

LATINA WOMEN IN STEM: A CRITICAL ANALYSIS OF PH.D.
STUDENTS' EXPERIENCES

by

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Abstract

The intent of this qualitative study was to better understand factors, which impacted Latin@ women's development of resilience and how they continued their education in science, technology, engineering, and mathematics (STEM). The participants were enrolled in Ph.D. programs at 5 of the 10 University of California campuses currently designated as Hispanic Service Institutions (HSIs). The study utilized the narrative storytelling format of testimonios, which capture the lived experiences of individuals from underrepresented backgrounds. These testimonios demonstrated the systemic issues that have led to the lower number of women of color in advanced degree programs in STEM that are currently dominated by White men. Utilizing LatCrit, a branch of critical race theory, this dissertation presented educational issues such as racism, sexism, gender bias, and cultural norms that universities can address to create more inclusive environments and better support women of color that are continuing their post baccalaureate education. As a challenge to deficit thought, the participants shared the factors that helped them continue their education, such as faculty mentorship, undergraduate research programs, family support, encouragement from peers, and awareness of career options. Although change is necessary at multiple levels of education, the

emphasis should be directed at colleges and universities to support undergraduate and graduate students in STEM disciplines.

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CHAPTER 1: INTRODUCTION

Latin@ college students represent the largest growing population in the United States from 2005 to 2015 (Fry & Lopez, 2012; U.S. Census Bureau, 2011) and has resulted in an increase in college enrollments (Krogstad, 2016). This increase occurred despite what some researchers have defined as a breakdown in the educational pipeline for Latin@ students to get to college (Crisp, Taggart & Nora, 2014; Rodríguez & Oseguera, 2015; Yosso & Solorzano, 2006). Despite the increased enrollment, it is unfortunate that Latin@ educational degree attainment continues to be a concern as Latin@ college students continue to have the lowest rates of completing a bachelor's degree among all race/ethnic groups (Krogstad, Lopez, López, Passel, & Patten, 2016). The rates for advanced degree attainment is also of concern as Latin@ college students are less represented in this area, similar to students from other underrepresented minority (URM) groups (Krogstad, 2016). This group is underrepresented in science, technology, engineering, and mathematics disciplines, which is referred to as STEM (National Science Foundation [NSF], 2015; Xu, 2015). This underrepresentation is increasingly important to address as the United States attempts to maintain its status as a world leader in development of these industries and its ability to contribute in growing areas in the scientific community such as climate change, renewable energy, and information technology (Galama & Hosek, 2008; United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2015). Despite the need for all URM groups to see an increase in education to fill workforce needs, this study focused on the Latin@ community and the low graduation rate and doctoral degree attainment for this specific group.

The term Latin@ was used throughout this study in lieu of the other terminology, such as Latina/o or Hispanic. According to Wallerstein (2005) the use of the “@” symbol demonstrates the importance of women within Latin American culture and is a more inclusive approach to describe a complex network of cultures and ethnicities for people of Latin American descent. Although one term does not exist to be inclusive of the diversity in these cultures, Latin@ is used to be more inclusive and to challenge the centrality of masculinity typically found in Latin@ cultures. Hispanic is also problematic with historical ties to colonialism and oppression, and will only be used to reference Census data or institutional statistics which also reference the Census. According to the U.S. Census, people who identify with the terms Hispanic or Latino are those who classify themselves in one of the categories listed on the decennial census questionnaire and various Census Bureau survey questionnaires – Mexican, Mexican American, Chicano or Puerto Rican or Cuban, as well as those who indicate they are another Hispanic, Latino, or Spanish origin. (U.S. Census Bureau, 2011).

Statement of the Problem

There is a gap between undergraduate education and post-baccalaureate degree attainment for women despite women receiving 57.3% of bachelor’s degrees in all fields in 2013 and 50.3% of the degrees in science and engineering (NSF, 2015). These data are significantly different for post-baccalaureate degrees for women from minority backgrounds only receiving 4.1% at the doctoral level (NSF, 2015). These data are considerably disappointing for Latin@ women when aggregated by race. In 2013, Latin@ women were the lowest degree attaining group when only 4% received a master’s degree or higher compared to 5% of Black women, 11% of White women, and 22% of Asian women (Gandara, 2015).

Women overall need more representation in STEM disciplines with more receiving doctoral education to contribute to these industries and postsecondary education. Numerous factors lead to the upsetting statistics in STEM for women, and unfortunately more so for women from URM backgrounds who tend to encounter more adversity. A meaningful characteristic to develop in students is resilience, or “the process of negotiating, managing, and adapting to significant sources of stress or trauma” (Windle, Bennett, & Noyes, 2011, p. 2). By developing more resilience, college students can overcome the many turning points in their journey where adversity can lead to attrition. This same development of resilience can assist Latin@ college women in overcoming multiple forms of discrimination, cultural factors, and gender bias in education. The focus of this new study was Latin@ women currently in STEM Ph.D. programs to learn how others have developed resilience, and to ultimately contribute to global STEM industries.

The growing concern for women in STEM is not exclusive to the United States. According to a report by UNESCO, reinvesting in STEM education has become important internationally to meet the global economy’s need for scientific research that will “play a key role in areas such as health, food security, water and sanitation, renewable energy, the management of ocean and terrestrial ecosystems, and climate change” (UNESCO, 2015). The report also stated that more young people need to choose engineering or science as a career to meet the needs of the globalized scientific community to solve real world problems. This is also reflected in a report by the President’s Council of Advisors on Science and Technology (PCAST) which “calls for an additional one million STEM degrees over the next decade to fill a critical shortage facing the nation’s STEM workforce” (PCAST, 2012). Women are now more represented in some STEM

disciplines; however, they are still considerably less represented in technology and engineering disciplines (NSF, 2015; Xu, 2015). To be more competitive for these industries, more women need to continue through the education system from bachelor's level through to doctoral level programs. As described before, women are completing PhD programs in STEM at a much lower rate than men. The discrepancy widens at the researcher level, with men now representing 72% of the global pool (UNESCO, 2015). The high proportion of women in tertiary education is not translating into a greater presence in research.

It is essential for STEM disciplines to change the rate of attrition, what has become a more common occurrence where students choose to leave the major in which they enrolled in college. Attrition continually impacts the STEM disciplines more than other fields, and more specifically, the attrition in STEM disciplines tends to affect more women. Chen and Soldner (2014) found that women leave STEM majors by switching to other majors at a higher rate than men, which furthers the argument for encouraging more women to continue and be resilient in their education. Attrition in STEM disciplines also impacts public universities more than private. The probability of switching majors was higher for college graduates who attended public 4-year institutions and majored in STEM disciplines compared to those at private 4-year institutions (Chen & Soldner, 2014). The approach of getting more women to study science and choose a scientific career need to be replaced with an approach oriented towards 'fixing the system,' that is, addressing the points of attrition, barriers and culture that are causing women to abandon science (UNESCO, 2015). These multiple perspectives inform the review of literature with a focus on public postsecondary institutions with a general concern for attrition from STEM disciplines.

Purpose of the Study

The purpose of this study was to better understand the factors cultural and social factors which contribute to the resilience of Latin@ women in college to encourage the development of support systems and institutional practices to increase the enrollment and degree attainment of Latin@ women in STEM. This increase can be supported with a better understanding of the resiliency factors which contributed to STEM Ph.D. students to continue their education given numerous obstacles with culture, gender, and undergraduate major. The state of California continues to serve the largest Latin@ population of any state (U.S. Census Bureau, 2014). The University of California (UC) system was created to educate the state's growing population and enroll an increasing number of college students as part of the California Master Plan (University of California Office of the President [UCOP], 2007). The UC system contributes almost half of the STEM degrees granted in the state (UCOP, 2015) and 4 of the 10 campuses have been designated as a Hispanic Serving Institution (HSI) for serving a high population of Latin@ college students. Therefore, this study focused on this target population in postsecondary institutions within the state's education system. It was the goal of this research to promote better services and support systems to encourage women to continue their education and pursue STEM PhDs by learning about what has contributed to the success of current graduate students.

Theoretical Framework

A major part of this research was a critical perspective that challenges social structures and helps identify systemic problems. Delgado and Stefancic (2001) described five basic tenets of Critical Race Theory (CRT) to analytically examine the social and cultural implications of legal, political, and power connections that impact groups of people. CRT framed the study around

challenging systemic issues in society, such as gender or race, to challenge the dominant narratives that exist in society. Although beginning in legal studies, CRT has moved beyond to other areas such as education to better understand and change curriculum and documented histories. CRT also includes an activist dimension to not only understand our social situation but to change it (Delgado & Stefancic, 2001). This framework was infused in the study to challenge all systems including the researcher and participant role in documenting the lived experiences of the participants. The complex realities for Latin@ women in education also require the CRT framework in that it highlights the multiple identities of individuals within a specific context that may change over time or within different social situations.

Intersectionality

A branch of CRT was created as a challenge to the lack of inclusion within CRT. The development of intersectionality was necessary to express the multiple forms of systemic oppression experienced by women of color (Crenshaw, 1991). With a strong feminist perspective, intersectionality challenges oppressive systems which oppress and diminish the value of women in society. Intersectionality challenges that multiple structures of oppression impact women simultaneously, such as women of color in male-dominated fields experiencing gender bias and cultural expectations which may not always align.

Crenshaw (1991) developed the theory of intersectionality to address the multiplicity of oppression women of color experience. Intersectionality describes an individual's entire lived experience through oppressive systems based on multiple identities experienced simultaneously at a specific time. The theory was developed as a means of explaining the systemic discrimination women of color encounter concurrently due to their simultaneous identification with at least two

groups, gender and race, which create multiple forms of social subordination. These forms of discrimination were traditionally viewed as connected to only one aspect of a woman's identity, usually in reference to race. Gender discrimination and race discrimination, although separate, are two overlapping systems of oppression for women of color. Women of color experience gender discrimination and race discrimination simultaneously, and intersectionality asserts that is not possible to dissect one aspect of a person's background without considering the influence of other factors. For Latin@ women, culture and gender often clash due to multiple social norm expectations and forms of discrimination.

LatCrit Framework

In the study of different race issues, Delgado and Stefancic (2001) and Solorzano and Delgado Bernal (2001) have advanced the CRT frameworks with more in-depth analysis and aim to center the Latin@ experience. Latino Critical Race Theory, or LatCrit as it is known in the community, also highlights the variety of ways to give voice to Latin@ peoples' experiences and challenges with a critical, interdisciplinary discourse on law and policy. CRT and LatCrit posit that it is crucial to understand race and racism to document and share the lived experiences of groups of people (Delgado & Stefancic, 2001; Ladson-Billings & Tate, 1995; Solorzano & Delgado Bernal, 2001). By examining systemic oppression in combination with Latin@s' diverse backgrounds and cultures, LatCrit theorists create a framework to challenge social injustice and provides a counter narrative to what is emphasized in society. One method used by LatCrit theorists is storytelling, which provides validation of oral history and individual experience, documenting the voices of individuals while challenging social structures and oppressive systems (Delgado Bernal, 1998; Espino, 2012; Solorzano & Yosso, 2002).

Chicana Feminism

During the Civil Rights Era, Mexican American women were often ignored by both the mainstream feminist movement and the overall Chicano Movement (University of Michigan, 2007). The overall feminist movement tended to serve the needs of White women's experiences and did not align with women of color given their very different lived experiences despite shared inequality due to gender discrimination. White feminists also experienced privileges that prevented them from fully understanding the injustices experienced by women of color. Chicana feminists also maintained the importance of positively and proactively involving men in their community despite patriarchal systems of traditional Mexican-American culture and communities (University of Michigan, 2007). Although positively involving the men in their communities, these feminists challenged the stereotypical, traditional role of a Mexican-American woman as mother and wife with the ability to contribute in many other areas. The nuanced perspective of the Chicana also challenged the stereotypes of women across all systems of oppression. Male leaders and organizers in the Chicano movement resisted the Chicana feminist movement, but the nuanced needs of women for empowerment within their communities incited more response and support for a more complex movement than the mainstream feminist or culturally relevant Chicano movement (University of Michigan, 2007). The Chicana feminist perspective informed the documentation and narrative creation for this study given the challenges and struggles faced by Latin@ women in college and especially in STEM disciplines. The environments largely dominated by White men require these students to continue the battles for fairness and equal treatment that were started by women in previous generations, both within the classroom, as well as with family and community members.

Research Design

This qualitative study encouraged participants to continue their education through the process of addressing their lived experiences and empower them to use resilience as a means of challenging the dominant narrative in doctoral education. This dominant narrative in education is that STEM disciplines are dominated by White men and few women of color enroll, and successfully complete, Ph.D. programs in STEM disciplines. Similarly, feminist perspectives challenge the problematic systems and institutions that oppress women in society, and “critical theory perspectives are concerned with empowering human beings to transcend constraints placed on them by race, class, and gender” (Fay, 1987, as cited in Creswell, 2014, p. 65). The study used testimonios, a storytelling narrative methodology used to document lived experiences, particularly for individuals who are from underrepresented or minority backgrounds (Delgado Bernal, 1998; Solorzano & Yosso, 2002).

Research Questions

The theoretical frameworks of Critical Race Theory and Chicana feminism inform the following research questions for this study:

1. What are the stories and lived experiences of Latin@ women in STEM education?
2. What cultural and social factors affect Latin@ women in STEM Ph.D. programs in California?
3. How do systemic factors around race and gender contribute to the resiliency of Latin@ women in STEM disciplines?
4. What do Latin@ women say can be changed about education to support their pursuit of a doctorate?

Definition of Terms

Chicano/a: A variation of the word Mexicano that became more widely used during the American Civil Rights Movement. Self-identified Chicanos view the term as a positive social construction and some choose the *Xicano* spelling to emphasize their indigenous ancestry (Tijerina Revilla, 2004).

Critical Resilience: A nuanced definition of resilience that highlights the multiple avenues of oppression faced by students of color with an emphasis on the different sources of support they find to become resilient. This challenges the deficit view of resilience that students of color have a lack of capital and rather stresses the cultural and institutional resources and embracing their ethnic identity to navigate and overcome institutional obstacles (Campa, 2010).

Hispanic: According to the U.S. Census, “Hispanic” or “Latino” are individuals who identify with one of the specific Hispanic or Latino categories listed in the decennial census questionnaire and surveys by the U.S. Census Bureau – “Mexican, Mexican American, Chicano” or “Puerto Rican” or “Cuban” – as well as anyone who identifies as another “Hispanic, Latino, or Spanish origin” (U.S. Census Bureau, 2011).

Hispanic Serving Institution (HSI): postsecondary institution that (a) is an eligible institution, which means it is an accredited institution; and (b) has an undergraduate full-time student enrollment that is at least 25% Hispanic (Department of Education, 2016).

Latin@: Term used to describe peoples of Latin American heritage. The “@” symbol provides a more inclusive approach and demonstrates the importance of women within Latin American culture and communities. Using this term also attempts to move away from masculine-centric terminology, such as Latino, where

masculine forms of words are used in Spanish to describe all individuals or groups of men and women (Wallerstein, 2005).

Latino: Became an official census term in 2000, but was coined by the French in the 1860s during their alliance with Mexico. They referred to the region as *Amérique latine*, meaning Latin America. “Latino” has at various times been seen as a term of power and solidarity, or an imposed categorization. It is more commonly used in the American Southwest and California (Turkel, 2015).

Resilience: “the process of negotiating, managing, and adapting to significant sources of stress or trauma” (Windle et al., 2011, p. 2)

STEM: acronym used to reference academic majors in science, technology, engineering, or mathematics disciplines, and also used to reference industry careers or fields.

Summary

This study contributes to an evolving conversation on the success of Latin@ women college students and their resilience in male-dominated academic fields and industries. With the increasing importance of STEM in a more globalized, technologically-connected world, universities need to support women in these fields to reduce attrition to other disciplines, and for students to continue their education through Ph.D. programs. Research on the development of resilience demonstrates that students can overcome adversity despite unwelcoming academic environments. This research also emphasized the cultural and social factors that support the development of resilience to continue education to post baccalaureate degree attainment. For Latin@ women in STEM, this can provide necessary strength when encountering numerous forms of discrimination that intersect within systems of oppression given their identities in multiple underrepresented groups. This study attempted to give current Ph.D. students an

opportunity to reflect on their own resilience, share their stories to challenge a dominant narrative in education, and give them the encouragement to overcome future adversity and to continue in their education.

