can meet other engineers, people she feels she can relate to. Like Alicia, Cristina further elaborated on the "wonderful resources" that SHPE provides. She explained, "They've also provided one-on-on tutoring for free" (INT #6, UT, p. 3). Cristina also detailed various SHPE sponsored events such as "Manitas, Manitas", similar to big sister, little brother, that create "a lot of mentoring opportunities" (INT #6, UT, p. 9). Socially for Cristina, she credits SHPE as the organization "where [she] met a lot of [her] friends when [she] first transferred here" (INT #6, UT, p. 2). As such, membership in SHPE provides Alicia and Cristina, among other participants, opportunities where they can primarily seek academic support (tutoring) but also social support and networking.

Others, such as Sara, noted how HES enabled her to meet upper classmen when she was new to the engineering program at UC-Berkeley. She shared the following, "Being part of that HES program…I kind of got to talk to a lot of upper classmen when I was younger and…ask them questions about classes and stuff and like different things" (INT #2, UCB, p. 3). Cristina revealed a similar sentiment about her membership in SHPE, "So it was really nice getting to know some older people who were a couple of years ahead of me that could help me and guide me" (INT #6, UT, p. 3). For Sara and Cristina, meeting upperclassmen and seeking insight and guidance provided access to students who possessed capital about how to navigate various aspects of their respective engineering programs. Hence, organizations also provide informal mentoring opportunities between upper and under-classmen. Perhaps underclassmen recognized

that they sought guidance from individuals who were once in their position, thus acknowledging that upper classmen were able to successfully progress in their respective program area. This type of interaction, ultimately, can suggest that they know people who have experienced similar setbacks and who, despite those setbacks, managed to persist.

Even though most participants sought membership in race-specific organizations, Clara and Dre disclosed how their attempt to join two different engineering societies proved to be unfavorable experiences. Clara noted,

> I tried joining ASCE, the American Society of Civil Engineers…they were not very nice. Like I went in and they would ignore me. They would just be like, 'Sign in' and they were just not nice people. And they're very selective about the people they talk to. Um, I don't know. They're not very welcoming and I guess that…that upsets me, and I don't do well with things like that. (INT #5, UT, p. 11)

Clara's experience at ASCE meetings, a predominately White member organization, did not make her feel welcomed because of the lack of communication she encountered with other members. The fact that members were selective about who they spoke with suggests that Clara was not viewed as one of the "selective" members of the organization, ultimately making her feel like she did not belong. Unlike the favorable experiences of Sara and Cristina where they felt welcomed and successfully communicated with other members in their respective organization, Clara felt unwelcomed at ASCE. Such experiences speak to the climate that often permeates

student organizations, whereby Latinas might feel more welcomed at race-specific student organizations rather than predominately White student organizations. The latter suggests that, despite the commonality as engineering majors, most of the participants needed to be connected to others who are racially like them in order to feel like they belonged within the student organization. Feelings of unwelcome, like in Clara's experience, were also experienced by Dre.

Dre expressed a similar sentiment as she tried to become involved with the American Institute of Chemical Engineers (AlCHE). During her first semester, Dre attempted to become involved but she "didn't feel comfortable" for two reasons. One, "A majority were White people" (INT #2, UT, p. 10). Two, "There wasn't this feeling of welcoming" (INT #2, UT, p. 10). She described her experience, "Like everyone was kind of in their own cliques and no one bothered to come up to me and like 'Hey, are you a freshman or a sophomore or are you new? Is this the first meeting you came to?'" (INT #2, UT, p. 10). Like Clara, Dre did not feel welcomed and the lack of communication from members also made her feel isolated before she could even become an active member of the organization. The mention of cliques and Dre's lack of admission into any of the cliques automatically makes her an "outsider" to others and makes her feel like an "outsider" within this environment. The experiences of Clara and Dre in their failed attempt to gain a sense of acceptance into two different, predominately White engineering organizations provides a glimpse of insight into why some minority engineering students seek membership into race-specific student organizations.

While eight of the eleven participants in this study gravitated to race specific student organizations for various reasons, Chilanga and Liliana felt indifferent about the purpose of student organizations such as SHPE and Society of Women Engineers (SWE). Chilanga admitted that she never self-identified as "a minority for being Mexican" (INT #4, UT, p. 11) and her one-time attendance to a SHPE and SWE meeting left an unsettling impression. Chilanga stressed,

> It was kind of the impression of like these students that don't do so well and they try to help each other to do well and…the same with the women society, SWE…Like it never really interested me just cause…I've…I don't know…I wasn't interested in being part of a group that was like 'Oh, just because we're Mexican or female we can do it' kind of deal. (INT #4, UT, p. 11)

It is important to note that Chilanga, born and raised in Mexico City, came from a financially privileged background as her parents own a brokerage firm. Therefore, even though she is Mexican she does not consider herself to be a minority. For Chilanga, organizations should not necessarily coalesce on the basis of race or gender simply because individuals will self-identify differently from others.

Liliana shared similar sentiments as Chilanga because she feels she "can't interact so much because [she's] Hispanic with another person" (INT #7, UT, p. 7). She expanded her thought:

> I consider myself a person, not a Hispanic person, and so I don't see the point of like why putting us together. Like I mean it's important but I don't think it should be the main focus. Like I don't think you should isolate a culture and, I

> think it might be helpful for some people. I find myself like there's a gap between certain Hispanic people here because they're like second generation, where I am actually raised in Mexico…I speak Spanish…there's a cultural gap kind of thing. (INT #7, UT, p. 7)

While Liliana acknowledged the importance of race specific organizations, she feels otherwise because of the generational and cultural differences between herself and other Hispanics. For her, being born in Mexico and being fluent in Spanish creates a cultural gap between others who identify as Hispanic but perhaps do not speak Spanish. Acknowledging such differences supports the notion that the Latino population is heterogeneous in nature and that the label of Hispanic does not guarantee camaraderie or instant connections with others who might *simply* look like them. Even more so, Liliana, like Chilanga, did not see the need or benefit of isolating and granting memberships in organizations on the premise of race. While Chilanga did not identify herself as a minority and Liliana distinguished the differences in regards to culture and generational status, Sophie, as a freshman, initially felt unwelcomed at SHPE because she felt she simply "didn't fit in." Sophie elaborated, "I don't speak Spanish. My skin's lighter than a lot of other Hispanic people" (INT # 9, UT, p. 9). She further shared,

> …a lot of my friends who are from the valley or from El Paso…have Spanish accents and there's nothing wrong with that but clearly we spoke different. We grew up different; like my family grew up different. I grew up in a very Americanized community so that kind of made me feel unwelcomed. (INT #9, UT, p. 9)

Unlike Chilanga and Liliana, Sophie initially felt unwelcomed at SHPE rather than choosing not to belong. Sophie speculates that her Americanization placed her at a disadvantage with other members of SHPE who were raised in non-Americanized communities. She acknowledges the differences in language and upbringing. Despite her unfavorable first impression of SHPE, Sophie chose to become an active member in her second year whereas Chilanga and Liliana ultimately chose not to seek membership. The previous three anecdotes exemplify how organizations, though designed to be a support system for Hispanics, does not necessarily embody a mission or atmosphere that is welcoming to *all* Hispanics.

Others, however, like Cristina, Sophie, and Sara sought additional organizations to meet their needs of belonging on the basis of race or gender. Cristina shared the following about her membership in a Latin-based sorority, Kappa Delta Chi,

> The majority of sisters are Hispanic or come from some sort of Hispanic background and so I think they were just seeking the same thing: to have other girls that they could relate to because they might not be able to relate to the students in the rest of their classes. (INT #6, UT, p. 9)

Cristina's reference of her Latin-based sorority as necessary for individuals who are not "able to relate" to other classmates suggests that the sorority is a venue where Latinas can meet other college-going Latinas. Her statement further hints that perhaps a majority of their classmates are not of Latin origin, especially for her as an engineering major. The sorority then serves as a system of support that grants membership on the basis of race and gender. Ultimately, the sorority fulfills a desire for those individuals, like

Cristina, who wish to be connected and surrounded with individuals who are racially like them.

Like Cristina, Sara yearned for interaction with other Latinas when she briefly joined TRENZA, which means braid in English, a student organization of Latinas in various disciplines. She had this to say about joining TRENZA only a few days after she arrived at UC-Berkeley:

> It's just a bunch of Latinas throughout all classes not necessarily in engineering but it's just throughout. And, I guess I had joined that because you don't really see a lot of Latinos or Latinas in my classes and stuff. So, it's kind of like I had missed that because I grew up with that kind of thing. (INT #2, UCB, p. 7)

Sara's explicit statement that details the lack of Latinas/os in her classes explains why she sought immediate membership in TRENZA. It is also important to note that Sara's environment, prior to her arrival at Berkeley, consisted of her association with mostly other Latinas/os. Her disclosure, given that Asians and Whites comprise a majority of the student demography at Berkeley, reveals that Latinas/os are found in scarce numbers in her classes and ultimately, represent few members of the entire student population. Because she "missed" others who looked like her, she sought similar racial individuals so she could feel connected to her new environment. Additionally, finding others that looked like her could also remind her of "home" while she navigated her new environment.

While Cristina and Sara searched for a connection with other Latinas, Sophie discussed the purpose of her membership in Kappa Delta Chi. She had this to say, "It's

been really nice to have a lot of friends that are girls cause you don't get that a lot in engineering" (INT #9, UT, p. 8). Sophie further noted, "So, that was kind of like a big, major factor cause a lot of people….they're a service based sorority…but for me it was more of the sisterhood" (INT #9, UT, p. 8). For Sophie, who considered herself to be "very Americanized", joining a sorority meant that she could be connected to other females and not necessarily to other Latinas. While Sophie certainly values her association with other Latinas, the fact that she mentioned sisterhood as the main reason for joining suggests that she might need to find others who self-identify with her on the premise of gender. Regardless, the anecdotes shared by Cristina, Sara, and Sophie illustrate how these individuals sought out organizations to fulfill their need to be connected to other Latinas or to other females because engineering lacks the presence of both Latinas/os and women in general.

Others, such as Dre and Clara, discussed their involvement with the Equal Opportunity in Engineering (EOE) program. Partners with SHPE and the National Society of Black Engineers, among others, EOE's main goal is to increase diversity within the college of engineering by promoting recruitment and academic development of underrepresented student populations (e.g., Hispanics, African Americans, Native Americans). EOE also offers engineering students various services which include, but are not limited to, meeting other engineering students, forming study groups as well as accessing tutoring and undergraduate research opportunities. Even though EOE is not a student organization, several participants noted the importance of this office in their experiences. Dre explained that her support came from EOE and never from her

department. She had this to say in regards to tutoring opportunities, "If I found that [individual help] it was through EOE when I requested a tutor and if they had an available tutor, but never within the department itself" (INT #2, UT, p. 12). In Dre's experience she did not feel she had any support from her department, so she sought tutoring services from EOE. Therefore, EOE was a source of academic support for Dre. Clara similarly acknowledged the academic support that EOE provided her. She asserted, "They're very supportive. Like they're always trying to get you like information and, um, they always want the best for you" (INT #5, UT, p. 4). She explained further,

> I kind of feel like they took the role that my brother had…like growing up my Mom was like 'Do your homework this and that' but my brother was the one that was actually 'Do you understand your homework?' He used to help me and then he used to be like 'Oh, I heard about this program. You should do it.' And I think that's what EOE does. Like, 'Oh, have you done the TREKS program? You should really do it and things like that'. (INT #5, UT, p. 4)

For Dre and Clara, EOE provided sources of academic support. Tutoring in the case of Dre and access to knowledge for Clara; knowledge that she might otherwise not have accessed. Rather than going to her "home" engineering department, Dre sought services from EOE. For Clara, EOE reminded her of elements of her "home" comparing the access of knowledge she received from EOE similar to the type of information her older brother used to provide her.