CHAPTER 2: REVIEW OF THE LITERATURE

This chapter presents a review of research on resiliency and highlights the experiences of college students with an emphasis on Latin@ college students in STEM advanced degree programs. Background on Latin@ college student achievement will provide context for the discussion of resiliency as a method of increasing Latin@ degree attainment. The concern for Latin@s in higher education increases at advanced degree levels of education and particularly for women of color in STEM disciplines. Data on bachelor's degrees attained by students in STEM disciplines shows that more women than men left STEM degrees and switched to a non-STEM major in their undergraduate education (Chen & Soldner, 2014). The researchers also found that students enrolling in STEM at public 4-year institutions were more likely to switch majors than at private 4-year institutions. This higher rate of attrition from STEM majors was the focus of previous research studies with an interest to discover the reasons why women choose other disciplines or leave these fields. The literature in this chapter highlights the research demonstrating successful changes and support systems to mediate these factors for URM college students, and more specifically for Latin@ women in STEM. Additional research on the development of resiliency will address how higher education institutions can increase student retention and increase the probability for women of color to reach their academic and career goals in unwelcoming, often male-dominated educational environments.

A paradigm known as deficit perspectives is often used in educational research when negative perceptions of student performance, particularly URM students, focuses the blame on the student rather than the oppressive, systemic inequities they encounter throughout their education (Flores, Cousin, & Diaz,

1991). The literature in this chapter attempts to move away from the barriers to educational attainment, and seek to build on what contributes to the success of Latin@ women in STEM disciplines, including how to encourage the development of resiliency. Emphasis will focus on the factors of resiliency in the context of critical race theory, also known as critical resiliency (Campa, 2010), and the potential implications for higher enrollments and academic success of Latin@ female college students in STEM advanced degree programs.

Resilience

There are different types of resilience which have been researched for many years. These different types of resilience are discussed along with more in depth discussion for its implications for educational settings, such as academic resilience (McMillan & Reed, 1994) and critical resilience (Campa, 2010). Resilience research has attempted to resolve what is different for people with resiliency that ensures they continue on a trajectory toward established goals when others, facing similar challenges or adversity, ultimately quit or change paths. Specifically, research on resilience attempts to understand what contributes to an individual's ability to overcome challenges (Arellano & Padilla, 1996; Campa, 2010; Crisp & Nora, 2010; Gonzalez & Padilla, 1997; Masten, 2001; Reason, 2009; Richardson, 2008). Various definitions and assessments of resilience exist due to the popularity of resilience research and its implications, particularly for educational settings. Windle et al. (2011) assessed the range of research studies and measurements around resilience and ultimately defined it as “the process of negotiating, managing, and adapting to significant sources of stress or trauma” (p. 2). This definition will be used in the discussion as it relates to academics and throughout the study as a recognized definition of resilience.

Background of Resilience

A brief overview of resilience research from its beginning informs more recent research of resilience (Campa, 2010; Gonzalez & Padilla, 1997; Masten, 2001; Reason, 2009) and was used in this study. The concept of resilience developed from previous research on hardiness or persistence (Maddi, 2002). Maddi (2002) studied managers at Illinois Bell Telephone Company in a 12-year longitudinal study on the psychological and medical effects of stress in the workplace. In researching work-related stressors, Maddi (2002) concluded that having attitudes related to hardiness prevented or delayed medical and psychological illness symptoms compared to managers with less hardiness who had experienced equal levels of stress. The research found that three elements are necessary for hardiness, which became known as the three Cs. Commitment was the first element and was defined as a predisposition to be involved with people, things, and contexts rather than be disconnected or secluded. The second element is control and focused on one's interest in having an influence rather than being passive or powerless. The last element is challenge and represented a desire to learn from experience rather than avoiding uncertainties, which ultimately lead to more opportunities to overcome challenges (Maddi, 2002). It was suggested that hardiness develops over time due to encouragement that the individual can turn adversity into opportunity. Over time, reflecting on one's own behavior and strength creates the mindset to take challenges as small obstacles rather than insurmountable barriers (Maddi, 2002). Over the last 15 years, resilience has become more common in research on the development of human determination and the ability to overcome adversity, especially in educational settings.

In exploring the extensive field of resilience research, Masten (2001) found that resilience is a common phenomenon with foundations in psychological studies

of adaptive human development. This study challenged the notion from studies conducted in the 1970s and 1980s that “resilience was a magical occurrence only available for some individuals assumed to be remarkable or special” (Masten, 2001, p. 227). Masten also identified two types of approaches to conducting studies on resilience that either highlight the variables or the person in their approach. The variable focused approach emphasizes the measurements of risk or adversity in an environment and the outcome given the qualities of the individual in said environment. A person focused approach is used to compare the different background and experiences of people to understand what make resilient individuals different from other people. Data from the different types of studies suggest that resilience is more common than once thought. Unfortunately, resilience factors often go unnoticed as they are expected to be demonstrated as “rare and special qualities” (Masten, 2001, p. 235) rather than everyday occurrences. The requirement that, despite adversity, individuals have to show a remarkable amount of adaptive ability to be considered resilient can lead to oversight and the exclusion of minor, yet important contributions to an individual’s overall resilience. The noteworthy finding from this research is that resilience is not something innate, but can be developed with behaviors, thoughts, and actions to increase an individual’s ability to overcome adversity. The topic of resilience has become important in work with education settings regarding the ability of students to overcome obstacles to their established goals, and is increasingly important in the discussion of students from URM backgrounds given the likelihood they will encounter obstacles in their educational careers.

Academic Resilience of Latin@s

As resilience research grew, other studies began to focus on specific populations within education, such as “at-risk” students, which at the time was

comprised of students of color. Later research on academic resilience was focused on specific populations and used racial categories to define the experiences of these different groups. McMillan and Reed (1994) conducted a qualitative study about resilience in an educational environment consisting of 62 individual interviews of resilient “at-risk” high school students. The participants were nominated by teachers and counseling staff in the schools due to their achievements and characteristics related to resilience, such as consistent pattern of success or improvement throughout the year despite having characteristics common to the “at-risk” population. The study sought to inform staff training programs to better serve the needs of “at-risk” students in schools with input directly from the students. The term “at-risk” was defined in the study as “students who were in danger of dropping out due to academic failure or other problems” (McMillan & Reed, 1994, p. 12). Despite being considered at-risk, the findings concluded that the students in the study demonstrated personal responsibility, optimism, a goal-orientation, and positive self-efficacy which contribute to them being more resilient. The study also concluded that meaningful adult relationships and role models provided necessary inputs of confidence building, high expectations for academic performance, encouragement during challenging experiences, and a support system when needed.

For Latin@s, adversity can be from cultural, social, or familial factors that compound the challenges with career choices in specific fields of study and academic performance. Some researchers (Arellano & Padilla, 1996; Cavazos et al., 2010; Gandara, 1982; Gonzalez & Padilla, 1997) have focused solely on the development of resiliency in Latin@ college students to better understand how to enhance this growing population’s ability to overcome educational obstacles. Demographics of American postsecondary institutions have been changing for

years with Latin@ students enrolling at higher levels than their White peers in 2012 (Fry & Lopez, 2012), and a continued increase outpacing other minority groups (Krogstad et al., 2016). The growth of the Latin@ population in colleges has created more motivation for research on this specific population, some of which will be discussed to provide more context.

In a qualitative study of successful Mexican American women in college, Gandara (1982) focused on the postgraduate degree attainment and the background factors that contributed to high educational achievement. Participants in the study were both men and women with J.D., Ph.D., or M.D. degrees, and were from families where the parents had not completed high school. Of the 45 Mexican American participants, 17 were women and had a variety of careers in law, medicine, or university education. A conversational method was used for the individual interviews with each participant covering 117 structured questions grouped into 10 categories: demographic information, religion, parental characteristics, school site conditions, home environment, connections with peers, factors related to health and wellbeing, and ethnic and cultural identity. The study focused on the comparison of the Chicana participants with their White female peers as well as the male subjects in the study. The interviews revealed that the role of the mother in family upbringing was a key factor in facilitating the academic accomplishments of female participants. The results showed that the majority of the female participants had integrated school experiences which led to higher levels of comfort in Anglo environments. Despite common cultural and social norms which discouraged women from continuing their education, the female participants were able to persist, despite fewer avenues and less support to reach their goals than the men in the study. The study also highlighted the importance of gathering women's perspectives to better understand the factors

which led to their academic attainment to inform future studies of resilience among Latin@ women. The emotional support of family to continue education, a considerable amount of integration in school, and a consistently good or outstanding academic performance, all define a narrow path for Latin@ women's success.

Resilience research has also served a different purpose in identifying and supporting "at-risk" students, who are categorized with lower academic potential due to limited English proficiency, poverty from lower socioeconomic backgrounds, and school practices such as tracking. McMillan and Reed (1994) stated that supportive, encouraging relationships and personal characteristics contribute to the development of resiliency. First, high expectations and encouragement from family can create motivation for students to meet those expectations. Second, students with higher resiliency have specific goals for their academics. A reality check, a term by the researchers, gave the student the necessary reflection on their place in the world to refocus efforts on education. Third, students identified as resilient had high levels of intrinsic motivation rather than external pressures forcing them to do well in school. Fourth, resilient students have an internal locus of control and believe that hard work is important. Lastly, resilient students showed high self-efficacy, which is the belief in their own abilities to be successful given tasks or work. In conclusion, this study by McMillan and Reed (1994) found that successful students with high resiliency require both intrinsic and extrinsic factors.

Arellano and Padilla (1996) discovered in their qualitative study that Latino "at-risk" college students can overcome the negative consequences of educational risk with the support of family and teachers. The researchers intended to uncover experiences not documented in the research by focusing on high achieving

undergraduate college students at a highly selective, private institution. The research uncovered themes around academic invulnerability that contribute to students overcoming sociocultural, personal, and environmental factors which typically lead to low academic performance or failure. Thirty students were put into three groups based on parents' education level, and then interviewed using a semi-structured protocol after responding to a demographic survey questionnaire and an instrument to gauge academic resiliency. Four general themes were identified in the results: parental support, positive outlook on their own success, personal characteristic of "persistence," and last was a strong identification with their ethnicity. These all contribute to higher rates of resilience and the student's ability to overcome adversity. An additional theme regarding mentorship or role model relationship developed from the interviews which connects to other research on resilience. An interesting finding from this study was that, although expected, no differences were found by gender regarding how students encountered obstacles in their institution. This can be explained by the students in the study following the path of high-achieving students, such as attending a Predominately White Institution (PWI) or attending a university with highly selective criteria. This constricted path leaves little variation in the students' experiences with secondary courses or involvement in school, and could explain why there was no difference in gender.

To get a different perspective, Gonzalez and Padilla (1997) conducted a study with Mexican American high school students, and results demonstrated a positive correlation between the variables of academic achievement and academic resilience. The transition from high school to college can be detrimental to student's goals of college completion, and this study helped create a better understanding of how to develop resilience among Mexican American high school

students. Using academic performance as a measure of resilience, the researchers identified resilient and non-resilient students using their responses to grades on a self-report survey. Students who selected their grades as “Mostly A’s” were categorized as resilient and those who selected “Mostly D’s” or “Mostly below D’s” were categorized as non-resilient. The researchers studied the different factors which contributed to the academic resilience of 133 resilient and 81 non-resilient Mexican American high school students in California. All participants in the study were given a questionnaire of 314 items with subscales which covered variables of delinquency, psychosocial development and maturity, school socialization, stressful life events, development of self-s of covering self-esteem, delinquency, stressful life events, confidence, and peer pressure and conformity, education questions around teacher care and involvement in school, and lastly ethnic awareness and pride. The students’ GPAs were analyzed using a *t* test for unequal variance prior to conducting a 3-way ANOVA using level of resilience, gender, and school as main effects. The key finding was that GPAs among resilient students were significantly higher than non-resilient students. Other findings were that sense of belonging at school, family and peer support, and the value of education were predictors of high academic resilience. The study findings underscored the integral role of community and family in the Latin@ community.

Over a decade later, Cavazos et al. (2010) conducted a qualitative study specifically focused on Latin@ college student’s experiences using the factors that contribute to the development of resiliency (McMillan & Reed, 1994) as a foundation for their study. Using this framework, Cavazos et al. (2010) discussed their findings along five factors: goal-setting; interpersonal relationships, which includes family support; intrinsic motivation; internal locus of control; and self-efficacy. One of the key findings from this research challenges deficit thinking

about Latin@ family support for education. A negative perspective of Latin@ families is a lack of emphasis on education and that the individual is to blame for low educational attainment, not educational inequities (Flores et al., 1991). Contrary to this negative view, Cavazos et al. (2010) found that family support and valuing education in the Latin@ community was important and something mentioned by a majority of the participants. Participants shared that although parents and family members were not able to support them financially, they had high expectations and encouraged them to pursue their goals. Another result in this study was an undefined academic path to higher education. Some of the participants were not high academic achievers in secondary education, but wanted and were able to succeed in postsecondary education. The last important finding was that students' lack of confidence in academic ability can be overcome through resiliency characteristics, such as self-efficacy workshops which teach students they can control their lives. For these reasons, it is important to educate students about resources to better navigate the system of education and encourage all students to pursue further academic goals. Important aspects of this research are missing in challenging dominant conversations of gender, ethnicity, and social norms that will be discussed in the next section to introduce critical perspectives on resilience in education.

Critical Resilience

The merging of resilience research with an ideology from a critical feminist perspective, which is a critique of the inequalities that stem from power and gender dynamics, results in what has been termed critical resilience (Campa, 2010). Although resilience has provided clearer language for the lived experiences for minorities in education, some theorists wish to advance the concept with a more nuanced definition. Campa (2010) posited that students of color experience

multiple avenues of oppression and therefore find different sources of support to become resilient. She identified a few issues with resilience in her qualitative study of five Mexican American community college students. First, resilience places the responsibility of academic achievement mainly on the student's effort without considering other factors, such as the cultural, economic, historical, and political contexts of their education. The implication is that students who drop out of school make that choice willingly rather than addressing the role of the institution or the system of education as a whole in that outcome. Second, research studies present resilience factors as fixed in that an individual either has them or not. Similar to Masten's (2001) discussion of resilience as a more normal occurrence, Campa presented the factors as fluid and changing throughout one's life, and greatly influenced by cultural values and individual circumstances. The study found that family contributions, which are often unobserved, are crucial to the development of critical resilience for Latin@ individuals pursuing college. The traditional views using a deficit perspective would consider these students deficient and lacking the necessary skills or motivation to succeed. The students in this research developed critical resilience from their family's commitment to education and a wealth of nontraditional resources, such as rich family stories, emotional support, and encouragement. Critically resilient students also understand and utilize cultural and institutional resources, while embracing their ethnic identity to navigate and overcome institutional obstacles.

Campa (2010) also identified four principles of critical resilience from her research. These principles build on previous definitions of resilience with a critical race theory lens to challenge embedded power structures. First, critical resilience includes the personal and environmental factors described in the established theory of resilience. Second, the concept of environmental factors is challenged by

examining the role of power within family, schools, and community. In a patriarchal society, this additional factor challenges how previous studies did not address the power dynamics in Latin@ families where a matriarchal kinship typically exists as the mother plays a critical role in the home structure. Third, Mexican American college students have complex intersections of identities and experiences informed by social, cultural, economic, and historical circumstances. Fourth, the theory of critical resilience emphasizes challenges with race, class, gender, and age for students' negotiating and navigating unwelcoming institutions and social environments given the intersections of these identities. The theory of critical resilience is used to address intersections of systemic oppression, which create obstacles for women in traditionally unwelcoming environments. This also explains how Latin@ women in college have utilized their social and gender identities to continue in their educational careers. Given that previous work on resilience has found that resilience can be developed and nurtured (Gandara & Contreras, 2010; Masten, 2001), this study of Latin@ women in STEM attempted to highlight the participant's current resilience, and further develop resilience to assist them in overcoming probable challenges in the rest of their academic and postgraduate work.

Latin@ Student Success

The increasing Latin@ population has led to an exponential college enrollment despite what some researchers have defined as a breakdown in the educational pipeline for Latin@ students to get to college (Crisp et al., 2014; Rodríguez & Osequera, 2015; Yosso & Solorzano, 2006). There is a demonstrated need for more efforts at all levels of education to evaluate the role of k-12 education in preparing students, and for colleges to better outreach to students from underrepresented communities with more discussion of what to expect.

When students get to college, research focuses on the academic and sociocultural factors that ease the students' transition into college and their persistence to graduation (Hurtado, Carter, & Spuler, 1996; Padgett, Johnson, & Pascarella, 2012; Trevino & DeFreitas, 2014). The issues facing college students from URM backgrounds is reinforced by studies on campus climate, which identify the impact of perceptions of inclusion and attempt to address systemic issues in education (Chang, Denson, Saenz, & Misa, 2006; Hurtado, 2005; Rankin & Reason, 2005) and stereotype threat which causes students to underperform due to fear of confirming negative stereotypes about their group identity (Steele & Aronson, 1995). Overall, research has identified many factors which contribute to the low degree attainment for Latin@ students in the educational pipeline through postsecondary education. This gap in equitable access to education in STEM fields may hinder the country's ability to stay competitive in technology and innovation (PCAST, 2012). Continued emphasis on the education of American youth, from all backgrounds, increase the STEM workforce and encourage more technological innovations.

Equity and Access in Education

A concern in education is the limited access students from underrepresented communities have in pursuing equal educational opportunities. Yosso and Solorzano (2006) discussed the educational paths for students, including community college and the institutional barriers for Latin@s in the education pipeline. These barriers include: insufficient school environments from preschool to high school, inadequate college opportunities, low transfer rates from community colleges to 4-year institutions intended to be a source of mobility, loneliness and lack of belonging in graduate school, and persistence to navigate a system that has failed others and themselves. The researchers emphasize three

critical transition points in the educational system: better preparation for students to go to college, postsecondary education transfers from community colleges to 4-year institutions, and undergraduate students to prepare for post-baccalaureate education. These are important areas that can increase the opportunities and achievement of Latin@ students. The authors challenge the inequities in educational access for URM students, particularly for Latin@ high school students who often have less opportunities and less access to resources or enrichment programs. This disconnect for URM students with less access greatly impacts their preparation, motivation, and encouragement for education beyond high school.

The disparities mentioned represent what researchers describe as the achievement gap, a theory related to the disparities between URM students' academic performance and their White peers (Gutierrez, 2008). This disparity has been questioned given the lack of context and history in achievement gap research studies and the use of static data or snapshots of the school and student. The connection between academic performance and other factors, such as class size, academic mobility, language, family income, and geographic location are often missing from studies on the achievement gap (Gutierrez, 2008). The author also described five myths in the education research around the achievement gap. First, this view of education perpetuates a myth of greater between-group rather than within-group variation and leads to a socially-constructed racial hierarchy of ability. Second, as with human development, student's identity is not static but these studies keep students in one category rather than recognizing their multiple, shifting identities. Third, the comparison of URM students against their White peers implies they are not worth studying without comparison to others. The emphasis then shifts to the importance of White students' performance and frames Whiteness and higher classes as the norm, rather than addressing the systemic

issues preventing URM students from excelling in academics. Fourth, the comparisons position the different groups against each other in a misguided battle for resources that if one gains the other loses. Lastly, the gap reference is used in discussions about certain groups of students without naming them, a dangerous rhetoric that further disenfranchises URM groups by not directly stating who is not being served (Gutierrez, 2008). Inequities in earlier education have repercussions for the entire system of education, and unfortunately, build on each other as students matriculate into secondary and postsecondary environments.

Research on multiple student groups exists, but for the purposes of this review, literature regarding Latin@ students was the focus. Crisp, Taggart, and Nora (2014) reviewed previous research and studies on the factors which contribute to Latin@ college student success outcomes. Their findings indicated that a combination of multiple factors contribute to the academic success of Latin@ college students including (a) sociocultural characteristics; (b) academic self-confidence; (c) beliefs, ethnic/racial identity; (d) precollege academic experiences; (e) college experiences; (f) internal motivation and commitment; (g) interactions with supportive individuals; (h) perceptions of the campus climate/environment; and (i) institutional type/characteristics. This extensive list highlights the broad range of factors to be considered when conducting educational research, and demonstrates the lack of breadth in previous research on URM students compared to their White peers. The researchers also broadly defined academic success as the “behaviors necessary to accomplish students’ academic goals, including course completion, course grades or grade point average (GPA), persistence in higher education, transfer to another postsecondary institution, and certificate or degree completion” (Crisp et al., 2014, p. 3).

Although any one of these topics can be covered at length, campus climate will be addressed next as it encompasses and is impacted by other areas of concern.

Campus Climate

Despite the obstacles to postsecondary education, Latin@s are enrolling and attending postsecondary education at higher rates, but there are still limiting factors to their success in college. Rankin and Reason (2005) defined campus climate as “the current attitudes, behaviors and standards of faculty, staff, administrators and students concerning the level of respect for individual needs, abilities and potential” (p. 48). This broad definition, although applied to LGBT students in their study of 4-year public institutions, incorporates the many stories of struggle and success for students from minority backgrounds. Particularly for students of color, campus climate impacts the educational attainment of college students and affects how campuses address systemic issues (Rankin & Reason, 2005). Campus climate is discussed in the literature with a focus on how it can impact the path for students from minority groups, including women in male-dominated fields.

At any institution, students from URM backgrounds will experience and view their campus quite differently from their White peers. Rank and Reason (2005) conducted a quantitative research study of over 7,000 college students to better understand how students from different racial groups, particularly URM backgrounds, experienced their postsecondary institution. The students were from different racial groups and attended 10 geographically diverse, public and private institutions. The quantitative survey was distributed to students using purposeful and snowball sampling rather than simple random sampling. This technique ensured the voices of URM students were heard compared to the input from the overall student body which would have resulted from random sampling. The

results highlighted significant differences between the experiences of URM students and their White peers around perceptions of racial campus climate, acceptance of diversity, instances of discrimination or harassment, and that the institution and administrators responded to or addressed issues of racism. The study found that students from URM backgrounds typically see their campus issues around race and inclusion more clearly, either as a result of exposure to more instances of discrimination, or having been socialized to be more aware of these issues. McIntosh (1988) challenged the normative views of society around race relations by creating a list of privileges afforded White people based on the color of their skin. This informs how college students perceive colleges and universities that remain predominately White. The positive views held by White students regarding campus climate support the idea that privilege allows people to overlook or disregard any negative experiences, an idea called epistemic privilege. Epistemic privilege, a form of White privilege, refers to the ability to remain unaware of benefits and barriers associated with race and racial differences (Johnson, 2000). This privilege restricts the ability for all students to understand the greater impacts of racial differences on students from URM backgrounds. Campus climate overall has important consequences and need to be continually addressed to create inclusive environments for students.

Hurtado and Ponjuan (2005) conducted a longitudinal study of a cohort of Latino students, who entered nine 4-year, public universities across the US as part of the class of 2000. The study intended to assess how the perceptions of campus climate and lived experiences of Latin@ college students affected their persistence and success. The study used a survey, initially given to students as they matriculated into college in the Fall of 2000. The researchers sent the participants the survey again at the end of their second year to assess the impact of multiple

factors which contributed to undergraduate college persistence. The study included 370 students who responded and completed both surveys. Four variables were used to describe the students' experiences in college: sense of belonging, hostile climate for diversity, self-reported analytical skills, and pluralistic orientation, which measures their understanding of others' perspectives and capacity to live in a diverse community.

Hurtado and Ponjuan's (2005) longitudinal study discovered that diverse experiences in college have more impact on academic outcomes and more specific findings for Latin@ college students. A result of the study was participation in academic support programs has a positive and significant effect on the development of analytical skills, which can increase the student's chances of success. Another interesting finding was that Latin@ males rated their analytical skills higher compared to their female peers, which is related to the development of confidence and the challenge with stereotype threat for different genders (Steele & Aronson, 1995). The researchers also found that support systems continue to be a key factor for remaining in college (Hurtado & Ponjuan, 2005). Students who choose to live at home with family or off campus tend to have a higher sense of belonging, which demonstrates the importance of family and peers. The researchers stated that the outcomes were important for post-college work when graduates will encounter challenging, nuanced social situations and complex problems. Graduates also need to develop skills to navigate interactions with coworkers from diverse backgrounds. Due to the representation of students in the survey research who attend Predominately White Institutions (PWIs), the research around institutions with a higher demographic of students of color was recommended for further research.

Stereotype Threat

To create inclusive learning environments, it is necessary to evaluate the experiences and responses to group stereotypes or instances of discrimination for URM students. College students are educated in racialized, changing environments which greatly impact their academic performance. Steele and Aronson's (1995) theory of stereotype threat suggests a self-fulfilling prophecy for students from URM backgrounds, as well as women, when they are concerned with performing badly and perpetuating a negative group stereotype. The study was originally conducted to study the impact of this threat on women and African American students, but has been adapted to include other minority groups. The original experiment randomly assigned 114 participants into three experimental conditions in four sub-studies. Once the participants were assigned different groups, a mixed quantitative and self-report response section test was administered to all participants but the purpose of the test given changed between the three groups. The different descriptions for the test were (a) diagnostic for intellectual ability, (b) a laboratory tool for studying problem-solving, or (c) a combination of a problem-solving tool and a challenge. The results from the study show lower scores on standardized tests for the African American students when told the test was to assess the abilities of the participants. Results of the study connected the performance to self-doubt and a fear of being judged by negative stereotypes, rather than the student's personal accomplishments or merit. The participants with more threat performed at a diminished pace and spent additional time with less accuracy on the tests. Considering the need for equitable education settings, the academic performance of students from URM backgrounds and women is undermined by unfavorable campus climates where stereotypes permeate the academic environment. This is one example of how campuses need to be more

inclusive of students from different backgrounds and challenge stereotypes to reduce the possibility of lower scores on tests from fear or anxiety around group representation.

Gonzales, Blanton, and Williams (2002) conducted a study on the effects of being a double minority, where two identities are in subordinate social groups, and the impact on test performance for Latin@ women in college. The 60 White and 60 Latin@ college students were randomly assigned to two diagnostic conditions with equal participants for each condition. The visibly White researcher explained to participants at the beginning of the experiment that they would work on sets of problems to test mathematical and analytical ability. After 12 minutes, they would each answer questions regarding their experiences and the task. Similar to Steele and Aronson's study (1995), the purpose of the study was shared with participants, with a different message given to one of the groups. The diagnostic group was told that the purpose of the study was to gauge personal performance and a test of their actual abilities. The other group was told the purpose was simply to understand problem-solving and no mention of ability was made. The findings supported ethnicity-based stereotype threat but was not significant in proving the double minority stereotype threat. The White women in the study did not have a difference for gender-based threat, and therefore, limited the study's findings for this measure. The study found that gender-based stereotype threat was connected to ethnicity in that there was significant differences between the group of Latin@ students, but not the group of White students. The Latin@ women in the study were the only subgroup to experience gender-based stereotype threat and similar to their Latin@ men peers, also experienced ethnicity-based stereotype threat.

Critical Race Theory (CRT)

CRT grew out of a need for scholars to explain the legal implications of race and power. Primarily in the 1980s, CRT built upon a movement in legal theory and scholarship known as Critical Legal Studies (CLS) (Delgado & Stefancic, 2001). CLS challenged the division of power among classes and its creation of social inequalities (Ladson-Billings, 1998). As a theoretical framework, CRT also served as a critique of its predecessor CLS, which scholars argue failed to fully critique racial injustice, dominant power structures, and institutionalized systems of oppression. An example was the rise of liberalism and the use of colorblindness in court hearings as a means of ending racism (Delgado & Stefancic, 2001). Color-blindness negates that someone's skin color can change the way someone is portrayed, treated, and ultimately has different consequences than someone in a majority racial category, usually White (Delgado & Stefancic, 2001). Critical race theorist, or "Crits" as they sometimes call themselves (Delgado & Stefancic, 2001), stated the color blindness prevents us from addressing all forms of discrimination, and instead limits us to extremely egregious forms of race-based discrimination or harm, that is usually condemned by all people despite race or background. Racism, which is the differential treatment of someone based on their race by people in situations of power, is learned socially and entrenched in our thoughts and social structures. All aspects of our society, including systems such as education, contributes to keeping minorities in subordinate positions overall (Delgado & Stefancic, 2001). Critical race theory attempts to understand systemic social oppression to make change for the individual and society as a whole.

Delgado and Stefancic (2001) defined a list of five basic tenets of CRT. The first two tenets address the system of racism and why it is unlikely to be

challenged due to the institutionalization in politics, social constructs, and socioeconomic backgrounds. The first tenet establishes racism as pervasive and ordinary, which in turn makes it difficult to eradicate or even address. Since racism can only be addressed in its most blatant forms, subtle or covert racism is often unchallenged and people of color are discriminated against through hidden or outwardly passive means. The second tenet builds on the first in that not only is racism difficult to address, there is no motivation or incentive for the majority of people to take action to fight racism. The self-interests of those in power prevent anyone from wanting to address racism or the systems of oppression that maintain the power structure. This would require self-reflection and a deeper understanding of privilege by the dominant majority in society. The lack of motivation forces people of color to wait for it to be convenient for the self-interests of the majority to align with their needs. Derrick Bell (as cited in Delgado & Stefancic, 2001) critiqued the legislative breakthrough *Brown v. Board of Education*, an essential governmental step for equal access to an adequate education. Bell stated that the legislation was only supported when those in power needed to meet industry needs with more educated workers. The third tenet describes race as a social construct created to instill and maintain a social hierarchy and is based on nonscientific information (Delgado & Stefancic, 2001). Aside from the physical traits shared by some individuals, such as skin color or hair texture, there is no objective or biological reasons for racial categories, other than to keep certain individuals in places of power and to maintain a hierarchy. The challenge with this understanding is that given structural inequality, the challenge for educational research is the necessity to use the same categories which created the inequities to study the inequities. Without identifying which people of color have less access to

adequate educational resources, society cannot begin to resolve issues or find ways to rectify the history of racial segregation and inequality.

The last two tenets provided by Delgado and Stefancic (2001) are related in their diverse definitions of identity and the unique ways our identities affect our lived experiences. The fourth tenet of CRT refers to society's favoring of certain categories of people at different times in history. The common occurrence for privileged groups to "other" certain minority groups out of convenience and the troubling consequences of these racialized, undesirable identities. This process referred to as differential racialization shifts the racialization of certain groups with shifting needs, such as the labor market (Delgado & Stefancic, 2001). The example given was the shift in Japanese and Mexican agricultural workers depending on what society needed. At one time, large groups of Japanese individuals were unfavorable and moved to camps but at other times were needed to support the developing war industry. Similarly, Mexican agriculture workers, who are essential to the economy and meeting the needs of a growing population, are currently being treated as others with discussion of immigration restrictions and possible removal from the country. The last tenet stems from the intersections of identity. Intersections of identity describe how different races have unique stories, and even within groups, individuals can experience the different aspects of that identity differently. An individual with a different gender, sexual orientation, or socioeconomic status greatly changes the ways in which that person lives and experiences societal norms. Since these intersections change the way someone experiences that identity, there is no one voice for all people of color. The assumption that all people of color experience racism and daily struggles similarly forces them to compare their experiences with others. It also forces the oppressed

in minority status groups to be the educators and story-tellers to White, nonminority groups who typically have power in society.

Intersectionality

A branch of CRT was created as a challenge to the lack of inclusion within CRT. The development of intersectionality by Crenshaw (1991) was necessary to express the multiple forms of systemic oppression experienced by women of color. With a strong feminist perspective, intersectionality challenges oppressive systems as singularly based and will also be used to describe the intersections of systems which oppress and diminish the value of women in society (Crenshaw, 1991). This is especially true for women of color in male-dominated fields or organizations, such as STEM disciplines.