Many other participants discussed their membership in academic student

organizations. Many, including Sarah, Alicia, and Marcie, discussed their membership in Pi Sigma Pi, a minority academic engineering society. For Chilanga and Liliana, however, they were members of program specific academic societies. Chilanga referred to Tau Beta Phi as "a fraternity but an academic one" (INT #4, UT, p. 10). Membership in this organization is by invitation only as members must maintain an A average in courses. Chilanga had this to say about Tau Beta Phi, "I kind of like that it was hard to get into and you had to be invited and that kind of thing" (INT #4, UT, p. 11). She further noted that Tau Beta Phi when compared to other minority student organizations was "just a lot more prestigious for sure" (INT #4, UT, p. 11). Admitting that she is "not very big on organizations" (INT #7, UT, p. 6), Liliana acknowledged her membership in Beta Mu Epsilon. Several participants did belong to academic engineering societies at UT. Chilanga and Liliana, for examples, wanted to highlight their academic achievements rather than their race or gender.

While most participants were active members in one or more student organizations, two participants were adamant about their need to not necessarily seek membership in any type of organization. Even though Marcie is a member of a campus intramural sports organization, she explains why she simply enjoys volunteering. She commented, "I like volunteering and I find myself doing it without having to do like an org[anization]" (INT #8, UT, pp. 9-10). Unlike Marcie, Liliana shared why she does not volunteer in many organizations. She disclosed, "I haven't done too much…too much volunteer with organizations or anything because I've always done research. So, I consider that to be my main focus, specialization" (INT #7, UT, p. 6). However, Liliana

adds that within her research teams and fellowships she does participate in "groups and meetings" (INT #7, UT, p. 6). Both Marcie and Liliana acknowledged that they only minimally participate in organizations. For Marcie, she does not perceive membership in an organization as important as simply volunteering time to various events. Marcie shared a list of events for which she annually volunteers, such as SEEK, Project HOPE, UT Explore, and Introduce A Girl to Engineering Day, to name a few. All of the events Marcie has been involved with are primarily community service-based. In other words, she volunteers an ample amount of her time to events that give back to the local community.

Giving back to the community is something that many participants had in common when discussing organizations in which they have membership. Student Engineers Educating Kids (SEEK) is an organization that was mentioned by several participants. SEEK is an organization in which individuals can either simply volunteer or receive course-credit. Sarah described SEEK as such, "We go volunteer at a local middle school, and it's usually, middle schools from like the bad side of town. So, we go and tutor them or mentor them or do engineering projects and teach them about engineering" (INT #1, UT, p. 9). Even though Marcie is no longer volunteering for SEEK due to course schedule conflict, she had this to say about her experience volunteering: "It's really fun cause yeah, kids get, they get so excited especially cause it's like kids that like 'oh, engineering'" (INT #8, UT, p. 10). She elaborated that SEEK influences students by giving them hope to become engineers even "if they live in the projects" (INT #8, UT, p. 10). For Sarah and Marcie, SEEK is an organization that allows them to utilize their

accrued capital and "pay it forward" to young, impressionable students who may aspire to become future engineers. Unlike other organizations where they might seek membership for academic and social support, their membership in SEEK offers support to possible future engineers.

Connecting to Others Like Them

Time and time again participants discussed their need to be connected to others like them. Even though self-identification varies from individual to individual, several participants expressed similar needs. More specifically, the sub-categories that emerged from data analysis suggest that participants, whether intentionally or not, surrounded themselves with other engineers. Even more so, a majority of the participants acknowledged the importance of recognizing the collective nature of academic struggles and more importantly, realized that such struggles do not inhibit their success. The last sub-category exemplifies participants' needs to be connected to others who are racially/ethnically like them. Participants' needs to be connected to others like themselves at various capacities (e.g., engineers, academic struggles, race/ethnicity), in other words, suggest that they sought similarities with others to acclimate to their environment.

Identifying with other engineers. Even though several participants mentioned the importance of hometown friends, many discussed the need to be surrounded by other engineers. Chilanga shared that her friends are mostly engineers because she enjoys socializing with other engineers. She commented, "I think I like hanging out with engineers because it is a similar way of thinking" (INT #4, UT, p. 3). Chilanga's quote

reveals that she likes surrounding herself with people who think like her. The "similar way of thinking", particularly in reference to engineers, infers that she enjoys like-minded individuals who might process information and understand comparable forms of knowledge.

Like Chilanga, Alicia discussed how being an engineering major determines that she will associate with mostly other engineers. She explained, "Class pretty much cause that's where…I don't really have a way to make friends in other places just because engineering is like your life when you're an engineering major" (INT #3, UT, p. 2). For Alicia, most friendships she has cultivated are a result of being an engineering major because of the rigorous academic aspects inherent in her degree program. While she might not feel trapped, Alicia certainly recognizes that because most of her time is spent with other engineering majors that friendships are bound to occur. Her comment of "engineering is like your life" is also indicative of how engineering majors are often truly consumed with coursework.

Chilanga and Alicia, for the most part, remain isolated in the engineering world. Esperanza corroborated Alicia's sentiment as she claimed the following about other engineering students she knows,

> So, those are the kids that I like hang[ing] out with the most and they are also engineers in multicultural but they are not just civil engineers because UC-Berkeley doesn't really give you a chance to meet any other kind of engineers just mostly the kind of engineering that you are doing. (INT #1, UCB, p. 3)

While Alicia is cognizant of how being an engineering major limits her time to seek friendships outside of engineers, Esperanza recognizes how her institution, and not necessarily her degree program, restricts opportunities to meet other engineering students. In her quote, the "kids" Esperanza references are students she met in a pre-engineering college summer program hosted by Berkeley. This program helped Esperanza develop friendships with different types of engineering majors.

When discussing social support that influences ability to persist, Sophie discussed why having friends that are engineers is crucial. She explained, "So, [my friends are] mostly engineers. Still I would say because our schedules match and they kind of get it when you can't hang out or they don't push those things" (INT #9, UT, pp. 2-3). Sophie's reference to how other engineers understand when you "can't hang out" suggests that engineering students are aware of the rigor and time consumption associated coursework/labs, internships, and membership in student organizations. Thus, explaining the culture of engineering majors to a non-engineering degree major, an "outsider", could be problematic and exhausting, at best. Perhaps Esperanza best describes the atypical social aspects of friendships that engineering majors often encounter, "We don't really go out that much…our socializing is doing homework" (INT #1, UCB, p. 4).

While for some participants knowing other engineers is a purposeful design of the culture of engineering itself, others recognize the importance of knowing other engineers in times of self-doubt. Sophie later shared how, at first, most of her friends either fell in one of two categories: 1). Some initial college friends were *not* engineering

majors. 2). Several initial college friends were former engineering majors who rapidly switched to other majors early in their respective degree program. The following comment, thus, illustrates the importance of surrounding herself with other engineers:

> And so then it was like, 'Oh, maybe engineering isn't for you, it isn't' and then once you start being around engineers and people are really focused that's not like really an idea anymore. Like we're all engineers; like we're going to be engineers. It's not 'Oh, maybe I can leave.' So, probably just being around other engineers is really helpful to persist because they just don't let you have the mindset that you're gonna not pursue engineering. (INT #9, UT, p. 3)

For Sophie, surrounding herself with engineers was not only a matter of convenience or a result of the design of the discipline. She realized early in her college career that being surrounded with people like her was vital to her persistence when friends, who started as engineering majors, decided to switch majors. Other engineers, for Sophie, were there to validate her academic abilities in times when she doubted her own ability to be successful. Thus, being surrounded by this culture of focused engineers was crucial for Sophie's ability to persist in her degree program. She might not have otherwise persisted if she did not recognize her need to be surrounded with other focused engineers. While most participants discussed how engineers comprise a majority of their friendships, Marcie and Liliana noted that they did not necessarily socialize with other engineers. Marcie stated, "Like yeah, it's okay to just be with random people" (INT #8, UT, p. 10). Liliana, who shared that she only had one or two friends that were engineers, also

similarly noted, “I socialize with my roommates, not particularly with engineering students” (INT #7, UT, p. 2). She furthered explained,

I look for people that are artistic or cultural-wise. It’s varied, you know? So, I just hang out with artists most of the time because I want to find that contrast and overall I consider myself a very tolerant person so I can just talk to anyone (INT #7, UT, p. 2).

While Marcie revealed that she enjoyed time with random people and not necessarily just engineers, Liliana explained why she *chooses* to associate with non-engineers. As she asserted, Liliana’s need for “contrast” implies that she does not need to surround herself with “like minded” individuals. Such a comment suggests that Liliana enjoys a balanced aspect to her social life. Even more so, she might even recognize the need to avoid consumption of engineering and consciously decides to surround herself with “artistic” individuals so all aspects of her life are not consumed with engineering.

Working collectively to overcome academic struggles. While most of the participants noted the importance of being surrounded by other engineers, several also felt the need to recognize that the academic struggles are part of their educational process as engineering majors. More importantly, participants, through knowledge of upperclassmen’s success, know that such academic struggles do not have to defeat them. Chilanga expressed, “I think that was always really helpful for me studying with friends and having friends in the classes and doing the homeworks [sp] together and preparing for the exams” (INT #4, UT, p. 4). Chilanga’s experience suggests that she had others to study with, to take classes with, to complete homework with, and to prepare for exams with. All of these time consuming events and her description of having friends with her

suggests that she was collectively working with others to complete academic tasks. She completed these time consuming tasks with others rather than executing them alone. Alicia similarly noted this about her classmates, "Whenever we have homework due we also get together and like do it together and it doesn't feel so bad when you have some someone else who has the same homework due" (INT #3, UT, p. 2). Like Chilanga, Alicia describes the importance of "not feeling bad" when completing homework with others. One, homework assignments serve as opportunities for individuals to see others who have to exert large amounts of time to complete assignments. Two, if the rigor of the homework challenges the group then individuals might not feel as inept about their academic ability.

Sophie revealed that, "Everyone's really helpful cause *everyone's* been there and needed help" (INT #9, UT, p. 6). Because everyone encounters struggles, it is "helpful" to recognize the need for assistance from others. Cristina further expanded on this notion, "And I think everybody goes through one point in their degree…at least once where you sit there and you think, 'I'm not gonna make it', like especially the lower level weed out classes" (INT #6, UT, p. 3). Thoughts of switching majors have also been present in the minds of many of the Latinas in this study. Sarah shared, "A girl that is my mentor…told me that almost everyone feels, at least once in their college career, that they need to change majors. So, it's okay to feel that" (INT #1, UT, p. 5). The possibility of non-persistence, especially in the first two years of coursework, is illustrated in Cristina's quote. Self-doubts about one's ability to persist surface as she later added, "Everybody's stayed up late freaking out not knowing if they're going to be able to do it

[pass classes]" (INT #6, UT, p. 3). Alicia similarly disclosed, "When I was like 'This is too much, I want to quit' but, you know, seeing my other classmates do it and they were still gonna keep on" (INT #3, UT, p. 3). When Alicia recognized the collective struggle and that others continued to overcome their struggles, then her decision was to follow suit. Perhaps seeing that others can persist, in spite of the difficulties, became partial motivation for her to continue with her studies as well.

Other participants were more explicit about embracing the collective struggle. Sarah insisted that, "The fact that it was hard for everyone also made me stay in it cause it's like 'Okay, I'm in this with other people and not just by myself" (INT #1, UT, p. 5). Alicia shared a similar story when referring to classmates,

> Not only are they some of my really good friends but they are in all my classes. So, it's kind of like if I didn't have them, I would probably be very, very like stressed out and like I wouldn't feel so like 'Okay, we're all in it together type of thing.' (INT #3, UT, p. 6)

Alicia later added, "If I didn't feel like I had other people going through the same thing that I was I would've been completely and totally lost and overwhelmed" (INT #3, UT, p. 6). For Sarah and Alicia, recognizing that they are not alone in their struggle re-affirms three aspects of their engineering experiences.

Embracing the collective on-going academic struggles that classmates experience is vital, but so is students' realization that they can persist despite their academic struggles. For some participants, it also seemed important to interact with other students who used to be in their positions. Cristina shared, "And, yeah, you freak out but it's

really great to talk to your friends and they're like, 'Don't worry. Like everybody doesn't do well in his class or this is the class that everybody struggles with" (INT #6, UT, p. 4). Alicia made a comparable assertion, "I just thought, you know, there's a bunch of other people who have done this before me and I'm sure I'm like just as smart as they are so I don't see why I shouldn't be able to finish" (INT # 3, UT, p. 6).

Both Cristina and Alicia realized that everybody experienced similar struggles and the reality that they were able to persist influenced their ability to persist. Older students, in other words, have taken the same courses and have managed to succeed. Therefore, listening to others who have been in one's position is like being able to see outside of oneself. Setbacks experienced are followed by successes. The precedent has been set; others have succeeded, so one can succeed as well. This sentiment was best described by Alicia, "I was like, you know, 'If they can do it, I can do it, too'" (INT #3, UT, p. 6).

Cristina noted a similar experience. She explained,

> Hearing those positive words and hearing somebody say like, 'It's going to be okay. I've been there. I've been in your shoes before' is something that's definitely has motivated…made me convince myself that it's not going to be so bad and that you're going to get through this. And you do that more than once throughout being a freshman and graduating in May. (INT #6, UT, p. 4)

Thoughts about not being able to persist have been present, at one time or another, in the minds of most of the participants. Recognizing that moments of uncertainty are not isolated thoughts that occur to only one individual is crucial to the mental well-being of

students. Cristina's quote reiterates that, regardless of classification, most students' need to be reminded by others who have been in their position that they, too, will be able to overcome their current struggles.

Identifying with other minorities and/or women. For participants, their need to relate to other Latina/os was evident even if they realized that not many Latina/os, in comparison to other ethnicities, were found in their engineering courses. For Dre, a transfer student from the University of Texas at El Paso (UTEP), she noticed the decreased number of Hispanics when she first arrived at UT compared to her first institution. She shared this about her first year experience at UTEP,

> My first year I did 'Introduction to Engineering' and I remember it was like 35 people. Only five of us were women but in that class since I took that class up at UTEP….I mean half of the people, if not all, are Hispanic. So, I mean, there was a difference there versus here. (INT #2, UT, p. 8)

Upon Dre's transfer from UTEP to UT, she noticed the decreased number of Hispanics in her courses. Coming from an environment where 74% of students are Hispanics to a campus that enrolls approximately 16% Hispanics was difficult for Dre. She later shared that she feels more comfortable around other minorities. Dre explained,

> I feel like people who are minorities or maybe I'm just, you know, like I said I hope not to sound racist but I feel like there's much more of an understanding in terms of people or persons, you know, with what's going on in their lives. (INT #2, UT, p. 3)

For Dre, she needed to connect with other minorities because she felt that they had a better understanding of who she was as a person and the struggles she encounters. She worried that the explanation for her preference to interact with other minorities would be interpreted as racist. Such connections, for Dre, are necessary so that she can interact with people who she feels she can connect with.

Other participants also noticed the scarce number of Latina/os enrolled in their courses. Esperanza highlighted the same concern as she estimated that minorities comprise "anywhere from 5-10 percent in the classroom" (INT #1, UCB, p. 8). She later noted that in a class of sixty students there are few Hispanic and Black students. Esperanza asserted, "I think the only time I have a Black student in my class is when my friend is there and then I'd say anywhere from three to seven Hispanics" (INT #1, UCB, p. 8). For Sophie and Sara, the limited number of Hispanics in their courses was something they learned to become accustomed to. Sophie shared, "Sometimes I look around the room and I'm like there's not a lot of Hispanic people in the room but that's okay, too, because I've gotten used to it" (INT #9, UT, p. 6). Sara expressed a similar thought, "I've gotten used to the fact that like I'm the only Latina in the room most of the time kind of thing" (INT #2, UCB, p. 5). Even though there is a level of complacency about the number of Latinas/os found in their classes, Sara discussed how she remains connected to other Latina engineers. She further detailed, I think what really helps is that I know people…like I know two grad[uate] students that are Latinas and they did the whole thing. They were [name of engineering program] here as undergrads, and I guess they kind of made it so it's not…it doesn't feel…I don't

know…it's just that like I've gotten so used to it kind of thing. (INT #2, UCB, pp. 5-6)

While Sophie and Sara have become accustomed to the limited numbers of Hispanics in courses, Sara further explained how she mediates the "normalcy" of who she typically does not see in her classes. Even though both Latinas have become acclimated to the limited presence of Hispanics, this does not necessarily mean that they agree with their ethnic underrepresentation. Rather, Sara discussed the importance of knowing other Latinas who, pursued the same engineering degree at Berkeley, have succeeded. Thus, she does not necessarily need to see other Latinas/os in her classes because she personally knows other Latinas who have been in her position and have succeeded. In other words, Sara's connection to former undergraduate Latina engineers helps her "get used to" being the only Latina in most of her courses.

Others discussed the importance of having an opportunity to connect with Hispanic counselors and advisors. Dre shared how a counselor referred her to a Latina psychologist to assist her with academic issues she experienced as an engineering major. She shared this about what her male counselor suggested, "He said it would be good for me to, you know, talk to someone especially like, you know, a Latina, and I went to talk to her" (INT #2, UT, p. 5). In this experience, Dre's male counselor recognized her need to feel connected to another Latina during her time of difficulty. This suggests that the counselor, too, recognizes the importance of connecting Latina engineering students to other Latina professionals. Liliana also boasted about her advisor when she shared the following, "And my advisor was actually Hispanic and he was the one that made me want to go pursue grad[uate] school. He, um, he was very kind to me. He was the one

that set up that interest" (INT #7, UT, p. 3). Because Liliana specifically mentioned her advisor was Hispanic, this suggests that she felt ethnically connected to him. Also, Liliana was appreciative of her advisor's kindness as she credits him for cultivating her interest in graduate school means that he positively influenced her. Liliana could have easily not revealed his ethnicity but the fact that she did possibly means that his ethnicity was of importance to her.

The need for participants to see other Latinas operating at various capacities is evident in the suggestions that Liliana, Marcie, and Sophie offered their respective departments. Because Liliana claimed to know only of two other Latina seniors in her program, she recommends that the department "invest more in diversity…like have diversity essays to promote diversity" (INT #7, UT, p. 8). While she had a suggestion to promote diversity with essays, she did not offer any other recommendations. The latter part of Liliana's quote also suggests that she was, at least during that moment, at a loss for ideas on how to increase diversity. Her concern was to invest in diversity because "there's not a huge Hispanic academic population" (INT #7, UT, p. 7). Being a member of the Hispanic academic population and recognizing the need to increase this population infers that Liliana would like to see more students like her on campus.

Sophie discussed how she recognizes the need for more Hispanic female faculty but is uncertain what can be done to fill this void in her department. She commented,

> And then I mean I only know one Hispanic faculty member who's a woman in my department and she is so nice and such a good professor….[Be]cause I know other women in the field but I have like three or four professors, no[ne] that are

> Hispanic so that's kind of…but then again it's hard to come by Hispanic women who've gotten their PhD in this department. (INT #9, UT, p. 9)

The absence of Hispanic females in positions of power was also a concern for Marcie. She explained, "Yeah, cause I don't know what the department can do to bring more, um, Latinas here unless they do like seminars with like big Latina names" (INT #8, UT, p. 12). While Marcie's idea might have first sounded plausible, she quickly rationalized "There are seminars. They have them here like distinguished lecturers…I don't think I've seen a lady name in there even just in general not just Latina" (INT #8, UT, p. 13).

Even though Marcie proposed a possible solution to heighten the presence of Latina distinguished lecturers, she quickly rethought her suggestion as she realized that she has yet to even see a woman distinguished lecturer let alone a Latina distinguished lecturer. Like Marcie, Sophie's suggestion to increase Hispanic female faculty prompted her to immediately recognize that a Hispanic woman with a PhD in her department "is hard to come by". Ultimately, both Sophie and Marcie recognized the increased need for Hispanic female faculty/distinguished lecturers but they both stumbled on the reality of that possibility.

As the data illustrated, most participants acknowledged the need to feel connected to other Latinas. Sophie, too, felt that it would be beneficial if Hispanic female faculty were more visible. When I further inquired about her perceived difference between female faculty and Hispanic female faculty she simply replied, "Just like probably self-identification" (INT #9, UT, p. 9). Sophie offered this insightful explanation to expand her thought,

> Just like the same as when I try to convince people to go tutor at low-income schools. Like those kids see you and you have the same color skin and the same color hair and you speak the same language and things like that help them self-identify. 'Hey, if they can do it, I can do it. Like they're not the only ones'. (INT #9, UT, p. 9)

Sophie's sentiment clearly illustrates the importance of seeing other Latinas in positions where they perhaps can aspire to be. While this is certainly important for children in primary and secondary schooling, Sophie's comment emphasizes the need for college-going Latinas to see people who look like them in positions of authority (e.g., faculty, distinguished lectures, advisors, etc). Increased visibility of Latinas in such positions could inspire a generation of young Latinas to be much more than what they've *only seen* they could be.

Positioning of Multi-Dimensional Gender Identities

Several participants discussed the various experiences that continuously shaped their multi-dimensional identities as female engineers. Their experiences in a male-dominated discipline illustrate that participants grappled with the various dimensions of their identities. The first sub-category details how participants recognized a need to prove their intellectual identity to their male counterparts. The second sub-category addresses how several participants ascribed to a gendered need to help others with their respective engineering degree. The third sub-category describes how participants sought to operate outside of their gender despite evidence of sexism. The last sub-category notes how participants negotiated future family and work identities.

Proving their intellectual identity. Several participants candidly discussed incidents where male students challenged their contributions because of their gender and consequently, the women had to prove their intellectual capability before their contributions were viewed as valid by male counterparts. Liliana shared the following example about how she had to fight for her contributions to be heard in classroom discussions, "I have to fight for my opinion to be heard, I feel just because there's not that many women in that area" (INT #7, UT, p. 6). Her struggle is evident and the source of her struggle, she feels, is because she is a woman. In this specific course, which is in a support area, she is the only female in a class of 55 students. She added how she has mediated this concern, "It's gotten better as I've gotten more assertive and so I've had to fight for my position in the classroom. Like 'Yeah, she knows what she's doing.' So, they hear me out" (INT #7, UT, p. 6). Liliana's assertiveness helped her establish her as a knowledgeable student in classroom discussions. The latter part of Liliana's quote suggests that she had to substantiate the substance of her knowledge to other male students before they were willing to hear her out.

Cristina, like Liliana, disclosed a similar incident while doing group work. She had this to say, "And even working on teams, like I've worked with guys before and sometimes it gets annoying because they don't, you know, respect you as much as their other male counterparts and it's frustrating" (INT #6, UT, p. 12). Frustrated that her contributions are not viewed as valid as her male counterparts, Cristina realized that she is not as respected because of her gender. She later added, "You just have to keep doing what you're doing. I mean it's there, realize that it's there and move on" (INT #6, UT, p.

12). Cristina feels that it is important to acknowledge the real source for the lack of respect. She, in other words, clearly understands that the lack of respect is a function of her gender and not necessarily to the quality of her contributions.

Esperanza discussed her experience with sexism in Berkeley's engineering school. She shared, "I feel like especially every, you know, once in a while you kind of run into sexism a lot, you know?" (INT #1, UCB, p. 11). Esperanza contradicts herself in regards to how often sexism occurs. Initially she says one runs into sexism "once in a while" and then admits that one "kind of run[s] into sexism a lot". This suggests that incidents of sexism occur more often than Esperanza would like to admit. She furthered explained,

> Like when you do a lab or when you're doing homework or when you're doing a project or even when you're in an organization, you know…you kind of have to…everybody walks in with a certain level of respect and you are about twenty notches below them [males]. So, you have to work your butt off just to get respected just as much as everyone. (INT #1, UCB, p. 11)

Esperanza's quote shows that, in her experience, sexist incidents are pervasive. The fact that Esperanza mentions labs, homework, projects, and organizations as instances where she must establish respect suggests that females are not as respected as males. To come in "twenty notches below them [males]", corroborates sentiments shared by Liliana and Cristina that female engineers must work harder to prove their intellect.