Crenshaw (1991) developed the theory of intersectionality to address the multiplicity of oppression women of color experience. Intersectionality describes an individual's entire lived experience through oppressive systems based on multiple identities experienced simultaneously at a specific time. The theory was developed as a means of explaining the systemic discrimination women of color encounter concurrently due to their simultaneous identification with at least two groups, gender and race, which create multiple forms of social subordination. These forms of discrimination were traditionally viewed as connected to only one aspect of a woman's identity, usually in reference to race. Gender discrimination and race discrimination, although separate, are two overlapping systems of oppression for women of color. Women of color experience gender discrimination and race discrimination simultaneously, and intersectionality asserts that is not possible to dissect one aspect of a person's background without considering the influence of other factors (Crenshaw, 1991). Crenshaw's argument is that race as a social construct is connected to socioeconomic status, health, education, law, and

to general social interactions. It is unrealistic to expect students to perform at their maximum capacity when they may have other extenuating circumstances preventing them from being fully present or able to engage in scholarly tasks. For Latina women, culture and gender often clash due to multiple forms of oppression (The Latina Feminist Group, 2001). Women are simultaneously expected to be independent, yet family oriented; assertive in speaking their truth, yet docile and accommodating; humble, yet confident. These are pressures from both external and internal sources as most Latin@s are religious, with about half identifying with Catholicism (Cooperman, Lopez, Funk, Hamar Martinez, & Ritchey, 2014). There is also the pressure from religious practices that often clash with women becoming independent. The dichotomies Latin@ women must balance, with the intersections of culture, gender, religion, and career with other social expectations, frame the important perspective of Latin@ Critical Race Theory.

LatCrit

Another development in the study of race from a critical lens is Latino Critical Race Theory, which is focused on the social, political, and economic improvement of all Latin@s (Pérez Huber, 2010; Solorzano & Delgado Bernal, 2001). LatCrit, as it is also known among theorists, attempts to address issues often left out by other CRT theorists, specifically language and accent, surname, immigration status, sexuality, ethnicity, or culture (Pérez Huber, 2010; Solorzano & Delgado Bernal, 2001). Although other factors are considered, CRT and LatCrit still emphasize that race and racism are crucial to document and share the lived experiences of people (Delgado & Stefancic, 2001; Ladson-Billings, 1998; Solorzano & Delgado Bernal, 2001). The following will describe how LatCrit uses a specific methodology to empower individuals to share their stories while challenging social structures and oppressive systems, even within academia.

According to Delgado Bernal (1998), narratives and storytelling serve many purposes in its methodology and benefit the participant in several ways. First, the participant can reflect on their lives and share their experiences within social institutions, such as education. Second, the participant is able to speak about their stories from their own viewpoint taking into account their view, emotions, and the context for which the story developed. Last, the storytelling or counter-storytelling challenges the dominant narrative in society that Delgado states is socially constructed by Whites who preserve racist views about people of color (Delgado Bernal, 1998). The use of narratives for people of color, specifically Latin@ women, was used to challenge racial stereotypes as well as gender norms in education.

A study by Solorzano and Delgado Bernal (2001) is an example of counter-storytelling using qualitative inquiry and counter-storytelling to challenge the dominant narrative in society. They used the stories of two student activists to define transformational resistance, a theory that challenges the framework of resistance from a critical lens. One story was about a student during the 1968 East Los Angeles student walkouts, a protest of the inferior quality of their education. This student shared her story of using her status as a good student to distract the school principal with a scheduled meeting which allowed college students to come onto campus and urge the high school students to also participate in the walk out. The other story shared the internal conflict a professor processed through while helping a student understand the strength in silence in the fight for social justice. The student shared that students without citizenship were scared to be active and vocal on campus for fear of their residency in the United States. The conversation challenged the idea that Chicana or Chicano activism requires vocal, overt resistance (Solorzano & Delgado Bernal, 2001). The dominant narratives, often

having a connection to privilege, would go unchallenged without the narratives in the two stories presenting different perspectives.

Solorzano and Delgado Bernal (2001) provided another example in the article with Anzaldúa's (1999) description of mestiza consciousness, a merging of multiple cultures and identities, that also challenges a dominant narrative of Latin@ women in society. Anzaldúa used cultural and linguistic references to describe everyday occurrences for Latin@ women in an Anglo society and her own experiences confronting internal cultural barriers. This use of interconnected oppressions highlights the multiple oppressive systems which limit the potential of strong Latin@ women. Anzaldúa makes a call for a new mestiza identity, which she described as an individual aware of her contradictory and interconnecting identities while challenging binary thinking in the Western world. Latin@ their histories and cultural practices have been created and recreated within a context of forced assimilation, segregation, colonial relations, patriarchy, and survival (Anzaldúa, 1999). The use of personal narratives to share lived experiences, and expose challenges with social structures, is a documentation tool used in cultural groups and provides alternative methods to document historical events and lived experiences.

The importance of oral history within Latin@ and indigenous cultures reinforces the need for more female voices to be heard and documented. Testimonio, the documentation of personal narratives, is used as a tool for sharing stories and challenging social class, racial, and gender-based oppression (Delgado Bernal, 1998; The Latina Feminist Group, 2001). It serves as a "crucial means of bearing witness and inscribing into history those lived realities that would otherwise succumb to the alchemy of erasure" (The Latina Feminist Group, 2001, p. 2). Delgado Bernal (1998) stated that testimonio and counterstorytelling can be

used to acknowledge, validate, and document the lived experiences and knowledge of women of color. As part of the framework for Chicana feminist epistemology, Delgado Bernal also presented the idea of cultural intuition, naming a complex process of acknowledging the distinct viewpoints of Chicana scholars. Chicana feminist epistemology is used as a means of resisting established theories that often distort or ignore the experiences of Chicanas. This epistemology is also used to uncover untold experiences for the individual that have been blocked or not shared due to social or cultural norms. Delgado Bernal, Burciaga, and Carmona (2012) suggested that *testimonio* differs from oral history or autobiography due to the involvement of the participant as they critically reflect on their lived experiences within a specific social reality, such as education. The *testimonialista* maintains a central role as the holder of knowledge by “privileging the oral narrative of personal experience as a source of knowledge, empowerment, and political strategy for claiming rights and bringing about social change” (Delgado Bernal et al., 2012, p. 364). Using *testimonio* in educational research challenges the racial, gender, and other socially oppressive structures inherent in the system of education.

Pérez Huber (2010) also utilized LatCrit as a theoretical framework to examine how Chicana college students navigate their education as they experience multiple forms of oppression and used *testimonio* to share the participants’ experiences. Pérez Huber (2010) developed critical race *testimonio* from a LatCrit framework and Chicana feminist epistemology perspective (Delgado Bernal, 1998) to document the challenges of undocumented students. The population of undocumented immigrants has increased, and this area of educational research lacked depth about how these students are impacted by institutional structures and systems unwelcoming to non-citizens. Pérez Huber (2010) described *testimonio* as

“a verbal journey of a witness who speaks to reveal the racial, classed, gendered, and nativist injustices they have suffered as a means of healing, empowerment and advocacy for a more humane present and future” (p. 83). For these reasons, testimonio serves as both a methodological tool as well as a means of empowerment for the participants.

Testimonio can also be used to integrate multiple individual stories to establish shared experiences. Espino, Muñoz, and Marquez Kiyama (2010) used their individual stories of multiple identities, described as *trenzas*, and used testimonio to weave together their stories while discussing issues they encountered in graduate school. The three authors shared that despite their differences in identification, either as Chicana, Latina, or Mexican American, they share similar experiences along their educational paths. The use of testimonio as a methodology helped the researchers uncover truths in their experiences while unpacking their different identities from several perspectives. The lack of shared stories and underrepresentation in the literature on graduate student experience reflects a master narrative in society about doctoral education that simplifies complex, nuanced issues for students of color. The presentation of individuals as one-dimensional has failed to recognize graduate students of color have complex identities, experiences, and cultural lives in the larger narrative of post-baccalaureate education. One challenge the researchers presented is that graduate students should extend social networks beyond their disciplines as they may not find support systems within their departments. Also, graduate students should be encouraged and empowered to advocate for themselves as they navigate new paths in academia and careers. The social connections between graduate students was highlighted as a positive experience despite differing experiences and was presented as a means of encouraging student success.

STEM Degrees and Race

Historically underrepresented racial and ethnic groups, particularly African American and Latin@, continue to be part of the science and engineering (S&E) workforce at rates lower than their presence in the U.S. population, whereas Asians and foreign-born individuals are represented in the S&E workforce at higher rates. Using U.S. Census data, Einaudi (2011) assessed the representation of Hispanics, Blacks, and American Indians or Alaska Natives in science and engineering. Among U.S. residents, Black females earned 68% of associate's degrees, 66% of bachelor's degrees, 71% of master's degrees, and 65% of all doctoral degrees awarded to Black students. Hispanic females earned 62% of associate's degrees, 61% of bachelor's degrees, 64% of master's degrees, and 55% of all doctoral degrees awarded to all Hispanic students. Einaudi utilized NCES data to find that Hispanic females are receiving more degrees at all levels of education, but hidden in the data is a discrepancy between STEM and non-STEM fields where the gender breakdown within URM groups was drastically different. Together, the URM groups comprise 27% of the U.S. population over the age of 21, but represent a much smaller proportion of the workforce in science and engineering careers: 14% of the highest degree holders and 11% of workers (Einaudi, 2011). From 1989 to 2009, the rates of enrollment for Black, Hispanic, and Native American students in science and engineering has increased consistently every year for Blacks, in 19 of 20 years for Hispanics, and in 17 of 20 years for American Indians/Alaskan Natives (Einaudi, 2011). Despite these substantial gains, Black and Hispanic U.S. citizens and permanent residents remain underrepresented within the science and engineering graduate student population when compared with the adult U.S. general population. In 2009, 7.8% of the U.S. citizens and permanent residents pursuing graduate S&E degrees were

Black and 7.1% were Hispanic (Einaudi, 2011). The findings confirmed the lack of representation in science and engineering jobs compared to the general population.

Considering the need for more qualified individuals, low numbers of Latin@ college students entering graduate school programs is a major concern as these students represent an untapped resource to fill jobs. The problem of encouraging more URM graduate students is the limited educational access for Latin@ students given their socioeconomic backgrounds, discrimination based on racial groups, inequitable education, and other social factors. A major barrier to graduate education equality, which is similar for most of society, is around gender where advanced degrees continue to be offered at a much higher rate to men.

Women in STEM

As a challenge to a dominant narrative in postsecondary education, this study attempted to highlight the academic achievements of Latin@ women in STEM advanced degree programs. A dominant narrative is that women are not pursuing advanced degrees and choose to leave their chosen disciplines prior to finishing their undergraduate education (Einaudi, 2011; Maltese & Tai, 2011). This is challenged by the data showing more women graduating with a bachelor's degree compared to men. An example was in the 2012-2013 academic year when 57% of degrees were granted to women compared to 43% to men. This is for overall college graduates as STEM disciplines are quite different. In STEM, men made up 65% of bachelor's degrees compared to women who received only 35% of degrees (Ross et al., 2012). An increase of women in postsecondary education, where women enrolled at 71.3% compared to men at 61.3% after high school, should indicate a change in the possibility for women to pursue and complete their education (NCES, 2014). Despite making up almost two thirds of undergraduate

students, women continue to be underrepresented in all STEM fields except life sciences and a new development of increased presence in mathematics (NSF, 2015). This increase does not signify equity, only that there has been some improvement for women in those specific disciplines.

Maltese and Tai (2011) reviewed datasets containing information for around 4,700 students who received a bachelor's degree in a STEM discipline. The goal was to uncover correlations between early attitudes around science and math, school experiences, planned major for college, and the individual student's background variables to better understand what may impede persistence in the STEM pipeline. The researchers discovered that for college bound students, race and gender were not significant. The issue with this finding is that the data does not reflect the barriers underrepresented minority students, particularly women of color, that prevent them from being college bound. The limited access to support systems and having less academically rigorous high school curriculum makes them less competitive than their peers who are different along race and socioeconomic status. The researchers happened to find that 2006 had the lowest percentages of degrees being conferred in all STEM disciplines than previous levels that aligned with the data on job projections.

The emphasis on STEM education and careers presents an increasing concern with the United States' ability to supply enough qualified individuals able to fill jobs in growing STEM industries. This concern combined with the impact of the impending retirements of the baby boomer generation, which is a large part of the science and technical workforce, make for major concerns for the US to stay competitive in a global economy (Galama & Hosek, 2008; Maltese & Tai, 2011). At the graduate level, women are making great strides in the number of degrees conferred but only in one area. Women now earn half of all doctoral degrees in life

sciences, but one third in the physical sciences, mathematics and statistics (Kelley, 2016). Although the argument can be made for women's increasing graduation rate, women have not achieved equal representation in undergraduate STEM studies overall. They also have a difficult path in graduate programs in all STEM fields, and continue to experience discriminatory practices which limit equal hiring in STEM careers (Beede et al, 2011; U.S. Census, 2011). Nationally, women represent 50.8% of the population, yet they still only represent 24% of total STEM employment (U.S. Census, 2011). These statistics reveal the necessity for change in STEM academic settings and industry.

The National Science Board (2014) releases data on science and engineering education and workforce and revealed that in 2013, women constituted 50% of the college-educated workforce, 39% of employed individuals whose highest degree was in a science and engineering field, and 29% of those in science and engineering occupations. The corresponding 1993 figures were 43%, 31%, and 23%, respectively, showing small gains in the number of women in the workforce. Women employed in S&E occupations are concentrated in different occupational categories than men with relatively high proportions in social sciences with 62%, and life sciences with 48%, but relatively low proportions in engineering with 15%, physical sciences with 31%, and computer and mathematics with 25% being women (National Science Board, 2014). The problem continues to be an unequal number of women in STEM fields both in academia and industry jobs, which leads to a wage disparity based on gender.

Di Bella and Crisp (2016) studied women entering what they referred to as atypical domains and the impacts on their adaptive ability. The focus of this study was not only to identify the negative barriers for women in STEM fields, but also discover the potential outcomes for women who are challenging stereotypes and

social conventions. The study selected 42 women, 24 of whom were in STEM and 18 who were in non-STEM fields. Most participants identified mainly as Caucasian. The women were randomly allocated as the second factor of control versus the experimental group. All participants were given a quantitative survey measuring stigma consciousness, exposure to stereotypes, and resilience to stereotypes, but only the experimental group was given a prompt before to reflect on their experiences as a woman in their academic discipline. The study showed a significant difference in the rates of resilience to stereotypes for the women in STEM disciplines compared to their non-STEM peers despite having no significant difference in the exposure of stereotypes. For women in STEM, resolving the stereotypical inconsistency between their gender and their academic field creates a daily requirement which in turn creates more adaptable beliefs and thoughts about being in an atypical environment. By building experiences that counter the stereotypical stories, women in STEM develop more resilience by engaging in a process of self-reflection when they can see themselves challenge stereotypes of gender roles.

Income Disparity

An issue that affects all careers and industries is the income disparity for women where men are paid more in similar jobs, with similar skills, and producing similar results (American Association of University Women, 2016). This is especially true for fields in STEM. The earning potential in STEM careers also tends to be higher which further impacts the wealth distribution along gender and racial groups when these careers continue to be predominately White men. Men in STEM careers earn \$36.34 per hour when women earn \$31.11 per hour on average, which is higher than in other occupations where men earn \$24.47 and women earn \$19.26 (Beede et al., 2011). The gender gap is less in STEM but the

earning potential creates more disparity compared to other careers (Beede et al., 2011). The wage difference is another factor in considering the impact on social class and race. Since individuals from underrepresented minority groups continue to be less represented in STEM disciplines and industry jobs, the wage differences for STEM versus non-STEM careers impacts the wealth distribution and greatly impacts the wealth gap between racial groups in the US.