Dre noted a different type of sexist incident during a class presentation. She shared the following,

> I remember coming in and, you know, I was just in my slacks, nice shirt and someone whistled at me. And I was just kind of like, well…other than it was funny more than anything, I just didn't know how to take it. And I was like, 'Well, okay, you know? Alright.' I guess men are just immature, I don't know. It just made me feel like kind of awkward but also I mean that is in everything, you know, like when guys try to hit on you; it didn't feel very professional to me at the time. (INT #2, UT, p. 13)

Dre's experience and her reaction suggest that she was unclear about how to react to such an incident. She quickly shares that "men are just immature". Dre ultimately recognized the unprofessionalism of this male student's actions. An incident such as this suggests that male students often undermine the intellectual ability of female students before they even begin to speak in a professional arena. The importance of the knowledge to be dispersed in this presentation was deflected by an act that treated Dre as *only* a female rather than a knowledgeable engineering student.

Like Dre, Esperanza also experienced a similar sexist incident but within a student engineering organization. As the only female officer in this organization, Esperanza felt silenced in board meetings. She disclosed, "When I walked into a meeting it didn't matter what I had to say, it didn't matter what I did because at the end of the day I was just a girl" (INT #1, UCB, p. 12). Esperanza, as in Liliana's and Cristina's experience, instantly recognized that her thoughts or suggestions would be automatically

dismissed because she was a female. She further discussed, "Like most of their comments kind of made me believe that, you know, I was something more to look at than something to actually contribute" (INT #1, UCB, p. 12). Similar to Dre's experience, Esperanza's physical appearance became the focal point rather than anything she might have had to say. She further provided an example to illustrate how her appearance rather than her intelligence was valued when invited by a male to accompany him to a meeting where they were going to ask for funds for their student organization. Esperanza described,

> He says, 'Oh, well, you know, you should…do you want to come along? Do you have extra time?' And I'm trying to figure out how to get extra time, trying to move around my other meetings and he says, 'Yeah, because they told me that it would be good to have a girl there; so, you can go and be the girl there.' (INT #1, UCB, p. 12)

Esperanza further understood her role in this meeting when she was instructed not to speak and to simply "stand there and look pretty" (INT #1, UCB, p. 12). The idea of attending a meeting to simply "be the girl there" has several implications. One, the male did not feel Esperanza had anything to offer to the discussion. This implies that the male felt he did not need help from a female when asking for the funds. Two, Esperanza's presence was an opportunity where they could display her for mere appearances; Esperanza as a pretty girl and the organization for being inclusive of a female board member. Three, Esperanza is exploited because of her gender. The need for Esperanza to just "be there" implies that in many ways the male would like her to act like a statue.

Statues, in reality, are polished, positioned, and displayed for people to admire their beauty. Because statues cannot speak, their voices are non-existent. Such is the case in how Esperanza was exploited to "stand there and look pretty" without speaking a single word.

In addition to sexism they confronted as engineering students, several participants discussed sexist incidents as interns. Sophie discussed in detail how her experience in two different internships, with two different companies has dissuaded her from entering industry. Early in her degree program, Sophie realized that she wanted "to be in the field" and "to be a project manager" (INT #9, UT, p. 10). She disclosed, "I want to, you know, be in charge and learn a lot about construction, be really knowledgeable and know my stuff and go out there and, you know, handle business" (INT #9, UT, p. 10). This quote illustrates that Sophie was interested in furthering her learning to eventually be in a supervisory position. Before Sophie could become a supervisor, she realized that she had to pay her dues. She described one of her internship experiences,

> And so I set myself up with internships to learn a lot first. Before you can be in charge, you've got to pay your dues. And the dues that I've paid were I made copies all day and I refilled the coffee machine and nobody ever, I felt, nobody ever gave me any responsibility or a chance to go out to actually be in the field. I mean I never went outside the trailer. I did paperwork all day. (INT #9, UT, p. 10)

Similar to her previous assertion, Sophie understood that internships were opportunities to learn and to pay her dues. The dues she paid, however, did not give her an opportunity to gain experience in the field. Rather, the company utilized her for clerical duties; typical of assistants rather than colleagues. She struggled to understand why she was not put on a job site while other male interns were. She rationalized, "So, I was like I don't know if it's cause they're guys or maybe they just felt like they were ready. I don't know…we were all on the same level in school…" (INT #9, UT, p. 10). Despite her attempt to comprehend why male interns were placed on job sites, she shared that "she never really understood that". She ultimately concluded that, "They didn't give me as much responsibility because I was a girl". As a result of similar experiences in two different internships, Sophie disclosed "That's kind of deterred me…like this is taking a lot longer…maybe construction isn't for me" (INT #9, UT, p. 10). Sophie's experience is an in-depth example of how female engineers, even before they enter the workforce, are discouraged about their prospects to even gain access to an actual job site.

On a comparable note, Cristina offered insight into why women engineers might not choose to enter industry. She noted, "You have to not only deal with the fact that, you know, you're working with men but you have to deal with maybe certain challenges men don't see" (INT #6, UT, p. 11). Cristina expanded on the latter part of her statement as she contended,

> Maybe if you're working on a team of mainly males, if they underestimate your opinion or your knowledge or your expertise in a certain field you can get discouraged and you can second-guess yourself. You have to know that you

> know what you know. And you can't let anything get in the way of that; otherwise you're never going to progress or you're never gonna go forward. (INT #6, UT, p. 11)

Thus, the challenges that Cristina refers to are a result of how some males refuse to see their female colleagues as knowledgeable experts in their respective field. Such experiences ultimately undermine the intellectual knowledge and capability that female engineers possess.

Ascribing to a gendered desire to help others. Several participants in the study discussed how certain aspects of their respective engineering degree would help others. For many, the description of the utility of their degree often promoted stereotypical traits often associated on the basis of gender. Chilanga shared that she "kind of wanted to make a difference for Mexico and felt that [her] strengths played to the engineering part" (INT #4, UT, p. 1). Clara described a similar thought about her choice of degree program, "It has a lot to do with social interaction and I like helping people so yeah, it's going to be a good fit" (INT #5, UT, p. 1). Sarah also disclosed the following about why she chose to major in her degree program, "I guess it stuck out because it was more for what I was interested in, which was serving people" (INT #1, UT, p. 1). Like Chilanga, Clara, and Sarah, Dre also recognized the impact she could make with an engineering degree. She stated, "I also, you know, wanted to do something good for the world in a way and I thought, you know, with my engineering degree I could do that" (INT #2, UT, p. 1). Chilanga, Clara, Sarah, and Dre all felt that their engineering degree would allow them to make a difference, to give back to their country (in Chilanga's and Dre's case)

and to help people in their communities (in Clara's and Sarah's case). Their degrees would be used to impact and improve the lives of others positively.

Some participants specified the impact their chosen degree programs would have on communities. Dre shared how she wanted to use her degree, "I was doing [degree program] engineering specifically but, I wanted to go ahead and, you know, use that and do vaccines and stuff and what not" (INT #2, UT, p. 1). Dre hoped to improve the health of individuals. While Dre wanted to create vaccinations, Estella discussed how, in her third year of college, she began to see exactly how she could apply her engineering degree. She had this to say, "And that's when you realize, 'Oh, it's important to have safe water and it's important to [have] like well-designed infrastructure and all that stuff'" (INT #3, UT, p. 4). Estella added, "And how that impacts everybody and not just consumers, you know?" (INT #3, UT, p. 4). For Estella, she recognized the importance for people to have safe and secure basic necessities (e.g., water and infrastructure). She also makes a distinction between how her degree will impact everybody and not just consumers. Estella's distinction of "everybody" versus "consumers" is quite interesting. While "everybody" inherently refers that all people would benefit from her degree, "consumers" refers that only individuals who have purchasing power would benefit from her degree. Therefore, she intends to use her degree in a manner that is beneficial to everyone rather than just a selected few.

Sarah made a similar assertion, "[program name] engineering was buildings roads, bridges, making sure the water is clean and I could just imagine myself, um, just working in that type of field that dealt with solving problems for cities, for communities"

(INT #1, UT, p. 1). Sarah's degree attainment means that she can help communities resolve concerns pertaining to water, roads, and bridges. She, in other words, sees herself as a problem solver. She recognizes the importance of sustaining the daily needs of people. Clara also noted, "[W]ater quality like you don't…if you care about water quality you obviously care about the people and their well-being and like a lot of these other things are like 'Oh, I just want to make a machine work'" (INT #5, UT, p.10). Clara explicitly discusses how one cannot be concerned about clean water without being concerned for the people who drink the water. She clearly denotes the difference between her degree program and other engineering degree programs, whereby individuals might be taught to simply "make a machine work". Clara obviously places a higher value on what she can do with her degree when compared to other students in other engineering programs. These Latinas all noted the desired utility of their degree. Their desire to make a difference by helping others, one could argue, is traditionally ascribed female characteristics.

In the latter part of Clara's quote, she hints at why you find more females in some engineering degree programs than others. She further explained, "That's one thing I've noticed that like engineers are mostly guys but as you get more specialized, environmental is where all the girls tend to con[gregate]" (INT #5, UT, p. 10). When I inquired about why she believes this is the case, she had this to say "I think it's more of a social, it's not a social science, but it takes into account a lot more social aspects of life" (INT #5, UT, p. 10). Here, Clara ascribes to the belief that females are more concerned with the "social aspects of life". This is why she believes that females are

more likely to choose to major in engineering programs that focus on the general well-being of people. Estella similarly noted, "I'm going into environmental…so you see more girls now cause I guess it's more a girly thing that guys want to do buildings…and girls are more into like I guess water and stuff and like environmental stuff" (INT #, UT, pp, 4-5). Like Clara, Estella suggests that females choose environmental engineering because it is deemed "girly."

Sarah revealed a similar way of thinking when she discussed the differences between engineering degree programs. She described, "So, electrical engineering was more with dealing with circuits and little things and then mechanical was you could do anything with it but it wasn't specifically serving people" (INT #1, UT, p. 1). Sarah's comment suggests that she understood that engineering programs are designed with different purposes in mind. Although she was aware of the utility of various engineering degrees, she also knew which one she wanted to pursue because of her desire to serve people.

Operating outside of gender. Despite their desire to help others, participants also sought to operate outside of their gender. Because participants were aware of their gender and racial/ethnic underrepresentation in engineering, several chose to position their identity outside of gender. As previously noted, Sophie detailed two separate internship experiences where she was not given an opportunity to go to an actual job despite. Even though Sophie concluded that she was given less responsibility because she was a female, she still questioned the frequency of sexist incidents in the workplace. Despite her experiences as an intern, Sophie was not certain if similar occurrences would

"actually persist in the workplace but it definitely deterred [her] from wanting to go into construction as my final job career" (INT #9, UT, p. 11). Sara, like Sophie, discussed a similar experience. When asked why she thinks female engineers do not enter industry, Sara claimed that she was unsure. After some thought, however, she offered the following perspective:

> Maybe they don't like it [engineering] anymore. Cause I know like I did an internship one time and then I thought it was really boring compared to like I don't know…I just thought it was just paperwork, and I was like 'How is this somehow engineering related?'. (INT #2, UCB, p. 10)

Sara's internship experience, much like Sophie's, was unfavorable as she, too, was consumed with paperwork. Although she did not elaborate on her experience, the latter part of her quote suggests that Sara was not given the opportunity to work on a job site. She found her internship to be "really boring" because the company failed to afford her an opportunity to connect her knowledge of engineering to an *actual* engineering work environment. Therefore, Sara's knowledge of engineering remained intangible as she was not able to *apply* what she knew. In this instance, Sara did not suggest that her experience as an intern had anything to do with her gender.

Of all the participants, only Chilanga felt that females had an advantage over males when it comes to employment in industry. She stated, "I think it's been a lot easier for girls to get the job than for guys" (INT #4, UT, p. 14). Chilanga added, "And I definitely feel like I go in with an advantage over a guy friend now just because companies are working so hard to…increase their numbers of women" (INT #4, UT, p

14). Because Chilanga believes that industry wants to increase the number of women engineers, she indirectly suggests that female engineers *choose* not to work in industry. Throughout our interview, Chilanga did not hint at or mention any incidents of sexism she experienced. Additionally, she had several job interviews with companies who were willing to hire her upon graduation. Because of her experience, Chilanga does not feel that females are disadvantaged when it comes to employment in industry.

Unlike Chilanga, some participants discussed the anticipation of discrimination as they spoke hypothetically about sexism in the workplace. Alicia commented the following about female engineers, "If they've been working at a job and it's like they've been working as an engineer, for example, for like a certain amount of years and they are still not where they want to be" (INT #3, UT, p. 9). Alicia further offered this explanation of why female engineers, after years of employment, are "still not where they want to be". She discussed,

> I'm not saying this is like rampant or anything but I think this happens is that you have a woman, you have a man, and you have a young lady like and if she's married, you know, what if she gets pregnant? And what if she has to do pregnancy leave? And what if she decides to just leave? And then you have that spot open again. (INT #3, UT, pp. 8-9)

Alicia interestingly makes a distinction between how supervisors might view female and male workers in industry even in a hypothetical situation as she notes "what if" in her explanation. She further added, "So it's like…if I were like a male supervisor maybe that would influence my decision unfortunately" (INT #3, UT, p. 9). She further added, "And

I'd be like 'Well, you know, let's just go with the man. He's probably gonna be here for a long time cause you never know like if she's married, she wants to have children or she wants to leave'" (INT #3, UT, p. 9).

In her view, Alicia rationalizes why females are not awarded promotions from the perspective of a male supervisor. The assumption is that males would be a better investment for a company because they do not possess the same family responsibilities as females. She frames a woman's choice to get married and to have a baby as a pragmatic reason why she would not be promoted. Such a perspective promotes the male norms often associated with engineering.

Negotiating family and work. Many participants discussed conflicting identities in relation to future family responsibilities and work. Several participants noted the role of family and how that often hinders female engineers' ability to be successful or to even enter the workforce. When asked why few females enter the STEM workforce, Alicia offered this explanation "Some of my friends I know are married…and I guess the traditional ideas that you get married and you have kids. So, maybe they quit their jobs or they decide they really want to devote themselves to their children" (INT #3, UT, p. 8). Alicia's explanation suggests that females who "devote themselves" to their family may decide to leave their jobs. Sarah detailed a comparable sentiment,

> Another reason that a lot of women is that they decide to have a family instead. So, especially Latinas, you know? Especially for like my family…it's normal that around—before 30 at least—you should already be married and have like

> three kids (she laughs). So, it's really hard to go into industry and raise a family. (INT #1, UT, p. 13)

Sarah offered comparable insight in regards to negotiating the conflicting identity of motherhood and career woman. In her statement, Sarah shares how for her, as a Latina in her family, "it's normal" to be married and have children by the age of 30. Sarah suggests that a job in industry and raising a family are in conflict with each other. One can engage in one (i.e., motherhood or career) only at the expense of the other.

Alicia also elaborated on the conflict between motherhood and career,

> As women that's a hard decision to like make. It's like you're either successful in your career or a really good Mom and you can't do both most of the time. And it's sad but that's the way it usually goes. (INT #3, UT, p. 8)

In this instance, Alicia discusses how females must choose to be good mothers or choose to be successful career women. Although she is aware of the difficulty associated with the choice that women must make, she believes that such decisions are typical. Alicia's quote also suggests that good mothers cannot be career women and that career women are not good mothers. Ultimately, women, in other words, can identify as successful career women or as good mothers but not both.

Others like Liliana and Sarah acknowledged the difficulty of family and work balance, but maintained hope that anything is possible. Liliana shared, "Like I don't see many faculty members that have kids or that, you know, [are] spending time with their kids…it just gets harder" (INT #7, UT, p. 8). Liliana's observations of female engineering faculty imply two things. One, many female faculty do not have children.

Two, female faculty who do have children often struggle to make time for their children. She expanded on her thought, "It just complicates the issue because like you can't really be successful like…of course, you can but it just makes it so much harder to devote so much time to let's say having a faculty position" (INT #7, UT, p. 8). Even though how Liliana knows whether faculty have children or when, and if, they spend time with their children is uncertain, her perception is that faculty life strains female faculty's ability to be successful mothers. In this quote, Liliana suggests that children jeopardize a female's ability to be a successful faculty member.

Sarah offers a less skeptical perspective of women, motherhood, and career. She details,

> So, it's definitely possible and, you shouldn't, women especially shouldn't think that I can either have this or—it's not "either/or" it's "and", I think. So, the more people that we get to think in that way I think we'll see more women as CEOs and things like that with family. (INT #1, UT, p. 13)

In regards to women's ability to balance family and work, Sarah remains optimistic about the possibility of women to be successful at work *and* with family. She is the only participant who truly believed that such a balance is possible. Her quote spoke to the importance of other women with families to set a precedent to demonstrate that women can be mothers and have successful careers. More importantly, she emphasizes the importance of women to recognize that they can have it all. While she could not speak to how to achieve such balance, she confidently expressed that "At least for me, anything is possible still" (INT #1, UT, p. 13).

Summary of Findings

The findings ultimately conclude that the Latinas in this study sought to cultivate and maintain systems of support. While several participants noted the importance of fathers and their respective family (e.g., mental and financial support, etc), they also proactively cultivated other systems of support (e.g., classmates/peers, student organizations) to help mediate specific academic struggles they were sure to encounter. Even though fathers and family were integral systems of support, participants were also aware of their need to build relationships with other individuals. More specifically, relationships they cultivated with peers were reciprocal in nature. While participants sought classmates to mediate academic struggles, they too offered the same source of support for their peers. In addition to family and classmates, student organizations were vital to their sense of belonging. Even though participants joined various student organizations for different reasons, each participant ultimately wanted to feel like they belonged in their environment. Each of the sub-categories that emerged from data analysis suggests that participants maintained and cultivated multiple systems of support to address specific needs deemed vital to their persistence.

The study also found that participants needed to be connected to others like them. For most participants, this meant surrounding themselves with other engineers. Regardless of whether friendships occurred out of need or convenience, a majority of participants knew the importance of being surrounded by other engineers especially in times of academic struggles. Such struggles, recognized as collective by all but one of the participants, were important for participants to recognize. Even though participants

encountered academic setbacks, those setbacks were not detrimental to their overall success as most realized that their academic struggles were experienced by most, if not *all*, engineering students. More importantly, participants realized that their academic struggles would not defeat them. In addition to being surrounded by other engineers and embracing the collective academic struggle, several participants also highlighted the importance of their need to identify with others who were racially/ethnically or gender-wise like them. Participants discussed how they joined race-specific organizations to associate with other minorities/women. For some, the lack of Latinas in their engineering courses meant that they searched elsewhere for role models who were Latinas and who had once been where they are as Latina engineers.

The study also concluded that these participants, even as undergraduates, had to position the multi-dimensional gender identities they encompass as female engineers. Many of the experiences shared by the participants chronicled an unfavorable and even hostile climate. For several participants, the atmosphere was one that constantly made them feel like they had to prove their intellectual identity to their male counterparts who did not value their contributions because they were female. Participants discussed such occurrences in the classroom, group work, student organizations, and internships. Several participants ascribed to stereotypical characteristics often associated with females when they discussed why they chose their engineering degree and/or discussed the utility of their respective engineering degree. Participants also noted how they often chose to operate outside of gender. For these participants, they realized the role that being female played in their experiences but often underscored their importance or

simply chose to "deal with it." Lastly, participants also shared how they negotiated conflicting family and work identities. Most participants were skeptical about women's ability to be successful in both motherhood and career. For some participants, the lack of precedent deemed a balance of family life and work almost impossible.

As such, the findings of this study provide insight into the perceptions of social support networks and climate in the persistence of 11 Latinas pursuing an undergraduate engineering degree. The themes and sub-themes that emerged from data analysis are identified in Table 7 below.

Table 7. Categories and Sub-Categories that Emerged from Data Analysis.

Category	Sub-category #1	Sub-category #2	Sub-category #3	Sub-category #4
Maintaining and Cultivating Systems of Support	The Role of Fathers and Family	Reciprocity of Peer Relationships	Student Organizations and a Sense of Belonging	--
Connecting to Others Like Them	Identifying with Other Engineers	Working Collectively to Overcome Academic Struggles	Identifying with Other Minorities/Women	--
Positioning of Multi-Dimensional Gender Identities	Proving their Intellectual Identity	Ascribing to a Gendered Desire to Help Others	Operating Outside of Gender	Negotiating Family and Work

The categories and sub-categories that emerged provide insight into an underrepresented and under-examined student demographic pursuing undergraduate engineering degrees. More importantly, rather than examining decisions of non-

persistence this study focused on how social support networks and climate assist and shape the persistence of Latinas in engineering. While this chapter revealed the experiences of the participants, the following chapter analyzes the data using the frameworks outlined in Chapter 2. In addition to data analysis, the next chapter details the implications of the findings as well as provides recommendations for practice.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This study sought to gain insight into the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in engineering. The previous chapters discussed the design of the study, the theoretical framework and relevant literature on the issue, the methodological approach and the findings of the study. This chapter details conclusions drawn from the findings in relation to the research questions and theoretical framework, implications of the findings, and offers recommendations for future research. First, however, I provide a brief overview of the study.

Brief Overview of Study

Latinas continue to be underrepresented in undergraduate engineering degree attainment, suggesting that further studies are needed to gain insight into the experiences of Latinas who persist through graduation with an engineering degree. The purpose of this study was to gain perspective into the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in various engineering programs, including architectural, biomedical, civil, chemical, mechanical, and environmental. The overarching research questions that guided this study were:

1). What are the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate degree in engineering?

Subsidiary research questions included:

2). What types of support networks are integral to Latinas' persistence in engineering?

3). What effect, if any, does participation in university clubs/organizations have on Latinas' persistence in engineering?

4). How are Latinas' perceptions about gender impacted by the male dominated discipline of engineering?

The theoretical framework that guided this study was Tinto's (1975; 1987) persistence theory, focusing specifically on the social aspects (e.g., familial influence, student involvement, etc). I included an extensive review of literature pertinent to women in STEM, minorities in STEM, and Latina/o persistence in higher education. To be fair, it is important to note that several factors can influence students' persistence and non-persistence decisions; however, this study focused only on social support networks and climate. While ample literature exists on the role of social support networks, few studies address systems of support for Latinas who pursue undergraduate engineering degrees. Similarly, minimal research accounts for the perceptions of climate for minority females, such as Latinas, who pursue engineering.

A constructivist view (Lincoln & Guba, 1985) framed this study. Eleven participants took part in this study; two participants from UC-Berkeley and nine from UT-Austin. Potential participants had to self-identify as Latina, major in engineering, and be classified as a senior. With the exception of the first participant at UC-Berkeley

and three participants at UT-Austin (See Table 8 below), the remaining participants were recruited through a snowball technique (Rubin & Babbie, 1997).

Table 8. Participants' Name, Institution, and Classification Status

Name	Institution	Classification Status
Sarah	UT-Austin	Senior
Dre	UT-Austin	Senior
Alicia	UT-Austin	Senior
Chilanga	UT-Austin	Senior
Clara	UT-Austin	Senior
Cristina	UT-Austin	Senior
Liliana	UT-Austin	Senior
Marcie	UT-Austin	Senior
Sophie	UT-Austin	Senior
Esperanza	UC-Berkeley	Senior
Sara	UC-Berkeley	Senior

Data were primarily collected through face-to-face semi-structured interviews that lasted approximately 35-70 minutes. Ancillary data were collected from participant responses on a demographic sheet and three online guided questions which further inquired about group work in courses, relationship(s) with faculty, and what their respective university does to make diverse students feel welcomed and like they belong. After I transcribed the interviews verbatim removing only non-verbal language (e.g., "hmm," "uh," etc), data were analyzed through content analysis (Lincoln & Guba, 1985). Data were then coded and categorized by similar or repeated ideas, also known as categories. To ensure the trustworthiness of the study, member checking and peer debriefing, among other methods (e.g., reflexive and methodological journal) were

employed. Participants also electronically received a copy of their respective transcript and were encouraged to clarify any statements or interpretations made.