A longitudinal study of women in STEM conducted by Xu (2015) found that the persistence of an earning gap for college graduates. The study used multiple data sources which tracked the education and work experiences for college graduates with bachelor's degrees. The study focused on several factors including the ratio of reported work hours per week with annual income, personal and family characteristics, demographic characteristics, marital status, and racial/ethnic background. Findings of the study by Xu (2015) revealed a substantial difference in the earning potential for men and women in the first 10 years of post-baccalaureate degree employment. Market discrimination, the favoring of men compared to women and the wage gap, impacts women's return on investment meaning their education and degrees are not worth the same as men's. The difference in income potential between men in STEM careers and women careers is 22.5% (Xu, 2015). Additionally, the percentages of female graduates holding a full-time job were significantly lower than those of their male counterparts within the 10-year period. One of the interesting findings is that women in STEM careers are penalized given growing family obligations, if they chose to have a family, that impact their earning potential. The researcher acknowledged that "it is not as a mere cliché that they struggle to balance work and family responsibilities; rather, it is the real-life challenge faced by the majority of professional women who are also the primary caregivers in domestic life" (Xu,

2015, p. 513). Similar information about income and the representation of women in STEM fields is well documented with numerous studies and statistical data (NSF, 2015). Overall, the study confirmed multiple findings for disadvantages for women in STEM to be more systemic and experienced widely for women in career positions rather than isolated events for only a few individuals.

Gender Bias

A well-documented issue in the underrepresentation of women in STEM is gender bias. Gender bias is the theory that men are favored over women in academic or social settings, and this leads to unfair hiring practices where women receive less pay, do not get hired, are not promoted to tenure track positions, or are treated differently in the process due to being a woman (Handley, Brown, Moss-Racusin, & Smith, 2015). These findings occur in multiple disciplines and cover the range of institutions. An issue arises when discussing the necessity for professors to conduct a selection process without bias or subjectivity. Faculty are expected to conduct and interpret their research findings without bias or subjectivity, so challenging them on the possibility of being unfair, therefore negating the idea that they can be unbiased, creates a larger concern among faculty (Handley et al., 2015). The large-scale changes needed for gender parity in faculty hires requires current faculty to admit there is a bias and a problem in STEM discipline regarding the admission of graduate students, selection of projects, selection of hiring faculty, and the review of publications and research studies.

Additional research on the impact of gender bias and discrimination has attempted to explore the difference within STEM disciplines by both gender and race. O'Brien et al. (2015) sought to better understand the difference in the representation of women who identified as White and Asian, compared to women from African American and Latin@ groups. The study sought to test a theory that-

related threat, such as gender bias or discrimination, would impact women from different ethnic backgrounds similarly and would create similar responses. This response was gauged by the participants' legitimacy beliefs, or as the researchers describe it, that there is a difference between men and women in STEM. The participants consisted of 241 women from three different types of universities; a Predominately White Institution (PWI) in the South; a Historically Black College/University (HBCU) also located in the south, and an ethnically diversity institution in the west. Asian American and European American women were categorized as overrepresented groups given their overrepresentation in STEM disciplines, and all other categories were grouped as underrepresented. The participants were given a logic test of 24 multiple choice items, and were also asked to rate the competence of the tutor during their test session using a Likert scale. The results of the study showed that women from URM groups tend to have negative perspectives of male researchers, but were less likely to be surprised by the suggestion of the tutor's sexism. The ethnicity of the individual and support for legitimacy beliefs can mitigate the negative effects of interacting with a sexist instructor and gender-related threat. Women from URM groups also rated the overall experience in the testing session more favorably when they were led to believe the instructor was sexist. These results support the conclusion that women continue to experience gender discrimination, but women of color have dealt with similar struggles before the academic setting and are more capable of coping with these challenges.

Aside from hiring practices, a bias in the selection of graduate students, assigning projects, or selecting new faculty hires does exist within academic settings. One study involved two general U.S. population samples of a 205 and 303 people, respectively (Handley et al., 2015). Using an online survey

instrument, the researchers presented faculty with a sample abstract of a paper which reported the existence of gender bias in STEM disciplines. The researchers then asked participants to evaluate the strength of the abstract and its findings. The study conducted three randomized, double blind experiments – two with participant samples from the general public and one with 205 university STEM and non-STEM faculty. The results demonstrated that males tend to evaluate the gender-bias research less favorably than females. More concerning was the finding of a more prominent difference by gender among STEM faculty compared to the non-STEM faculty. The study suggested a hesitancy among males, who typically do not see the problem or wish to avoid it outright, to accept evidence of gender biases in their fields. The study highlighted a need for future work in academia to address gender bias and to increase the selection and success of women in STEM disciplines.

In researching hiring practices in STEM, only one study found that bias in hiring practices was no longer an issue. The research study by Williams and Ceci (2015) suggested that the underrepresentation of women in STEM is more an issue of supply, suggesting that women decide not to pursue these careers, rather than on the demand side, for example the biased hiring practices that favor men (Williams & Ceci, 2015). The researchers presented information describing the belief that STEM fields continue to be “inhospitable male bastions” can become a self-fulfilling prophecy and lead to a self-reinforcing environment where women do not feel welcome. The increase in female hires shows promise for making larger changes to the campus climate for female faculty, but these are only within certain disciplines such as science and math. Despite more objective hiring practices, the entry to the professoriate is only the beginning, and one of many stages where gender bias can become a limiting factor.

Changes in education also need to be reflected in work environments to support women. This requires industry leaders to affect change in their organizations to adapt to changing demographics and employee needs. Fitzpatrick (2012) discussed the need for organizations to also adapt during her president's remarks at the 2012 Annual Conference for the Association for Women in Science, using the analogy of resilience to systems theory and the resilience of socio-ecological systems. The resilience alliance referenced in her statement pointed to resilience as "the ability of a system to absorb disturbances, to be changed, and then to reorganize to have the same identity" (Fitzpatrick, 2012). She also stated that the workplace often tends to be structured for employees to not be resilient when they encounter adversity or challenges, particularly for women of color. To create resilient institutions, Fitzpatrick recommended building structure to actively design opportunities for women to explore and gain valuable experience as division chairs or department heads. This addresses issues of confidence but also increases the visibility of women in leadership positions, which in turn influences the institutional culture that typically limits women's upward mobility. These changes may not eliminate all concerns for women in STEM. After getting hired, women may continue to encounter gender bias and discriminatory practices in academia or industry. Leaders within the institutions or organization play a crucial role in creating environments that are more open to change when problems are experienced and reported.

Latin@ Women in STEM

Latin@ women have made progress in attaining associates degrees but continue to have low percentages for bachelor's degree attainment. Gandara (2015) reviewed data on women of color and found that they are even less represented in STEM at advanced degree levels. Latin@ women have the lowest

percentage of graduate degrees compared to all women of other non-Hispanic racial groups combined. There was only a 2% increase for Latin@ women who had a graduate degree, where other groups experienced larger increases in the decade from 2003-2013. In 2013, just 4% of Latin@ women had completed a Master's degree or higher by age 29 compared to nearly 5% of Black, 11% of White, and 22% of Asian women (Gandara, 2015). Although doubling over the decade, similar to the numbers of bachelor's degrees, the progress for Latin@ women has not been sufficient to close the gap and does not reflect the significant increase in the general population or college going women.

Latin@ women have additional stressors and limitations in STEM disciplines while in college with the intersection of cultural and social values/expectations along with their gender. A study by Cole and Espinoza (2008) examined a longitudinal sample compiling 146 Latin@ college students who majored in STEM disciplines and completed surveys. The researchers determined variables which contribute to Latin@ students' academic performance. The researchers analyzed data using descriptive statistics, factor analyses, and regression analyses and found that of the background variables, such as college prep courses and family support, the only significant finding was the influence of gender and high school GPA. Cole and Espinoza (2008) also found that although URM women in college were less likely to enter STEM disciplines, the students who did enter these majors from these backgrounds were more academically prepared. A reasonable goal for increasing URM students enrolling in STEM majors is to target students with an interest but are not receiving high GPAs. Support programs should focus on developing these students' self-esteem with regard to science and math while enhancing their knowledge and skills in their interest areas. Mentor programs with older students can also encourage the

development of confidence for younger students and challenge negative perceptions about pursuing STEM fields. Other significant factors were connected to the overall college experience, such as time spent studying and classroom environment with faculty support were positively correlated with academic achievement for Latin@s in STEM.

A different study by Peralta, Caspary, and Boothe (2013) used LatCrit and a mixed methods research design to study the persistence of Latin@ college students in STEM disciplines. An online survey was administered to students enrolled in post-baccalaureate or graduate programs, as well as undergraduate students who were in a bilingual education program. Students were selected to participate in separate, unstructured conversations with the researcher. Participants represented multiple ethnic backgrounds within the Latin@ community and of the students who completed the survey, a total of 17 were selected for the qualitative conversation to give their testimonio. The intentionally unstructured conversations developed along responses from the participants after initial prompts about education experiences. The results showed that most messages about STEM were negative and impacted Latin@ students in grade school, which led to further lack of confidence in their preparation to pursue STEM. These students were often encouraged to leave school and join the workforce when they encountered discrimination or teasing from peers. Peralta et al. (2013) found that this can be challenged with intercultural groups or additional social justice and sensitivity training with teachers and staff to feel more comfortable challenging social norms in schools. The testimonies also revealed a language challenge for many Latin@ when teachers were not able to communicate effectively or created additional stressors and discriminatory environments due to language differences. These language differences are often mistaken for intelligence deficits when really it is

an issue of cultural awareness and the need for environments supportive of difference to be cultivated. The inability to recognize the difference between a communication challenge and an intellectual deficit needs to be challenged with teachers. The growing U.S. Latin@ population (U.S. Census Bureau, 2011) has the intelligence necessary to meet the demands of a changing workforce with the proper structures and environments.

A majority of Latin@ students are first generation college students, which presents an additional challenge in education as they are the first in their immediate family to attend college. Dika and D'Amico (2016) conducted a quantitative study of first generation college students (FGCS) at an urban, large research institution. One of the findings from this study was academic preparation early in a student's education can greatly impact their success as a first-generation college student and was found across all disciplines. One correlation for STEM student's persistence was the perception of preparation in mathematics, where if a student majoring in STEM did not feel prepared, they were less likely to persist in their major. Aside from academic preparation, Dika and D'Amico also found that perceived social fit was also a predictor for persistence for STEM and non-STEM majors, while perceived academic fit was only significant for non-STEM majors. The results of this study show differences between STEM and non-STEM disciplines and would need further research to discover other nuances within disciplines rather than a between STEM and non-STEM dualistic breakdown. The subgroups by major within each binary category would reveal more significant differences for student persistence.

One area of development for STEM is in engineering, where women are enrolling and graduating at significantly lower rates than men (Esquinca, Villa, Hampton, Ceberio, & Wandermurem, 2015). Esquinca et al. focused on the

underrepresentation of Latin@ women in engineering and combined both resilience and persistence in the qualitative study to explore why women were not pursuing careers in this field. Interviews were conducted with each of the participants in the study, and they were asked to discuss their process to their major choice with further elaboration on the experiences in their studies. The research outline presented spaces of struggle for the individual participants as well as their resources for resolving crisis or struggles. The analysis pointed to recurring themes in the Latinas' narratives: (a) Crisis points revolved around events in lower division, "gatekeeper" courses; (b) participants drew on their communities of practice to make sense of these difficulties; and (c) a number of participants identified their mothers as the figure who confirmed engineering as the right career choice for them. The results of this study confirm the importance of family in considering and solidifying a career in STEM disciplines

Summary

The increased enrollments of Latin@ college students is not representative of the increase in the general population despite steady increases over the last decade. As mentioned, this can be due to a number of sources given education barriers and differences in access to equitable education, as well as retention in college, particularly for women in STEM disciplines. Issues around campus climate and discipline specific challenges limit the success of URM students and women in college when they do not feel they belong or do not feel confident in their abilities. As demonstrated in the review of literature, academic resilience is one means of encouraging URM students to continue through undergraduate education to graduate school. By developing resilience, these students will be more likely to continue through graduate school and pursue careers within their chosen fields. A gap in the literature exists of the intersectionality of current

Latin@ women in STEM that creates challenging environments and cultural pressures in their pursuit of a doctoral degree. Also missing is a discussion of the social, cultural, and gender identities assist Latin@ women be successful and develop resilience factors to overcome adversity. Increasing confidence and resilience is critical for STEM education to meet industry needs and to improve the lack of race and gender diversity in postsecondary education and STEM workforce. A paradigm shift is necessary to begin valuing the contributions of URM students and women with unique perspectives and strengths, particularly in STEM disciplines often dominated by White men.

From a CRT perspective, college students' personal stories provide a better understanding of the challenges and obstacles these students must overcome, as well as challenge the dominant narrative in education. By documenting the lived experiences of current Ph.D. students, the study served the purpose of providing this necessary information, in addition to providing reflection and resilience development for the participants to continue overcoming adversity. Race has continually been an issue in the inequitable education experiences for URM students, as exemplified by numerous studies in k-12 and postsecondary education. One of the tenets of CRT, interest convergence, suggests that the needs of racial minority groups can only be achieved when those needs align with the interests of the dominant culture. LatCrit has also challenged the variety of ways to give voice to Latin@ women's experiences and challenges, with an understanding that intracultural norms can also hinder the success of strong women in society. It is in the best interest of the country and US economic standing to encourage the development of Latin@ women in education as a subgroup to help meet the needs of a global economy.

CHAPTER 3: METHODOLOGY

Introduction

This chapter presents the purpose and methodology for the study after the review of literature on resiliency and the frameworks of critical race theory and Chicana feminism. The importance of weaving together multiple identities for the participants is informed by the work on intersectionality. This theory demonstrates the need to uncover multiple truths from the participants through sharing their narratives and lived experiences. These stories give insight into the challenges faced by women in STEM disciplines at public universities in California, and will help universities better understand and support this student population. This chapter further discusses the use of testimonio, or life story-telling, to document and share the lived experiences of the participants. This study helped participants identify and clarify their understanding of cultural and social expectations, and the development of academic resilience while reflecting on overcoming past adversity. The methods used such as site selection, participant selection, demographic questionnaire, as well as the qualitative interview protocol, are also discussed in this chapter.

Purpose of the Study

This research study intended to uncover the social, cultural, and academic factors which contribute to the resilience of Latin@ women in college. The purpose was to encourage the development of support systems and institutional practices to increase the enrollment and degree attainment of Latin@ women in STEM. This was accomplished by employing a narrative approach embedded within a critical race and LatCrit framework that incorporates the counter-narrative (Delgado & Stefancic, 2001). Public universities in the state of California were the

focus in this study given they serve a large population of Latin@ college students. The UC system contributes to almost half of the STEM degrees granted in the state (UCOP, 2015) and 5 of the 10 campuses have been designated as a Hispanic Serving Institution (HSI) for serving a high population of Latin@ college students. Therefore, this study focused on these sites given the concentration of the target population in postsecondary institutions within the state's education system. The goal of this research was to promote better services and support systems to encourage women to continue their education and pursue STEM Ph.D. degrees by learning what has contributed to the success of current graduate students. This also served the participants by reflecting on their own ability to overcome adversity.

Research Questions

The theoretical framework, Critical Race Theory, informs the following research questions for this study:

1. What are the stories and lived experiences of Latin@ women in STEM education?
2. What cultural and social factors affect Latin@ women in STEM Ph.D. programs in California?
3. How do systemic factors around race and gender contribute to the resiliency of Latin@ women in STEM disciplines?
4. What do Latin@ women say can be changed about education to support their pursuit of a doctorate?

Research Design

This qualitative study encouraged participants to continue their education through the process of addressing their lived experiences and empower them to use resilience as a means of challenging the dominant narrative in doctoral

education. A narrative exists that STEM disciplines are dominated by White men and few women of color enroll, and successfully complete, Ph.D. programs. Similarly, feminist perspectives challenge the problematic systems and institutions that oppress women in society, and “critical theory perspectives are concerned with empowering human beings to transcend constraints placed on them by race, class, and gender” (Creswell, 2014, p. 65). Testimonio, a storytelling narrative methodology, was used due to document the lived experiences of individuals who are from underrepresented or minority backgrounds to challenge the dominant narrative.

One of the tenets of CRT scholars is the centrality of experiential knowledge. The use of storytelling contributes to the generalizability of the findings given the specific individual experiences are telling of larger systemic problems to be addressed (Delgado Bernal et al., 2012; Delgado & Stefancic, 2009). It was the intention of the researcher to highlight specific examples of how Latin@ women encounter additional challenges in academia given social, cultural, gender, and life influences. The use of qualitative or quantitative methods primarily depends on the topic and the research questions asked. Therefore, what becomes crucial in a Chicana feminist epistemology goes beyond quantitative versus qualitative methods, and lies instead in the methodology employed and in whose experiences and realities are accepted as the foundation of knowledge (Pérez Huber, 2010; The Latina Feminist Group, 2001). CRT scholars recommend the adoption of an explicit goal for research to serve the ends of creating a more just and democratic society that permeates the entire research process, from the problem formulation to the drawing of conclusions and the use of results (Mertens, 2010). Using narratives and storytelling provides an alternative to the dominant research paradigm, which bases much of the sociological and psychological theory

on the heterosexual, cisgender, White, male perspective, which was not inclusive of different identities around gender, ethnicity, or ability. The purpose of this research was to challenge dominant narratives of doctoral students in STEM and support the women of color who are currently enrolled in Ph.D. programs. Often utilizing reflection, this methodology can empower participants to overcome future challenging environments and discrimination with a better understanding of their own resilience after reflecting on past adversity. This change in the status quo is the purpose of using this theoretical framework and testimonio as a method to advance social justice goals.

Chicana feminists challenged the stereotypical, traditional role of a Mexican-American woman as mother and wife with the ability to contribute in many other areas (University of Michigan, 2007). The Chicana feminist perspective also challenges other social stereotypes that reflect a dominant narrative of women across multiple identities, such as gender, ethnicity, race, class, and sexuality (University of Michigan, 2007). Semi-structured interviews were used to encourage the sharing of stories from the participants around these topics and to learn about the factors which contributed to their resilience and continued pursuit of education. The interview protocol (see Appendix A) emphasized participant family histories, experiences in both secondary and postsecondary education, choice to pursue a STEM major, family support, systemic issues they encountered regarding their identities, mentorship, gender bias and discrimination, intersectionality of identities, and a general discussion about their post baccalaureate experiences including the factors that contributed to overcoming obstacles.

Testimonio differed from standard interview as the emphasis was on the participant's story rather than the researcher's specific questions. Although certain

topics are raised, the general purpose was to encourage further sharing of stories and experiences through reflection. The participants' narratives were analyzed and presented in two different formats. The first was each testimonio of the participant presented as a narrative. Specific experiences from each participant was then arranged by themes found in the narratives that address the research questions. While maintaining the central focus on the participant's testimonio, the organization of these thematic stories demonstrate shared experiences for Latin@ women in STEM disciplines. The testimonios contribute to an overall challenge to a dominant narrative with the counter-narrative that women in STEM, specifically Latin@ women, can be successful.

Reliability and Validity

Validity in this study was largely on the premise that lived experiences and the narratives of participants are valid sources of knowledge (Delgado Bernal, 1998). Given the CRT framework, the participants' stories are a challenge to the dominant narrative and the stories from the participants themselves are what establish validity. Validity in a qualitative study also means the researcher must use procedures to check for accuracy in the findings. These can be any procedures such as member checking, data triangulation, or addressing researcher biases for the study (Creswell, 2014). Reliability in a qualitative study means that the approach to the research is consistent for other researchers and different studies. This requires an adherence to the theoretical framework and pedagogical tenets from the literature. In this study, the researcher followed CRT and LatCrit frameworks and utilize a feminist epistemology to challenge patriarchal structures, systems of oppression, and dominant perspectives (Delgado & Stefancic, 2001). Similar terms for validity are trustworthiness, authenticity, and credibility and are represented in evaluating qualitative research (Creswell, 2014). The use of

multiple validity procedures enhanced the accuracy of the study and the findings. The first procedure is member checking and allowing the participants to analyze the transcripts of the interviews. This ensured the accuracy of the transcriptions and the follow-up interview also served this purpose for participants to comment or add additional information to their narrative. The stories established the lived experiences that reflect data evidenced in literature on STEM disciplines regarding women's multiple forms of discrimination in academia. Lastly, the researcher established biases in a positionality statement regarding his own identities and the areas of privilege that was challenged in the analysis of the testimonios.

Institution Selection

College and universities which offer STEM Ph.D. programs in California and designated as a Hispanic Serving Institution (HSI) were selected for this study. According to the Department of Education (2016), an institution of higher education is given HSI designation if it:

- (a) is an eligible institution, which means it is an accredited institution; and
- (b) has an enrollment of undergraduate full-time equivalent students that is at least 25% Hispanic students at the end of the award year immediately preceding the date of application.

California has the highest Latin@ population and the most colleges and universities designated as HSIs (Excelencia in Education, 2017) and was chosen for this study given the high population of students who meet the criteria for this study. Although the HSI designation is given for undergraduate full time enrollment, the California institutions also have a larger population of Latin@ graduate students enrolled on the campuses compared to other states. Nationally, HSIs with graduate programs have increased from 87 in 2004-2005 academic year to 156 in the 2013-2014 academic year (Excelencia in Education, 2017). The sites selected for this study were University of California (UC) system campuses

designated as HSIs given the higher target population of STEM Ph.D. students. Table 1 displays the different campuses with both graduate and undergraduate student enrollment data, which is used for the HSI designation. The UC system has outpaced peer institutions in the ethnic diversity of its STEM graduates with 12% of UC's STEM graduates from underrepresented minority groups, up from 9% in 2000 (University of California Office of the President, 2015). There are currently five campuses designated as HSIs. All five HSI designated campuses were used for this study to represent the different regions of the state and to gather more data around Latin@ women's academic resilience.

Table 1

University of California (UC) Hispanic Serving Institution (HSI) List

Name	Grad Total	Grad Hispanic	% Grad Hispanic	UG Total	UG Hispanic	% UG Hispanic
Merced	384	45	11.7	5,840	2,670	45.7
Irvine	5,580	604	10.8	25,016	6,273	25.1
Riverside	2,708	326	12.0	18,584	6,743	36.3
Santa Cruz	1,589	191	12.0	16,007	5,072	31.7
Santa Barbara	2,813	238	8.5	20,045	5,089	25.4

Note. HSI designation based on undergraduate enrollment. Graduate enrollment provided for reference. *Excelencia in Education, 2017, Analysis using U.S. Department of Education, NCES, IPEDS, 2015-16 fall institutional characteristics and enrollment surveys.*

Participant Selection/Sample

At each UC campus, a graduate diversity officer provides support services for students from underrepresented minority backgrounds and coordinates opportunities for professional development. These contacts were utilized to contact graduate students to be selected for the study through purposeful sampling.

Purposeful sampling is a technique used to select participants based on specific criteria, such as characteristics of a population or the objectives in a study, and uses a non-probability sampling technique to select the most appropriate participants (Creswell, 2014). Information for the study taken from the consent form (see Appendix B) was also sent to a few professors in the different disciplines at each institution to share with students. Interviews were conducted with a minimum of 10 Latin@ women currently enrolled in STEM Ph.D. programs. Although the intent was to have participants from different disciplines across the five institutions, the majority of women of color are in the biological sciences and thus generated more responses from that discipline. Also, the study was limited given the overall small target population of Latin@ women in STEM Ph.D. programs.

Data Analysis

Qualitative research methods are used to examine the nuance of human behavior and understand social phenomenon from the perspectives of the participants with the ability to capture the complexity of multiple identities and experiences (Creswell, 2014). Using a form of storytelling called *testimonios*, the participants shared their stories of adversity in education and reflect on their own development and examples of resilience (Campa, 2010; Delgado Bernal, 1998). A person's *testimonio* reveals an epistemology of truths as well as how an individual has come to understand those truths. The use of *testimonios* also bridges and connects generations of displaced and disenfranchised communities across time (Delgado Bernal et al., 2012). Although only a limited number of Latin@ women currently study STEM disciplines in Ph.D. programs, their *testimonios* represent a rich history of past and future individuals in these distinct experiences. This study documented new narratives of Latin@ women in education and challenge the

dominant narrative in STEM disciplines. This also served the purpose of avoiding the deficit perspective and focused the study on the factors that contributed to developing resilience.

All conversations were recorded using both a voice memo application on the iPhone, as well as digital recorder in the chance one of the forms of recording malfunctioned or had problems. The mp3 files were sent for transcription to Rev.com, an online service to upload digital files for human transcription. The testimonios were transcribed and reviewed for edits, particularly for Spanish quotes and any discussion that was inaudible for transcription. The transcriptions were shared with the participants for clarification to involve them in the process of sharing their stories. The second follow-up interview, conducted by phone using Google Voice, an online service that also records conversations gave the researcher the opportunity to clarify stories and offered the participant a chance to elaborate on the stories provided in the first interview. This second interview also served as an opportunity to encourage further reflection and to check in with the participant about their thoughts since the first interview. Once approved by the participant, the transcripts from both interviews were used to find commonalities between the students' testimonios discussed in the form of themes. Their stories serve as evidence as to how and why women of color succeed at the postsecondary level, and how to adapt current practices and policies to better prepare them for post-baccalaureate programs.

The testimonio for each participant was created using quotes from their interviews. The researcher gathered stories and ideas shared by the participant to create the narrative around different aspects of their identity and individual experiences throughout their education, their upbringing and stories about their family, and the pursuit of advanced an advanced degree in STEM. The

interpretation of the narrative data collected from this study were coded and analyzed before being organized in themes discovered and defined throughout the study. This was achieved through open coding, a process where the researcher reads through lines of text in transcriptions to assign codes to sections of the narratives (Creswell, 2014). During the phone conversations, the researcher drafted notes and documented times to reference during analysis of the calls which aided in adding sections of new narrative to the coded information. All but two follow-up conversations were recorded with two not due to technical difficulties. Thematic data analysis was conducted with *QSR NVIVO10*, a software used for analyzing qualitative data. During the use of this application, codes from the open coding process were used to find additional sources of information from participants' narratives. This also aided the researcher in determining if participants were responding to a code idea in a similar or different way, such as whether or not they experienced gender bias or if they experienced it during their undergraduate or graduate education. The major themes found during analysis were used to collect shared experiences between the participants' testimonios. By identifying the factors that were critical to the development of resilience for each of the participants, there is a greater opportunity to assist students to reflect on these factors in their own lives and encourage their ability to overcome adversity in the future. The themes taken from open coding and from the analysis through NVIVO were also analyzed through the Critical Race Theory lens and related to the literature to make suggestions on how universities can encourage the development of resilience. The participants' experiences with racism, sexism, and classism inform future changes in postsecondary education. These suggestions also contributed to the counter narrative of Latin@ women in STEM, aligning with the values of LatCrit theories.

Delimitations of the Study

As evidenced in the literature, women of color are not well represented in STEM disciplines at the graduate and postgraduate levels. The emphasis on the experiences of Latin@ women in STEM Ph.D. programs narrows the population and given the small population, the voices and stories of these students are crucial to document and share. Latin@ males were excluded from this study for a few reasons. The feminist perspective informs the first reason emphasizing the necessity for sharing women's voices and challenging the dominant narrative that men are the only successes in STEM. The second is that there is an increased interest in the study of Latin@ males in college by several organizations, and therefore, this study served as a counterbalance focused on women's experiences in higher education. Documenting the voices of women in STEM support the overall efforts to better support students of color, particularly the growing Latin@ population enrolling in colleges and universities.

Limitations of the Study

The focus on California as a state with a large Latin@ population is the first limitation of the study. The unique environment of California limits the applicability of these students' experiences to other states or universities as this state tends to have more progressive politics, more racially diverse communities, and the highest number of universities identified as HSIs than any other state. The study was also limited by the small population of Latin@ women in STEM which made it difficult to find participants. This is particularly evident in the discipline representation with the majority of participants from biological sciences and the limited number from other disciplines. Another limitation was the dependence on connections the graduate diversity officers at each institution. Without knowing how many Latin@ women were enrolled in STEM Ph.D. programs at each

campus, as the numbers were general overall Latin@ graduate students, it was difficult to predict how many respondents would agree to participate in the process. A technical difficulty was the use of online resources for recording interviews that did not record all follow-up interviews properly, and the limitations of an online transcription service that required the researcher to edit the transcriptions for inaudible statements or ones that were made in Spanish. The researcher took notes during the follow-up interviews so thankfully was able to add stories from the participants, but was limited to direct quotes that were documented or stories that were built from memory. The use of Google Voice for the follow-up interviews also created digital recordings that could be downloaded and listened to on a computer, which provided the researcher the ability to add stories and direct quotes to the narratives. The second issue was resolved by doing a search for the phrase inaudible in the Word documents provided by the transcription service, which was used for statements that were either too quiet to transcribe, or for language used other than English. The researcher was able to replay the digital recording for that section of the interview to edit the transcription for accurate documentation of the narratives.

Positionality Statement

The researcher worked at a UC campus that was in the study and manages fellowship programs for underrepresented minority students in STEM. The experiences from women of color at the undergraduate level informed much of the purpose behind this study. Also, the researcher was connected to the graduate diversity officers at other institutions through these programs. The convenience of the relationships with these staff members granted access to the target populations of Latin@ women in STEM Ph.D. programs. With a background in social justice education, the researcher was aware that women of color experience more

discrimination due to the intersection of systems of oppression. A goal of the researcher was to uncover the negative experiences for women in STEM to justify the need for inclusive practices and to challenge the male-dominated spaces in higher education. A firm belief that all students can succeed permeated this study in that given proper instruction, family and social support, eliminating unnecessary barriers, and environments that support their development, women of color can be successful contributors in STEM disciplines. This also served the industries in these fields to have more mentors for future STEM students.

The researcher is also from the Latin@ community, identifying as Mexican American, and witnessed some of the discrimination against women based on cultural and social norms. The researcher wanted to uncover truths about Latin@ culture that undervalue the contributions of women, and in sharing these truths, change cultural norms so that younger women can be successful in any field they choose. Although not fluent in Spanish, the researcher ensured that the stories and language used in testimonios were kept as they were described rather than translated and changed to fit the dominant narrative in English. As a queer person of color working to dismantle systems of oppression, the researcher acknowledged his male privilege in wanting to research the experiences of women and made every attempt to challenge the interpretation of stories from a feminist perspective, challenging the patriarchal structure of education. As a beneficiary of male privilege, the researcher acknowledged his identity and privilege to challenge the power dynamics that existed in conversations with participants who identify as women.

As a first-generation college student, and the first in his family to pursue a doctoral degree, the researcher also challenged his own narrative knowing that male privilege has played a role in his success. The challenge was to relate to the

stories of the women in the study, but not reinterpret their stories given his own experiences and challenges. The range of experiences in education, challenges with family, and cultural background inform the dedication to changing higher education institutions to increase the representation of women in STEM and to create more inclusive environments for students to reach their goals. The research study contributed to a growing understanding of connected systems of oppression and challenged the dominant narratives that contribute to the low enrollment of women, particularly Latin@ women in STEM.

CHAPTER 4: FINDINGS

Borders are set up to define places that are safe and unsafe, to distinguish *us* from *them*. A border is a dividing line, a narrow strip along a steep edge. A borderland is a vague and undetermined place created by the emotional residue of an unnatural boundary. (Anzaldúa, 1999, p. 25)

In this chapter, the participants' testimonios are framed using Critical Race Theory, the understanding that race and racism impact people from URM backgrounds disproportionately than their White peers (Delgado & Stefancic, 2001), and intersectionality which is the concept that Latin@ women in STEM disciplines are balancing multiples identities and communities (Crenshaw, 1991). Anzaldúa's (1999) concepts of borderlands and new mestiza consciousness inform the viewpoint of documenting of the women's stories with education, family, and their own sense of identity and purpose. To answer the research questions for this study, the testimonios are organized by individual participant to give their stories of challenge and success in pursuing a Ph.D. in STEM. An overview of the participants, *las mujeres*, succinctly presents some of their demographic data and educational history. The CRT framework also values the individual experience and life story as a source of information to substantiate the need for change. Therefore, aspects of the participants' testimonios are collected and presented around themes to demonstrate systemic factors in education. Other themes are used to highlight the stories of family, culture, and identity that contributed to their success and motivation to continue their education. Lastly, the overarching themes discovered through the narratives of the women highlight concerns about educational access, gender norms, and how to support future Latin@ women in STEM disciplines.