Analysis and Discussion

What follows is a discussion of the themes that emerged from data analysis and theoretical framework utilized to frame this study. *Creating a sense of belonging*, *Navigating hostile climates*, and *Understanding the gender factor* were common themes that emerged.

Creating a Sense of Belonging

An important theme repeated by participants was the importance to maintain and cultivate systems of support to create a sense of belonging. Participants often spoke about the role of their families and more specifically, their fathers as they pursued their respective engineering degree. In addition to family, participants reiterated the importance of peers and how the reciprocity of such relationships proved to be viable tools in their persistence. Lastly, several participants also discussed the significance that student organizations had in their acclimation to their new environment. Several participants acknowledged the aforementioned systems of support, which ultimately enabled them to create a sense of belonging on campus. Creating a sense of belonging while at college, ultimately, positively influences persistence decisions of students (Astin, 1984; Hurtado & Carter, 1997; Johnson et al. 2007; Tinto, 1996).

The study found that familial influence remains critical for Latinas' success and persistence in engineering. This sentiment supports the previous work of many other researchers who have found that family support is paramount to Latina/o success in

college (Arellano & Hurtado, 1996; Gandara, 1995; Gloria & Rodriguez, 2000; Hernandez, 2000; Rendon, 1994). Several participants noted the various capacities in which their families comprised a system of support. For Latina/o college students, family provides a strong bond (Vega, 1995), strength (Rendon & Taylor, 1990), support and emotional security (Hernandez, 2002). All of these assertions were corroborated with the findings of this study. Participants shared their connection with their families and how they often sought parents for strength and emotional security in times when they encountered academic setbacks and challenges. Others like Cristina and Dre disclosed how families provided unconditional and unbiased support to help with their emotional and mental well-being. Such instances suggest that their parents and families serve as a genuine outlet where many participants shared their vulnerabilities and perceived educational shortcomings (e.g., not completing homework, performing poorly on an upcoming test). Furthermore, several participants in this study noted the role that family plays in their motivation to pursue college and attain their respective degree (Kimura-Walsh et al. 2009). As noted in previous studies (Nora, 2003) as well as this study, Hispanics' connection to parents remains a crucial aspect for not only a successful transition from high school to college but also their decision to persist in college.

Fathers and friends. While families, collectively, provided multi-faceted levels of support, the parents, more specifically, mothers have been found to be of particular importance to the educational endeavors and achievement of Latinas (Cammarota, 2004; Rodriguez et al. 2009). While a few participants noted the importance of their mothers and their parents collectively, several participants highlighted the influence their father

had on their decision to pursue engineering. The latter part of the Latinas' experiences provides new insight into the role of the father, which has been scarcely identified within the Latina/o population. For Dre, Clara, and Marcie their decision to pursue engineering was an opportunity to emulate their father. Some Latinas suggested that they are able to achieve something (e.g., degree from UT for Cristina, engineering degree for Alicia and Sophie) that their respective father once sought but were not able to realize. Thus, for Cristina, Alicia, and Sophie their success in engineering fulfills prior aspirations held by their respective father. Such a finding in this study suggests that fathers are no longer only financial providers but a critical source of support who can influence their respective daughter's success and persistence in engineering. Also important to note is the fact that most of these fathers can be considered "white collar" workers versus "blue collar" workers. Such a distinction suggests that their occupations also influence the level of interaction with their daughters, especially since they are pursuing a male-dominated discipline. This findings suggests that degree choice influences the level of interaction and influence that fathers have on daughters' decision to pursue and persist.

Peer support. In addition to family, this study also found that peers proved to be a vital support system that helped most participants acclimate to the social and academic aspects inherent in undergraduate life. Peers, like family, provided participants with a multi-leveled system of support (Bonous-Hammarth, 2000). Because all of the participants mentioned the importance of peers in regards to academic-related instances (both inside and outside of the classroom context), one could argue that such a system is a valuable component that is vital to student success and persistence in engineering.

Along with other sources (e.g., family, faculty, student organizations), peers continue to constitute a viable support system for students. This assertion has been corroborated with previous studies that have found peer groups influence individual growth in college (Astin, 1993) and increases college adjustment (Hurtado et al. 1996). Findings from this study mirror previous studies that noted the particular importance of peer support for Latina/o students (Gloria et al. 2005; Hernandez & Lopez, 2004).

As a result, all of the participants in this study recognized the need to cultivate an academic support system with classmates. This system of support was one of reciprocity as participants were also simultaneous sources of support for peers. More specifically, Liliana, Marcie, and Chilanga noted the importance of "peer help" which connotes that peers help other peers with any course-related queries. Sarah and Dre, for instance, explicitly discussed the importance of proactive measures needed to secure peer systems of support. The venues in which Sarah, for instance, meets people are engineering-related programs, courses, or organizations. This is indicative of two important aspects pertinent to engineering majors: 1). Many engineers spend an abundant amount of time on campus, which increases their exposure to the availability of resources that programs and organizations have to offer. 2). Many engineers are consumed with the engineering culture that permeates beyond classroom and lab times. Sarah's experience during her freshmen year where she did not make an effort to seek out peers for support implies that success in engineering is not one that can be accomplished *alone*. Because peers took the same courses and completed the same homework/labs, they were able to assist each other in their learning.

Still another integral aspect of the peer system of support was the collective academic struggle that participants and their classmates experienced. Participants did acknowledge the reciprocity of such relationships and how their collective struggles were defining aspects of their support network with peers. Seeing other students struggle with course material was a concrete reminder that, as in the words of most participants, *everybody* inevitably encountered. The use of the word *everybody* encompassed a reality for most, if not all, engineering majors, regardless of GPA, that they may not be able to persist. The doubt and uncertainty about their academic ability is subsided when they recognize that other students struggle just as much. While many students might become trapped in the moment of the struggle, the importance is for students to recognize that the struggle is both temporary and continuous as semesters' progress. Participants recognition of such experiences corroborates the work of Attinasi (1992) who suggests that students create a support system with other students to help combat the psychological (as well as the social and physical) aspects of college. Even more importantly is the reality that, despite such struggles, these struggles are not a source of defeat for participants. By acknowledging their collective struggles, participants inferred the following three assumptions. One, course material will be challenging for most, if not all, students. Two, every student encounters academic struggles in engineering. Three, students' ability to see that other students struggle reduces anxiety about their lack of understanding of the course material. In other words, when students embrace the collective struggle they realize that their own difficulty with the course material is *not* a result of one's lack of ability but rather the rigor of the curriculum itself. Only Dre

expressed that her lack of academic success was a result of her own academic potential rather than recognizing that most, if not all, other students' experience, at one time or another, the same self-doubts about their ability to be academically successful.

The role of student organizations. In addition to family and classmates, this study found that several participants noted the importance of student organizations and how their membership in such organizations aided in their sense of belonging. Even though only 4 out of 11 participants identified their membership in student organization(s) as integral to their persistence in engineering, the fact that 10 out of 11 participants were members of campus organizations suggests that students recognized the potential benefits associated with their membership(s) in student organizations. This study found that student involvement with their college environment via group association (e.g., student organizations) promoted positive interactions that ultimately helped students integrate socially and academically. Such findings confirm the work of Tinto (1975, 1987) and Astin (1999) which noted the importance of student involvement.

Numerous participants highlighted the various academic and social systems of support that membership(s) in student organization(s) afforded them (See Table 9 Below). Many discussed their membership(s) in various organizations such as, but not limited to, Society for Hispanic Professional Engineers (SHPE), Student Engineers Educating Kids (SEEK), Pi Sigma Pi, Kappa Delta Chi, Hispanic Engineers and Scientists (HES), Beta Mu Epsilon, and Tau Beta Phi. For some participants, SHPE provided a system of academic support with "wonderful resources" and "mentoring opportunities" and social support as the organization served as a venue where they could

meet others engineers and, for some, who later became their friends. Such formalized mentoring opportunities have been found to assist Latina/os to develop strong internal and external connections to the students' respective university (Gloria et al. 2005). Sara and Cristina similarly explained how HES and SHPE, respectively, provided them with opportunities to meet older engineering students whom they sought for academic-related advice. Similar to the findings of Gloria and Rodriguez (2000), upper-classmen essentially served as peer role models for several participants.

Table 9. Participants' Current, Previous, and Attempted Membership(s) in Student Organization(s)

Name	**Current Membership(s)**	**Previous Membership(s)**	**Attempted Membership(s)**	**Volunteer Status Only**
Alicia	Society of Hispanic Professional Engineers (SHPE); Pi Sigma Pi	Fair Food Austin		
Dre	SHPE; Pi Sigma Pi		American Institute of Chemical Engineers	
Chilanga	Tau Beta Phi	American Society of Mechanical Engineers; Organizacion Latinoamericana	SHPE; Society of Women Engineers (SWE)	Organized golf tournament at EXPO
Sarah	Pi Sigma Pi; SHPE; Student Engineers Educating Kids (SEEK)	Engineering Chamber Orchestra Church Group		

Table 9 Continued…

Name	Current Membership(s)	Previous Membership(s)	Attempted Membership(s)	Volunteer Status Only
Clara	SHPE; Pi Sigma Pi		American Society of Civil Engineering	Equal Opportunity in Engineering (EOE)
Cristina	SHPE; Kappa Delta Chi			
Liliana	Beta Mu Epsilon	Language and Linguistics Art Club	SHPE	EOE
Sophie	Pi Sigma Pi; SHPE; Kappa Delta Chi	Habitat for Humanity Club		Longhorn Tutoring Program
Marcie	FLAGS	SHPE; SEEK		Engineering Day; UT Explore; Introduce a Girl To Engineering Day; Project HOPE
Esperanza	Hispanic Engineers & Scientists (HES); Arab American Association for Engineers	Dance Works; Students for Justice in Palestine		
Sara	HES; CalNERDS	TRENZA		

The role of race-specific organizations. Despite inconsistent results on the type of student involvement most beneficial for Latina/o students (Schneider & Ward, 2003), most participants sought out race-specific organizations as a way to secure a sense of belonging within their respective environment. Ethier and Deaux (1994) found that student involvement with race-specific organizations increased college adjustment which

consequently, increased the likelihood of persistence. For several participants in the study, this was certainly the case. Several participants actively sought membership in race-specific student organization(s) such as TRENZA, SHPE, HES, and Kappa Delta Chi to mediate their underrepresentation in engineering. Previous studies have noted the importance for Latina/os to join other Latina/o student organizations (Arellano & Padilla, 1996; Hurtado & Kamimura, 2003; Tomas Rivera Policy Institute, 2008), especially in regards to how such memberships in race-specific organizations influence persistence decisions (Oseguera et al. 2009).

Similar assertions highlighted the importance of race-specific organizations as Esperanza, for instance, a bi-racial student who is Latina and Arab- American was a member of two different race-specific campus organizations. While Chilanga discussed her initial membership in Organizacion Latinoamericana as a way to identify with her Latin American identity, Sara also noted her current membership in HES and previous membership in TRENZA, both race-specific organizations. The importance of race-specific student organizations is evident as *all* of the participants were either members or attempted to be members of such organizations. Such findings confirm various studies that emphasize the importance of Latinas' affiliation with other Latina/os via student organizations (Gloria et al. 2005; Hurtado & Kamimura, 2003).The need of most participants to seek race-specific campus organizations speaks volumes to the sense of belonging on the premise of race that these participants sought at their respective university. Only Chilanga and Liliana noted their disagreement with the need to coalesce student organizations on the basis of race and their membership in engineering academic

honor societies suggest that they wanted to be recognized for their academic achievement rather than their race.

Others like Dre and Clara sought membership in organization(s) that made them feel welcomed after they encountered negative experiences with attempts to gain membership into White-dominated engineering student organizations (e.g., AlCHE and ASCE), respectively. Such incidents made them feel like they did not belong and as a result, they sought membership(s) in race-specific student organization(s) that made them feel welcomed. This finding does not corroborate Schneider and Ward's (2003) assertion that general support and not race-specific support was more important for Latina/o students. Noteworthy is the fact that some race and gender-specific engineering organization(s) also made some of the Latinas in this study feel unwelcomed. Cristina, Chilanga, Liliana noted cultural differences (e.g., too "Americanized", members who do not speak Spanish) that made them feel unwelcomed in SHPE. Even though UT-Austin and UC-Berkeley had race-specific student engineering organizations, some participants reported their lack of "fit" to some of these organizations due to cultural differences found within the Latina/o population (e.g., cultural, generational, language). Some participants' experiences of feeling unwelcomed by some student organizations (e.g., AlCHE, ASCE, SHPE, SWE) implies that not all Latinas will identify with the underlying mission of some campus organization(s). This suggests that the manner in which some participants identify themselves (e.g., race, gender, researcher, academic achievement) differs from the way other people identify them.

While some participants noted that they typically surround themselves with other

engineers and not necessarily other Latina/o engineers, many others noted the opposite as they specifically sought race-specific organizations to expand their Latina/o engineering network. This premise was evident in the fact that participants' almost-exclusive membership in engineering student organization(s) illustrates their need to be connected with other engineers. Only one participant, Marcie, did not officially claim membership in an engineering specific organization except for her involvement with engineering community-related events. Other than volunteer work and her consistent involvement with intramural sports, it is uncertain why Marcie chose not to seek membership in an engineering student organization. Unlike the other participants, Marcie was the only participant who struggled with her decision to double major in engineering and visual communications. After much consideration and realization that it would take her twice as long to graduate college, she continued to pursue engineering because it was more "profitable and preferable." Still, ten out of the eleven participants were members of engineering specific student organizations. One can argue that participants' need to be connected with other engineers implies a parallel culture that only engineers can understand, particularly with regard to the amount of student involvement and commitment necessary to persist in engineering.

Navigating a Hostile Climate

Research has documented the unfavorable climate that Latina/os often feel on college campuses (Gloria, 1997; Gloria & Castellanos, 2003; Gloria et al. 2005; Hurtado & Ponjuan, 2005; Ponterotto, 1990). Many Latina/o college students have reported feelings of alienation via social exclusion on their college campuses. Several participants

discussed the hostile climate—at a multi-level and multi-dimensional level—they encountered while attending their respective university. More specifically in regards to climate, the study found that only a few participants explicitly attested to the "cold", "competitive", or "unwelcoming" climate of their respective university. Like similar findings in previous research (Lederman & Bartsch, 2001), this study found that engineering, like the climate of science, was perceived to be hostile and negative by female students. Several participants, however, detailed the hostile climate they encountered at a departmental level, within classrooms and student organizations as well as during internship experiences.

Unfavorable multiple climates. According to the participants' experiences, unfavorable climates were a result of various reasons which included, but were not limited to, the competitive atmosphere that the university exuded, the grading policies that promoted competition, the lack of perceived support from the respective departments, the lack of acceptance by some student organizations (e.g., cultural gap, "Americanized"), and the overt incidents that promoted male superiority and female inferiority in the classroom and in the future STEM workforce (e.g., respect, contributions, challenges, etc). While some unfavorable climates were a result of overt incidents by males (e.g., whistling at Dre before presentation, instructing Esperanza not to speak when asking for funds), adverse climates are also the result of covert incidents that made some of these Latinas automatically feel like they and their knowledge were less respected or less valuable (e.g., group work). This is similar to Dingel's (2006)

research that found that women in science classrooms were made to feel that they lacked knowledge.

Institutional role in promoting an unfavorable climate. An unwelcoming climate remains an integral aspect of institutional characteristics that often influence students' persistence decisions. Tinto (1975) posited that institutional characteristics often influence decisions of non-persistence, which implies that students are not *solely* responsible for why they choose to leave college. While the two participants from UC-Berkeley shared how their institution promoted cliques, only one participant from UT-Austin noted the competitive atmosphere of the university. At UC-Berkeley, the two participants felt the university did not secure their sense of belonging as both of their initial concerns were the few numbers of minorities that were admitted into the college of engineering. One participant even anonymously revealed that UC-Berkeley did nothing to recruit students of color. Moreover, the lack of visibility of others like them and their perception that UC-Berkeley was not committed to diversity made both students feel like they did not belong and as a result, sought ways to make themselves feel like they belonged. Students' perceptions of campus climate cannot be underscored as "campus climate mediates undergraduates' academic and social experiences in college" (Swail et al. 2003, p. 57). Despite the incongruence with their institutional characteristics, both Sara and Esperanza will imminently graduate from UC-Berkeley. This study found that unlike at UC-Berkeley, most participants who attended UT-Austin did not perceive the campus climate as unfavorable. I argue that the perceived climate for minority students differ as the two participants from UC-Berkeley were aware of

policies that did not promote Latina/o acceptance and inclusiveness, whereas UT-Austin students often spoke race-specific organizations and programming, such as Equal Opportunity in Engineering that made them feel like they belonged. In short, this study found that institutional context matters. Students at UCB often highlighted the role of race and then gender in their experiences, whereas the students at UT often spoke about discriminatory incidents due to their gender rather than race.

Unwelcoming departmental climate. Participants, more often than not, referenced an unfavorable department climate. The study found that gender discriminatory incidents created unfavorable departmental climates at both universities. While few participants noted perceived biases or prejudices on the premise of race, several participants explicitly discussed or alluded to how their gender often challenged their sense of belonging within their respective degree program. As detailed in the previous chapter, several participants noted various instances where their intellectual contributions were made to feel less valuable by their male counterparts via classroom discussions and/or within group work. Such instances support the landmark work of Hall and Sandler (1982), who coined the term "chilly climate", to describe the hostile climate that female college students feel while they are on their respective campus. This premise can be readily applied at a departmental and at a classroom level as participants' experienced various incidents that constitute a "chilly climate". This "chilly climate" was especially problematic for most participants as they pursued their engineering degree. This suggests that engineering programs, whether intentional or not, continue to promote a climate that is masculine in nature (Sagebiel, 2003).

Instances of unfavorable climate were not only perceived at an institutional, departmental, and classroom level. The study also found that some participants experienced an unwelcoming climate when they attempted to join certain student organizations. Dre and Clara shared how their initial attempt to join their respective engineering student organization proved to be unfavorable as nobody attempted to make them feel welcomed. While Liliana described the "cultural gap" between her and other members in SHPE because she was raised in Mexico, whereas others did not even speak Spanish, Cristina, as a transfer student, felt she did not "fit in" at SHPE because she was too "Americanized." The experiences shared by Esperanza, Dre, Sara, Clara, Liliana, and Cristina referenced an unfavorable climate at various institutional levels (e.g., university, college, department, student organizations). For these participants, the climate was one that promoted a cold, competitive, and an unwelcoming atmosphere which inhibited their sense of belonging on their respective campus.

Unfavorable internship experiences. Incidents of discrimination were also evident outside of the realm of college as two participants discussed unfavorable internship experiences. Sophie's and Sara's disclosure about their negative internship experiences are important to consider as internships often serve as the gateway to the STEM workforce, which several female engineers are choosing not to enter. The fact that other male interns, in the same internship as Sophie, were placed on job sites while she was not suggests that negative internship experiences can dissuade women from wanting to enter the STEM workforce. Hence, participants' internship experiences and anticipated discrimination in the STEM workforce revealed another level of climate that

some of these Latinas will encounter upon the completion of their undergraduate degree. Research has noted females' struggles to gain credibility in terms of their work (Rosser, 2006) and in peer review (Wenneras & Wold, 1997), to name a few, but little remains known about the internship experiences of female engineers. Several of these participants experienced, whether they acknowledged it or not, adverse incidents or feelings about the climate—a climate that is multi-level and multi-dimensional gender discriminatory in nature. Such incidents created an unfavorable climate for these participants despite their reluctance to acknowledge that these events promoted a divisive force between them as female engineers and their male counterparts.

The incidents shared by participants do not occur in isolation and it speaks to the sexism that permeates the climate that some female engineers experience while in college. These experiences support previous findings that detail females encounter gender related barriers in their pursuit of a STEM degree (Etzkowitz et al. 2000). For many participants in this study, they found ways to combat such incidents. Within the context of this study, gender discrimination was pervasive and although several participants disclosed the pervasiveness of the issue most of them did not allow it to affect them academically nor did it influence their decision to persist. This finding countered the finding of Schulze and Tomal (2006) who suggest that women do not persist in STEM disciplines because they "do not feel welcome[d]" (p. 257). This sentiment proved to be quite the opposite for these participants. Despite some unwelcoming experiences, most participants detailed how peers, along with other

systems of support, mediated the "coldness" of the climate and consequently, aided in their decisions to persist.

Understanding the Gender Factor

Participants in this study shared some interesting perceptions about gender and its role in the male-dominated discipline of engineering. There is no doubt that most participants in this study encountered various incidents throughout multiple climates (e.g., classrooms, labs, group work, internship, anticipate in the STEM workplace) that promoted an unfavorable atmosphere for them as female engineering students. An unfavorable gendered climate is often, among other reasons, blamed on how male students treat female students in the classroom and in regards to academic-related tasks despite females' proven academic success (Bystydzienski & Bird, 2006; Clewell & Campbell, 2002) and in the STEM workforce (Heilman et al. 2004).

Proving their intellectual ability. Instead, participants shared how they had to prove their intellectual identity to their male counterparts. Several interviewees noted their assertiveness in classroom discussions or group work where, until they proved otherwise, their contributions were viewed as less valuable by their male counterparts. While Liliana, Cristina, and Esperanza fought to be heard in the classroom, group work, and in a student organization, Dre sought to rationalize why such an incident would occur. Lauren, for instance, noted her need to view her classroom contributions as valuable regardless of what her male counterparts might think. All of these experiences work in contrast to participants' attempts to create an identity that is linked with their intellect rather than their gender. The aforementioned experiences chronicle the

perceptions that many males label women as "deficient" because they are not viewed as individuals who "naturally" fit in the sciences, despite women's proven capability of success in academia and in the workplace (Bystydzienski & Bird, 2006; Clewell & Campbell, 2002). The underlying message of these incidents is that the knowledge female students possess is undermined or dismissed by male students primarily because many continue to maintain that "biologically driven gender differences in abilities and interests" remain (AAUW, 2010, p. 17). Rather than being viewed as intellectual counterparts, female students become mere objects of affection or empty vessels that have nothing valid to offer, leaving some students to become weary of having to prove their intelligence (Seymour & Hewitt, 1997).

A gendered desire. Further experiences shared by participants also revealed that they often ascribed to a gendered desire to help others when discussing the utility of their respective degree. When asked why they chose to pursue engineering, several participants discussed their need to "serve people", "make a difference", and insisted that they "care about the people and their well-being". Gendered characteristics that promoted female and male gender stereotypes were also evident when several participants offered explanations of why females overwhelmingly choose to pursue certain engineering programs (e.g., civil, environmental). Such assertions indicated that participants ascribed to stereotypically assigned characteristics associated with their gender. I argue that social and environmental factors (AAUW, 2010; Varma, 2009; Verkiri & Chronaki, 2008) as well as bias in socialization play an important role in how females perceive themselves in regards to gender. Most Latinas noted the desired utility

of their degree with gendered characteristics. Their desire to make a difference by helping others, one could argue, is traditionally ascribed female characteristics.