Las mujeres

The 10 women, las mujeres, in this study shared their testimonios with individual stories of struggle and accomplishment, as well as similar, but sometimes contradictory experiences across the group. Although the majority of the women are in the biological sciences, differences in their experience or education emerged as they reflected on their path to the Ph.D. Many of the similarities were around the lack of Latin@ students in college, and the challenges of educational equity or preparation for college. All the women in the study identified as first-generation college students, which produced some of the similar, positive reinforcement for them to be successful and focus on education, but without some of the necessary information to navigate the system. Despite their parents' education or full understanding of their daughters' path, the participants received multiple forms of encouragement from their families who value and emphasize the importance of education.

Overview

The participants are listed below (see Table 2) with pseudonyms intentionally chosen to represent actual Latin@ women who have contributed to different disciplines and work at the National Aeronautics and Space Administration (NASA). As an additional challenge to the dominant narrative, the use of real women's names supports that Latin@ women can pursue STEM disciplines and find success at high levels in government agencies and research discovery. See Appendix C for a list of the women at NASA. Additionally, Table 3 displays some of the demographic data for each participant shared on the demographic questionnaire. See Appendix D for the demographic questionnaire.

Table 2

List of Participants

Pseudonym	Discipline	Year in Ph.D.	Ethnic Identity
Nitza	Biology	5th	Mexican American
Adriana	Biology	7th	Latina/Cuban
Serena	Biology	2nd	Hispanic/Mexican American
Ellen	Biology	2nd	Mexican American
Gloria	Biology	3rd	Mexican-American
Lydia	Engineering	2nd	Mexican
Olga	Biology	2nd	Hispanic
Annie	Biology	4th	Mexican American
Maria	Engineering	3rd	Mexican American
Griselle	Engineering	3rd	Mexican American

Table 3

Participant Demographic Data

Parent Education Level	Language	Discipline Area
At least one parent with some college education (2)	English as first language (3)	Science - Biology (7)
At least one parent graduated high school (4)	Spanish as first language (7)	Engineering (3)
At least one parent with grade school education (3)		
Parents had no education (1)		

Testimonios

Nitza, 5th-Year Biology Ph.D.

With parents who immigrated to the U.S., Nitza had to navigate the educational system and her story demonstrates a learn-as-you-go mentality for many first-generation college students. Her father came to the U.S. through the Bracero Program, a set of laws and policies as part of an agreement between the U.S. and Mexico, that allowed Mexican citizens to come over the border if they were to work, mainly in agriculture. Nitza's father decided to take a break from university in Mexico on visa but then decided to stay here. Her mother came to the U.S. as an undocumented immigrant and married her father who got his "green card" during the Reagan Administration. Since she was a child when they became legalized, she does not remember having the struggle of "thinking about what's going to happen if they are stopped by immigration or whatever. We would visit Mexico once a year or once every other year, ever since I was little. We go to Zacatecas often." (Nitza, 5th-Year Biology Ph.D.)

Nitza came across opportunities and found out information by being around others who were following paths she found interesting. This started in high school when recruiters came to provide information to students. One of her responsibilities was to deliver notices to students to meet with college counselors and recruiters. She was also introduced to research at her undergraduate institution when tours of labs were being offered. The announcement was at her peer study group for science students, and she decided to go on the tour: "I thought it was interesting, so then I became involved in research." (Nitza, 5th-Year Biology Ph.D.). She also found out about the Bridges to the Doctorate program from another student who was asking her what she will do since she graduated.

My PI said, “You know my funding is ending. What are you doing to do?” I didn’t know. When I told the graduate student about the conversation, she said, “You know there’s a Bridge to the Doctorate program. You should apply. You don’t have good grades but you have other stuff like you’ve got research experience and you have gone to conferences to present your research.” So, I did that and I applied and I got in. (Nitza, 5th-Year Biology Ph.D.)

She met her future PI when she was a guest lecturer at her undergraduate institution. She also didn’t realize it at the time but she participated in an informal interview for graduate school. She reflected on the meeting,

She was asking me, “What did you do here? What is a ligand?” So, I told her about my projects and explained to her. Later I thought to myself, “How does she not know what a ligand is?” It was not until later I realized, that was an interview. (Nitza, 5th-Year Biology Ph.D.)

The importance of family and supporting each other is an understatement for Nitza. She commuted as an undergraduate student attending a university in the Los Angeles area. She was living in campus housing for a few years at the beginning of her Ph.D. program, but decided to move back in with her parents. She explained her decision to move in with her parents,

If I’m paying for rent to some other landlord, I might as well just help my parents pay for the house. And they are there to support me and then my mom cooks, too. So I don’t have to worry about that (Nitza, 5th-Year Biology Ph.D.)

Her parents encouraged her to continue her education so that she can access other careers. She shared a common sentiment from other participants that with an education, they would have the ability to get better careers compared to the ones of their parents. She shared the parents told her, “You should get a job where you don’t have to work hard labor. If you have this opportunity, you are a citizen, things are paid for here.” She also references her visit to Mexico and the disparity she sees in the education system in another country. “I see how things are over

there and I think I am lucky to be here. So that has opened my eyes about all the great opportunities we have in the US and we should take advantage of that.”

Nitza described feeling unprepared for college and the challenge of starting without being ready for the transition. She felt she had inadequate preparation from her high school to be successful in college. “I just didn’t know how to study for those classes. I thought it was like in high school, but it wasn’t.” She was also not sure what to major in when she was planning to go to college.

I didn’t realize until high school where I liked my biology class. I said, “Well, I don’t know what I’m going to major in but out of all of my classes that I’m taking right now, biology was my favorite one.” So, I thought I would just major in biology. (Nitza, 5th-Year Biology Ph.D.)

In her first year in college, her academic advisor also encouraged her to switch her major when she struggled in a few classes.

I remember once a counselor sat me down and said, ‘You know, this is the end of your second year and your GPA is not that great and you’re a science major. Well you took two Chicano studies classes, why don’t you decide on that?’ and I thought, what are you trying to say? You say that because I’m Hispanic? You think I should be a Chicano studies major because it’s right for me somehow? Because of my background. (Nitza, 5th-Year Biology Ph.D.)

Despite not having a college education in the U.S. themselves, Nitza’s parents have supported her to keep going after what she wants but do not place excessive stress on her, as experienced by other participants.

My parents told me, “You are doing the best you can and it’s fine if sometimes you don’t do well, it’s okay.” They don’t really push me in terms of having to be the best in my class. I feel that the support they’ve offered me has really helped me all the way now to graduate school because I know that I have that emotional support... because they’re always there for me and I think that has helped me stay.

She ended by sharing a challenge to a dominant narrative that men are better in the sciences and that women struggle.

I hear a lot how people say, “there are a lot of studies that say males are better at STEM than females and because the way kids are raised.” Perhaps. I remember hearing that “boys are better in math,” but that’s just not how it is. We’re taught that since we’re little, but I didn’t see it like that. I just thought that I’m just going to do my best. I didn’t see it as, “Oh, I’m a girl doing science.” I am just doing it.

Adriana, 7th-Year Biology Ph.D.

This participant shared that she feels she is “a Latin@ in her own right” (Adriana, 7th-Year Biology Ph.D.). During her story, Adriana revealed a complex tapestry of language, culture, religious beliefs, and the meaning of identity through her testimonio. “I consider myself first and foremost Jewish, and then from that, Latina,” she shared when asked about her identity. Adriana has a multicultural, multifaceted upbringing with parents who were born and then raised in multiple countries, speak multiple languages, and practice a religion that depending on the country, was not accepted in society. Her entire family speaks Spanish and lived in Cuba, Argentina, and ultimately in the United States, often facing anti-Semitism, discrimination for language barriers, and struggle due to their socioeconomic status in a working-class family.

They [her family] would say, “Wait you’re Jewish? How can you be Jewish and also coming from a country that speaks Spanish?” Most people are surprised by that or they’ll ask if I converted, or not really understand how those two things can be separate. I usually respond with, “Well Judaism is a religion. I’m not sure what that has to do with where my family is from.” (Adriana, 7th-Year Biology Ph.D.)

Some of the discrimination she faced was from other students of color.

When she became a participant in a research program for minority students, others saw her as taking the spot in a program for minority students.

I did feel like certain people felt like they should have been... Like I took their place because I wasn’t a “true minority” and having to explain my background, it’s a little demeaning. It wouldn’t necessarily get me down. It’s just more upsetting in that moment that I had to explain myself” (Adriana, 7th-Year Biology Ph.D.)

Adriana only found out about the research program when a friend told her to go with her to an event. Then the friend encouraged her to join the group. Being in the undergraduate research program turned out to be “one of the best decisions” (Adriana, 7th-Year Biology Ph.D.) because it helped her find her path with new opportunities and ideas. She reflected on changing her path,

A friend invited me to go to the meeting and I signed up. I was introduced to research and that there is this other option where I didn't need to go to medical professional school. I could go to graduate school. That whole program opened my eyes. I ended up switching pre-pharm to applying for graduate school in biology. (Adriana, 7th-Year Biology Ph.D.)

With a supportive family, Adriana felt she was always expected to go to college. She reflected on her parents' encouragement for school,

I had parents that really wanted my sister and I to have better lives than they did and were really striving to push us to go to college. In fact, it wasn't an option. I was pushed by my dad to have good grades. It wasn't acceptable to not have good grades. I'm lucky things come easy to me. It was just assumed I would go [to college]. It [push to go to college] was definitely more from my dad than my mom, but my mom always expected me to go to college too. (Adriana, 7th-Year Biology Ph.D.)

She also shared that her parents were unaware of American education and the levels of postsecondary degrees.

We knew so little about college. My parents couldn't help me with questions about college because they didn't go. Then questions about graduate school, absolutely no idea. At the beginning, all three of us through a master's [degree] was higher than a Ph.D. That's how little we knew. (Adriana, 7th-Year Biology Ph.D.)

She became aware of her future interests in the sciences when the D.A.R.E. program came to her school to educate youth about drug use. Her fear from the presentation stuck with her. “I was so terrified after that day. I was the one kid affected by it.” She stayed with her PI who works on tobacco related disease and toxicity to continue researching smoking and tobacco use. She wanted to continue to “make new discoveries and solve problems people have. I get to study new

things and help people make better decisions.” She elaborated on her feelings after reflecting on pursuing her education,

I am very appreciative of the route that I’ve taken in that I haven’t had necessarily as much trouble as other people that I know, but I’m also glad that I’m able to represent... Maybe not the stereotypical Latina, but a Latina in her own right and this weird niche mix of things. It’s something I am very proud of where I am and on the days where I’m like, ‘What am I doing?’ it’s important to remember why I’m doing it. It’s a big stepping stone for me and to push myself forward. I am happy. I don’t think I could see myself doing anything else, honestly. (Adriana, 7th-Year Biology Ph.D.)

Serena, 2nd-Year Biology Ph.D.

Serena is unique compared to the other students as she is only one two participants who received an education outside of the US, but the only one to have some college experience. Serena’s education started in Mexico and even started her university education there. At the time of her university experience, her family was deciding whether to move to the United States. She had to decide whether she would stay for university in Mexico and let her parents leave without her, or to risk her education by going with them. By taking a leave of absence from the university in Mexico, Serena followed her mom’s advice:

My mom said, “Just give it a try. See if there are more opportunities. If not, you took your leave of absence and you can go back to your university if you think it will not be better in the US.” That is how I decided to leave. (Serena, 2nd-Year Biology)

In a large family with nine children, Serena reflected on a complicated decision to continue her education instead of finding a job to financially help her family. The short-term versus long-term impact of a stable career is more nuanced given the family importance for Latin@ communities. “I thought, ‘Maybe it’s true. At the end of the day, when I finish school, I will be able to help them more than if I work now and help them now.’”

Her mom supported her education along with her siblings. Without her dad's knowledge, her mom found a way to make sure the family had the money to pay for their education.

My mom somehow would bring in money. It was tough though because in school they always ask you to buy extra school supplies. There was a point when all of us were going to school, and it was tough for our parents to pay for our education. (Serena, 2nd-Year Biology)

Serena also had a traditional Mexican upbringing, but the cultural challenges she experienced created more motivation for her.

I come from a very traditional family. I saw differences in how my parents treated my brothers and then my sisters and I. I saw there were more preferences towards men, in my family at least. I didn't like that. I wanted to be different. I wanted more equal rights. I saw that in education. Maybe there's no equality yet, but there's more. (Serena, 2nd-Year Biology)

When asked about the educational differences between men and women, Serena highlighted the difference in communication style. She added, "Maybe I have gotten different treatment because... I just think that sometimes guys are more able to speak up. Just by being a man, sometimes people think that you have certain skills."

She found her passion in biology but was inspired by her father and his work as a carpenter. Her inspiration also came from her upbringing in Mexico where she saw issues with food production. She elaborated,

Just watching him do math and drawing all the models. That he did for the furniture he made. I think it was one of the things that influenced me to go into science. Also, I thought science was a lot more interesting to me at least... I feel science pursues truth. So, I thought "Ok, maybe I'll do biology, the truth in life." In the region I grew up in Mexico, there was a lot of vegetation, but there's also a lot of contamination. I wanted to make an impact in society. Somehow... through science I would be able to do that. (Serena, 2nd-Year Biology)

Serena also remembered seeing other Latin@ scientists that she could also pursue science and research. "For me it was at SACNAS. Well, that lady and that

guy are Hispanics. They can do research. They can have a family. If they can, I can also make that happen.” She remembered it was the chapter president who introduced her to research opportunities. At first, she did not apply worrying about the additional workload and if she could balance it with school.

I thought, yes I want to get research experience, but I don’t know if I can with all of the work I have. I don’t know if I’m going to be able to balance. The next time around, I applied and got in. (Serena, 2nd-Year Biology Ph.D.)

Serena was the only participant to directly address the need to find balance in a career. It was also importance for her to ensure the goals of each student are seen as equal.

I need to be able to analyze my life and find what makes me happy because pursuing an education, it’s one component of my life, but I also have personal goals. Connecting your personal goals with your academic goals, is one thing you need to do for you to find a balance in your life, for you to find peace, happiness. (Serena, 2nd-Year Biology)

Ellen, 2nd-Year Biology Ph.D.

Ellen grew up balancing two nationalities living and crossing the US-Mexico border. Although born in San Diego, her parents wanted her to have what they called the “privilege to have both experiences” so they lived in Tijuana and crossed the border to go to school (Ellen, 2nd-Year Biology Ph.D.). Fearful of her leaving and not returning, her parents encouraged her to go to school nearby instead of taking an opportunity to go to college in Mexico, but in another state and a greater distance away compared to the schools in San Diego. The internal struggle with wanting to grow up was balanced with her awareness that she needed them as much as they needed her. Her decision was to stay closer to home to have “not only the emotional support, but mostly economic too” (Ellen, 2nd-Year Biology Ph.D.). This decision came with unforeseen challenges as a first-generation college student. To commute over the border forced her to learn a

difficult lesson in managing her own time, and the more challenging lesson, to not take early classes. She shared, “There were days I didn’t know if I was going to make it to exams or class, and of course there were professors who didn’t care if you were commuting or that you literally live in another country.”

As a first-generation college student, she did not know the differences in course load and curriculum from high school to college and enrolled in five classes her first semester at the suggestion of her father who said, “you took all these classes in one semester [in high school] so you’ll be able to hand it.” She also stated that she had no one she could ask questions before she found a mentor later in her education. “Before that, I was talking to my peers and being like, ‘Which counselor do you think is better because I’ve tried like two or three’” demonstrating that students tried helping each other navigate the system. First-generation students depend on each other to find information and listen to peer advice regarding which resources are reliable at an institution.

Ellen also discussed the disparity she sees in different educational environments, and the privileges some people have particularly if their parents received a college education. She provided an example:

When I went to this science fair, it was pretty obvious that there were projects that had an advantage because their parents had certain privileges, so they [student] had the privilege of having parents with an education or had access to cool science stuff. There was one that did HPLC, and you need a fancy machine, and I’m like, “Come on!” so if we start earlier with access to things at a younger age, that would be cool. (Ellen, 2nd-Year Biology)

When she was deciding to apply for Ph.D. programs, she intentionally did not apply to programs close to home. She was tired of commuting and knew that if she was closer, she would feel the “something in our culture that you need to be super close to your family” and would need to commute home and visit every weekend.