Recognizing gender decisions. Other perceptions about gender illustrated how some participants recognized the role their gender plays in their decision-making process as a student and potential future engineer in the workplace. Dre and Sophie had two distinct sexist experiences and they both attempted to rationalize the occurrences. Similar to Dre and Sophie, Cristina was empathetic about why male supervisors would be more apt to promote male engineers rather than their female counterparts in the workforce. Despite evidence of gender discrimination, several participants like Sophie denied the pervasiveness of sexism in the workforce. This sentiment is corroborated by Jorgenson (2002) who found that women in science and technology "dispute the significance of gender inequalities" (p. 352). This suggests that participants, in spite of their need to rationalize sexist incidents, remain critically aware of how gender and their reaction to how they are treated because of their gender as female engineers remains central to their perspectives. In most cases, participants consciously operated outside of gender as they sought many different reasons to explain why they did not have a favorable internship experience (e.g., Sara, Sophie). "Discourse of gender neutrality", according to Eisenhart and Finkel (1998), occurs when females inadvertently maintain a subordinate status by choosing to suppress any stance that promotes differential treatment on the basis of gender.

Balancing family and career. As noted in previous studies (Mason et al. 2009; Rosser, 2006; Silverman, 2001; Wasserman, 2000; Xie & Shauman, 2003), participants

discussed how balance of family and a career in STEM seemed unlikely. When asked why they felt that many females choose not to enter the STEM workforce, several participants' highlighted the negotiation of family and work as problematic. Alicia, for instance, shared the "hard decision" that women encounter when deciding whether to be good mothers or have successful careers. Only Sarah remained less skeptical about a woman's ability to have a successful career and motherhood. The premise of motherhood is a gendered issue, whereby females often feel that they must decide between being good mothers or successful career women. This suggests that family responsibility remains integral to female gender identity. Even though all of the participants were traditional-aged college students, they were aware of the decisions they, too, would have to decide in the future when it came to motherhood or career. How they will negotiate this in the future remains, I argue, an under-examined issue but one that, because of their gender, is an important area to conduct research.

Implications of Results

The findings of this study indicated that participants perceived various sources of support networks (e.g., family, peers/classmates, student organizations) as integral to their persistence in engineering. This study also found that a majority of participants experienced unfavorable climates throughout various levels (e.g., institutional, college, departmental, student organizations, internships) of their experiences as undergraduate engineering majors. Lastly, the study found that participants encountered many challenges in their undergraduate experience because of their gender. Based on the findings, four recommendations for practice are presented.

1. *Colleges of Engineering should implement mandatory peer engineering mentoring programs for female students.* It is recommended that Colleges of Engineering implement mandatory peer engineering mentoring programs for female students. Such programs would pair upper-classmen with lower-classmen engineering students (e.g., freshmen with juniors, sophomores with seniors) and when and if possible, with females of the same race/ethnicity. Both mentors and mentees will be given guidelines, which entail their responsibilities and will be required to meet at least three times a semester (e.g., beginning, middle, end). Several Latinas in this study noted that knowing older Latina engineering students provided them with guidance and allowed them to access information about courses and faculty. Gloria et al. (2005) argue that, "Implementing formalized peer-mentor programs by collaborating with student organizations that are Latina/o specific would assist students to develop strong internal and external university connections…" (p. 216). The benefits of this program are threefold:

    a. It provides mentees with self-identification as they will see another person like them navigate the engineering culture.

    b. Mentors will become role models for mentees.

    c. Mentors will provide access to information about resources or share stories about the struggles they've encountered in their undergraduate engineering program. Ultimately, the idea is to create a cyclical peer

mentoring program that is ongoing and continuous until each student graduates. As semesters progress, the one-time mentee, in other words, will eventually become the mentor.

2. *Engineering departments should subject themselves to yearly evaluations from its' students.* It is recommended that engineering departments' contract outsiders to conduct anonymous yearly evaluations whereby students are given an opportunity to express how well the department is meeting their needs and what can be done to improve their educational experience. The same underlying premise can guide the purpose of student ratings via survey questions about their respective departments. When participants in this study were asked what their respective departments could do to improve their success and retention, several participants offered thoughtful recommendations about what could be done to advance their success and the success of others like them. The survey questionnaire should include a wide range of questions such as, but not limited to, queries in regards to the types of resources that have or have not been beneficial, the types of resources they would like to see offered, feedback on their experiences with their instructors, what the department is doing well, and what the department needs to improve upon. Concerns shared by students should be given serious consideration and, when possible, some suggestions should be implemented.

3. *Departments should promote inter-departmental collaboration on ways to promote a favorable gendered classroom environment.* It is recommended that faculty and teaching assistants work collaboratively with their respective departments and meet twice a semester (i.e., beginning and end) to discuss what can be done to promote a favorable gendered classroom environment. Anderson (1999) asserts that, "Instructors are responsible for identifying the appropriate rules, norms, and protocols that guarantee or at least maximize the chance that all students can become equal participants in the learning process" (p. 71). Because students spend a majority of their time in classrooms and labs, faculty and teaching assistants often witness sexist incidents or create them. Are such incidents addressed? If so, how and when? What types of incidents seem to be most prevalent? What, if anything, have faculty or teaching assistants attempted to do to mediate current and prevent future sexist incidents? Such inquiries will bring incidents of gender discrimination to the forefront and begin serious conversations on what role faculty and teacher assistants can play in the mediation of such incidents.

4. *Educate all engineering students about the types of incidents that constitute a "chilly climate" for female engineers and offer conscious solutions that promote a gender equitable learning environment.* The reported high number of gendered incidents in this study suggests that students need an outlet in which to share and discuss such experiences and be given tools to mediate future sexist incidents. While this would partially assist with this issue, the other responsibility of this

office would be to educate male students about the types of behaviors that promote a sexist environment. Murray, Meinholdt, and Bergmann (1999) posit that "female students need to be able to recognize and deal with gender inequality, and so do [our] male students" (p. 182). Male engineering students can no longer be part of the problem without also being part of the solution.

Recommendations for Future Studies

Because research on the success of Latinas in engineering remains limited, further studies pertinent to this demographic is warranted. To gain insight into the multifaceted educational experiences of Latinas in engineering, the following five recommendations for future studies are offered.

1. *It is recommended that researchers employ qualitative methods of inquiry to uncover the voices of Latinas in engineering*. Because of female underrepresentation in engineering, researchers must also begin to disaggregate participant samples on the premise of race/ethnicity. Research often focuses on female experiences or minority experiences in engineering, while fewer studies specifically focus on the experiences of a specific group of minority females. Such disaggregation seeks to uncover the nuances present in the experiences of minority women who remain vastly underrepresented in engineering in terms of both gender and race. Employing the latter type of studies will shed insight and authenticate voices from within the discipline.

2. *It is recommended that researchers explore the relationship that Latinas in engineering have with their parents and what role, if any, fathers play in their education*. While most of the literature on Latina/o success in higher education focuses on the role of the mother, several participants noted the influence their fathers had on their initial decision to pursue engineering. Because of the findings of this study, further research needs to explore the type and level of support that fathers provide their daughters as they pursue undergraduate engineering degrees. Such an analysis is necessary to determine how and in what ways fathers support their daughter's educational experiences and what impact, if any, it has on their initial interest, entry, and persistence in engineering.

3. *It is recommended that researchers explore how females in engineering choose to conceptualize gender.* While some participants explicitly noted the divisive gendered climate in their undergraduate engineering experiences, several participants ascribed to stereotypes associated with gender. Other participants rationalized and even denied an unfavorable gendered climate despite some of the experiences they shared. This suggests that several Latinas in this study rationalized incidents of gender discrimination with empathy. Further studies are needed to examine why some Latinas choose to conceptualize the role that gender plays in their pursuit of an undergraduate engineering degree and how, if at all, it shapes their perception about the future STEM workforce.

4. *It is recommended that researchers examine the coping mechanisms that Latinas employ when they encounter gender discrimination in their undergraduate engineering experience*. Whether blatant or subtle, participants' experiences with incidents of gender discrimination at all levels (e.g., institutional atmosphere, classroom experiences, student organizations, internship experiences, and anticipated issues in the STEM workplace) were pervasive in this study. While some participants shared how they self-assured their contributions in group work, few discussed their decision to be more assertive in the classroom to establish their positionality. Understanding how Latinas in engineering specifically successfully cope with various types of gender discriminatory incidents can create tools that future females pursuing engineering degrees can employ.

5. *It is recommended that further studies examine the entry, or lack thereof, of Latinas into the STEM workforce upon their completion of their engineering degree*. The National Science Foundation reported that Latinas comprised *only* 1% of science and engineering jobs in 2003 (Excelencia in Education, 2007). When discussing plans after their imminent graduation, most participants in this study were uncertain about what they would do or whether they wanted to enter the STEM workforce. This suggests that, at least for a majority of the Latinas in this study, the successful attainment of their engineering degree did not signify that they would enter the STEM workforce. At the time of this study, only two participants were certain about the next steps to take in their future and neither was going into industry to utilize the technical aspects of their respective

engineering degree. This suggests that a difference exists between what are deemed "hard" and "soft" engineering programs and as a result, what type of engineering jobs are likely to attract more females. Architectural engineering, for instance, is a field considered to be "soft" engineering because engineers primarily focus on designing systems. A "hard" engineering program, such as petroleum engineering, requires physical labor in the field which more often than not attracts male engineers. Much research attributes the shortage of minority female engineers in the workforce to the lack of minority females who pursue and attain engineering degrees. Albeit limited, this study suggests otherwise. Hence, studies that examine why minority female engineers who are successful in higher education choose not to enter the STEM workforce are warranted.

Final Thoughts

While the findings of this study provided insight into the perceptions of social support networks and climate in the persistence of Latinas pursuing an undergraduate engineering degree, other questions about Latinas' multi-faceted educational experiences in engineering remain unanswered. The underrepresentation of Latinas in engineering does not mean that they are nonexistent. As numbers of Latinas pursuing undergraduate engineering degrees continue to grow, it is important that they share their experiences. It is time for Latinas who pursue undergraduate engineering degrees to be not only seen but to be heard as well.

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APPENDIX A

SEMI-STRUCTURED PROTOCAL INTERVIEW QUESTIONS

1. What prompted you to pursue a degree in a STEM discipline?
2. Talk about your perceptions about pursuing a STEM discipline prior to starting college.
3. What does your family think about you attending (name of institution) to pursue a (name of degree)?
4. What role does your family play in your ability to continue your education?
5. Who do you primarily socialize with when you are outside of the classroom? Why?
6. Who comprises your academic support network? Why?
7. What kinds of social support have had the biggest influence on your ability to persist?
8. Was there ever a time in your degree program where you wanted to switch majors? If so, why and how did you decide to continue in your program?
9. Was there ever a time in your degree program where you wanted to quit college? If so, why and how did you decide to continue your studies?
10. Talk about the most difficult experience of your college career and why?

11. Describe your feelings about your department.

12. From an ethnic minority perspective, describe your feelings about your department?

13. Describe your typical classroom setting.

14. Describe the type of student-to-student interaction that is typical in your classes.

15. Describe the type of student-to-student interaction that is typical in your labs.

16. Discuss any organization or clubs that you have been active in.

17. If you could attribute your success and persistence in your degree program to three things what would they be? And Why?

18. What suggestions can you offer your department to help increase minority female success in your program?

19. Would you share with me your plans after graduation?

20. Are there any questions that I didn't ask that you think I should've? Or is there anything else you would like to contribute to your interview?

APPENDIX B

PARTICIPANT DEMOGRAPHIC SHEET

Please fill out the following information.

1. Were you born in the United States? If you were not born in the United States, please put where you were born.
2. Were your parent(s) born in the United States?
3. What occupation(s) do your parent(s) hold?
4. Are you the first in your family to attend college?
5. Do either of your parents have a college degree?
6. Do you have siblings? If yes, are you the oldest, or middle, or youngest child?
7. How did your primary and secondary schooling prepare you for college and peak an interest in engineering/technology?
8. Did you take any advanced courses in high school? If so, name the courses please.
9. In high school, a majority of the student population was of what ethnicity?
10. What is your major?
11. What is your expected date of graduation?
12. What is your classification?

13. Where is your hometown?

14. What pseudonym for your name would you like me to use for this study?