When asked about her future goals, Ellen was not completely sure of what her next steps would be. She ruled out becoming a professor when asked if that was a path she was considering.

No... I answered that so fast. I see how it would be cool because that would grow... I mean I was complaining about there aren't Hispanic women in science but that's not for me. I see my PI and I've seen other professors, and it was all about trying to get grants. I see amazing women faculty that have their labs and have families, but I don't want to do that. It's not for me. I want to mentor so either go to industry or work at a national lab. My dream job is to work at NASA, but you know, that's a dream job. Either way I could still mentor. (Ellen, 2nd-Year Biology)

When asked about her continued pursuit of her goals, she replied, "Even though you go through challenges, it's worth it. We will see dark times, but there's always light at the end of the tunnel."

Gloria, 3rd-Year Biology Ph.D.

Gloria was always different than the rest of her family. She reflected on an instance when her family members identified and called her out for being different. "I've been told I'm crazy because I was reading a book when I was on vacation with them. I mean, what's wrong with reading a book? This is how I relax." Her identity as a scientist was also encouraged from a deeper sense of who she wanted to be. It was during the story of telling her mom she wanted to move away for college that she realized she had developed a feminist viewpoint on life.

I was like one day you're going to die, and who's going to take care of me? Who's going to show me how to be on my own? When I told her that, and that I didn't want to depend on my husband like she did, or her mom did, or my great-grandma did, it was like was an eye opener for her that I needed to leave, and that's why I did. She really respected that I wanted to do something with my life and not depend on a man. Is that feminist? (Gloria, 3rd-Year Biology)

Gloria talked about an obstacle around family that many students consider when applying to college. With opportunities to stay at home and go a local

college, many parents will encourage the student to stay close by and stay connected to family. It is not common for Latin@ parents to push their children to attend school further away from home.

I don't want to stereotype or generalize, but I think in some Hispanic communities. I know for me, my mom because she's from a rancho... women don't leave home until you get married. My mom didn't want me to leave home. My dad, I remember the day it happened because I told my mom I needed to leave. She was like, "Why can't you go to Cal State [local CSU]?" (Gloria, 3rd-Year Biology)

One of the only participants highlighted the spiritual connections she has with others as necessary support and guidance to overcome adversity and stay motivated. When discussing her support system, she identified that the women's prayer group has helped her process her fears, as well as the challenges she has encountered. "Once, somebody told me that I cannot go to school because my job as a Hispanic woman was to stay at home and take care of my kids." She experienced further discrimination when she told someone she is going to get her Ph.D.

Another person told me, "what are you going to do now that you're done with your bachelor's degree? Oh really, you're going to get your PhD? That's good because you aren't going to be like the other short, dark Hispanics." I get that shit all the time. I'm Christian and my faith really helps me. We have a women's prayer group every Tuesday. I see people that have the same common goals and were willing to help each other in any way we can to over those obstacles. (Gloria, 3rd-Year Biology)

A similar experience in the biological sciences has been to have more women as PIs in labs for the students. Gloria also brought up the appreciation she has for her PI who identifies as a woman.

I've been really blessed because the lab I'm in right now, my PI is my first female PI. She is not an assertive person, and I feel really comfortable talking to her. At first, she is really patient with me. I don't have to be very assertive, I think I chose the right lab because it comfortable for me. She is not intimidating like in other labs during my rotations. Choosing the right

lab is important for someone, whether Hispanic or not Hispanic, for you to thrive. It was important for me. (Gloria, 3rd-Year Biology)

Gloria demonstrated her internal motivation to achieve her goals when she replied to a question about how she will stay motivated throughout her graduate education.

I will still have my own obstacles, but it's my dream to get my Ph.D. I'm really scared because I have my oral examinations coming up. This is something I have always wanted to do. It sounds cheesy but I feel like it's something I was meant to do, that it's something I need to fulfill. If I don't do it, I'm not going to be satisfied. I like knowing that my research is going to impact so many fields and my knowledge is going to impact so many lives. Two of my friends have ALS, and I want to do more research in that as a postdoc. I want to give people hope, that there is a cure for something. Not only that, I want to educate people around me and being an example that if I can do it, you can do it too. (Gloria, 3rd-Year Biology)

Lydia, 2nd-Year Engineering Ph.D.

Lydia is from a large family with nine siblings. Although she was only one of a few who went to school after high school, she sees her path through education as a positive way to give back to her family. Her education helped them be more aware and for other life lessons she learned outside of the classroom.

I want to be knowledgeable so hopefully I can not only help my family, also so that they can pursue or educate themselves for all kinds of things like political reasons, to be better informed, for their health, for their well-being. (Lydia, 2nd-Year Engineering Ph.D.).

The daughter of immigrants, Lydia understands the value of the opportunities she has been given.

I had the opportunity and a lot of things at my disposal. I should use them to the best of my advantage. Man, I was missing a whole world of things, like a whole system of things that I never knew existed. Now that I know they existed I feel like I was late in the game, but at the same time, now that I have the opportunity I don't care how late it is. I'm going to take advantage to the fullest. (Lydia, 2nd-Year Engineering Ph.D.)

Lydia chose to go to work with her dad as a gardener, the offer her brothers received, because she didn't want to cook or clean, but she was still expected to do the "girls tasks" when she came home.

One of the things my dad used to make me do was translate NOVA specials about the theories of the universe and how to make molten steel or something like that. It was interesting. I used to hate it because first of all, there were words I couldn't translate. He would get mad at me like, "Don't you go to school?" "Well yeah, but I'm in the third grade." I didn't know what that meant back then. (Lydia, 2nd-Year Engineering Ph.D.)

Lydia's mother was her source of encouragement to continue her education.

She shared:

I guess she was the only one, like my mom said, 'You know, you should do what you want. You should go to school no matter what. You should get your driver's license no matter what.' My dad didn't let me drive, but my mom made me get my license. (Lydia, 2nd-Year Engineering Ph.D.)

Her father also challenged her when she said she wanted to go to school. He wanted to have more help with gardening and she was a hard worker.

Why don't we just expand the business? The school system is the mafia. They're just trying to work against you. They're never going to let Mexicans go. We've been here forever and we haven't excelled for many reasons. One of them is because society doesn't want us to excel. "Pa que quieres ir a la escuela, they're going to work against you anyway." (Lydia, 2nd-Year Engineering Ph.D.)

Her upbringing informed much of what she saw as important to her development.

Many things influenced her interests in STEM. It was mostly about wanting to know more about science.

It's a mixture of things. I think being a gardener is one thing. My dad always told me, "Look at this little seed and it's going to grow." My dad can put seeds and then later he'll put water, and make trenches and all this stuff. Then you get some explosions going. You're like, "Okay, this is the process of how plants grow," and then NOVA. I think there was an Ebola special, like epidemics hitting the world. I thought, "Man, this is affecting the world." I think it's a combination of things that makes you want to go into science. (Lydia, 2nd-Year Engineering Ph.D.)

As one of three engineering participants, Lydia highlighted a unique disconnect from her education in truly understanding the career of an engineer. It was not until she started in research that she learned more about the field and career possibilities.

You take classes and learn stuff but then you have hands-on experience in the lab and you're like, "Shoot, I can do more things than I thought I was capable of." Sometimes, we have to fix the glove box or change the oil on the pumps, or know how the pumps work to provide vacuum inside the chambers. Then learning that, I think "Why did I always limit myself from learning these things?" (Lydia, 2nd-Year Engineering Ph.D.)

Her lack of understanding of what engineering was, or what an engineer does as a career, were also barriers for her in high school. She described a lack of understanding that could be incorporated into curriculum in earlier education. "I think a teacher in middle school, he said, 'Why don't you want to be an engineer?' I was like, 'I don't know anything about construction and I'm afraid of heights.' I thought engineering was like construction." She also reflected on the advice her high school guidance counselor gave her.

One of the advisors said, "You know, if you stay in these ELD classes you won't qualify to go to a four-year college so you need to get out of them because that's not going to count towards anything and you need to get certain requirements to a four-year college." Also, I didn't know how to apply to actual college because some of the applications require a letter of recommendation. I didn't even know anything of that and I barely got my ACT or SAT done and I never went through any prep classes or anything. I rented a book from the library and tried to learn like that. (Lydia, 2nd-Year Engineering Ph.D.)

Lydia was also unaware of research and what it meant to go to graduate school. As a first-generation college student, research opportunities help students form a deeper meaning of education and the possibility of going beyond an undergraduate education.

In the beginning, you don't really think that you're going to go past college. You just think, "I just want a good job, to get a car, and be okay with

myself, being able to take care of myself.” Then you realize that you can go further than that and you start learning things that you never thought you would learn before. I think I literally knew how a battery worked in college and now I’m doing research on how to modify them to make them better. (Lydia, 2nd-Year Engineering Ph.D.)

As she reflected on her cultural values and the importance of family, she struggled with her graduate school environment, particularly the expectations of a high-profile lab and program that demand productivity and results.

I don’t know if it’s because I’m Mexican. From my cultural background we tend to add a lot of personal things to our work or just to be, like I said, for us family is really important. I don’t think if I told them my mom’s sick they would take that as an excuse for not having data that month. That’s just one thing that you have to settle your mind. Like, “Okay, you’re working with different kinds of people, and they work a totally different way, and this is their goal.” They’re about results and cranking out those results and having the data by that month so it’s totally different. I guess they care about your development but not really. They just really care about the work and just forget about you. (Lydia, 2nd-Year Engineering Ph.D.)

In engineering, Lydia has met only a few mentors in her educational career. For her, having a visible example of who she could become, and the support from her family, makes it believable and gives her more confidence that she can complete her Ph.D.

Actually, there’s ... that time in [undergraduate research program] that I went to a symposium. There was a speaker. She was one of the material science Latinas and she said there’s only five or six in material science and engineering that are professors, have full time professorships. I was like, “Dude, I think I’ve met two of the six, with her included.” I thought, “Whoa, that’s quite tough,” but at the same time they’re an inspiration. “Okay, they did it. I should be able to.” (Lydia, 2nd-Year Engineering Ph.D.)

Reflecting on her purpose in education, she discussed her curiosity in wanting to understand things better and then wanting to make an impact in the world. Her excitement at discovering the world around her is evident in her stream of consciousness.

Okay, so there's basic atoms and elements and then you realize the energy that it takes to hold them. Then you realize what they can make and then you just go through this hierarchy of atoms to a molecule to molecular structure to some sort of system and some sort of material and that material can exhibit all these other properties that are governed by chemistry and physics and then you're all like, "Wow, this comes from a very simple thing but it can be so complex in its understanding." I don't think I know anything, but every time I keep uncovering these unknowns of the material I get so surprised because it has a big effect in its overall performance whether it's its strength, whether it's its electronic properties, whether it's its applications for batteries or fuel cells or even for bio sensing they're starting to use. I also want to do something that's not going to be deadly to the environment and be good even to help my community or even the world. There's a lot of need so I also want to be a scientist not only to learn, but to see if what I learn can help somebody. (Lydia, 2nd-Year Engineering Ph.D.)

Olga, 2nd-Year Biology Ph.D.

The daughter of immigrants, Olga acknowledged that she was privileged to have a private education growing up through high school and her parents could afford things her peers did not have access to.

My mom was one of 16 and came from Mexico when she was four. She grew up in Chicago. My mom received her GED and my father got into landscape engineering with the machines and stuff. I don't know my real father but the father I grew up with, who I love intensely and know my life would be completely different had he not been in my life. He was very conservative. Came over when he was 22, moved to Chicago, worked as a landscaper. I did not see my parents much because my dad would work until the evening. My mother would come home from work and expect the house to be clean. Typical Mexican. She would make dinner and then go out to bingo or to the bar. (Olga, 2nd-Year Biology)

Although she had three siblings, she said, "I kinda grew up alone because they were out of the picture." Her two sisters and brother followed different paths and were not interested in school.

My brother went to live with his father and dropped out of school when he was in eighth grade. Did not go to high school. My younger sister was pregnant by 14. My other sister was on drugs by the age of 16. I spent a lot

of time alone and had to... I found a lot of rescue in things that my other Mexican girlfriends at that age didn't like. They liked dolls and playing house. I was super into science and computers at a very young age. Because my parents could afford those types of toys, I would get a microscope. I would get a computer. Actually, I think I was one of the first to get a computer, from anyone I knew, in like 1987, probably. It was still MS-DOS, coding, green letters. Old school. That was impressionable because that pushed my thinking very different. (Olga, 2nd-Year Biology)

As a single mother, and the only parent in the group of participants, Olga has overcome very different challenges compared to other participants. She reflected on the development of her independence and the use of her “aggressive personality” to make it through education and to overcome challenges in STEM. As a Muslim who wore a hijab, Olga also discussed the complicated intersection of her multiple identities in academia, both at her undergraduate institution and in graduate school. Her stories and examples of gender and cultural norms reflect the complex social structures in academia that encourage, and often force, students to assimilate from their non-White cultures.

A school counselor helped her develop and process her identity with a different type of future for herself. She did not connect with other people given her interests in education – computers and science.

“It [education] was never an empowerment. I was always the black sheep.” Her counselor told her “It's not that you don't belong in your family, or that you don't belong in this high school. It's that you belong somewhere that you haven't found yet. I firmly believe that you will find that ground.” (Olga, 2nd-Year Biology)

She later found her place and sense of belonging in college when she was exposed to new topics and research areas.

It was the first time in my life I felt intellectually fulfilled. I was very sad that I had not had that opportunity before or be exposed to that before. Everything I was told was weird about me, was beautiful in research. After I found my place in research, it was a strange ride throughout my undergrad because I traveled a lot. I traveled to San Antonio, Seattle, New York... Kenya, different parts of California, all to do research. Everywhere I went, I

was usually the only, American Mexican girl there. You had people from Brazil, Guatemala, maybe some who came from another country but I was usually one of a very few first generation Mexican. It was strange because not only was it male dominated, but then it's White, Asian, and then you know, then there's you. (Olga, 2nd-Year Biology)

Despite the sense of belonging she found in research, Olga also struggled with the Latin@ community because of her different religious beliefs and the social concerns of safety for Muslims in the US.

Even within my own people there is another subordination or discrimination... because I used to wear a hijab. I just took it off last year because it became difficult with the climate we have in our country. (Olga, 2nd-Year Biology)

She also had the most experiences in undergraduate research programs than other participants. As a non-traditional student, she was also challenged with having summer research opportunities and once again feeling out of place.

I got into [university] for the summer and I had decided to send my girls to Morocco. I had already decided to split up with my husband. I was at [university] for the entire summer. They fed me. They housed me. They provided everything. I was paid through [company name], the biotech company. It was cutthroat. So, I'm 37, and everyone in the program, except for maybe three or four of them, were under 21. Way out of my age range. They had a difficult time relating to me. Some of them, the ones who could relate were the ones who came from the Midwest or came from homes that were divorced... you could tell they had life experiences where they were forced to not live in a perfect little envelope. (Olga, 2nd-Year Biology)

She participated in summer research experiences at highly selective research institutions in California, an experience most institutions encourage for their undergraduate STEM students to pursue. Her PI was ending the summer with meetings to discuss performance and areas of growth with students and made a problematic statement during the conversation.

She sat me down and said, "Do you really want to do this at your age? I mean, you're a single mom, you have two kids. You're very social and you get along with everybody. I think you should go into something in the humanities." This was from a woman, my PI. I told her, "As a Latina I am

used to hearing that I can't do something or that I shouldn't do something. So, this is not the first time I have heard it, probably won't be the last time, and it will not be the last time I don't listen to this type of advice." And I just left her office. Never looked back. (Olga, 2nd-Year Biology Ph.D.)

Reflecting on her experiences of gender bias, her unique perspective challenges what most believe is to be an experience with men in academic.

"The most traumatic experiences as a woman, have been by another woman. You would think the opposite, right? It is a reflection of where we are as a gender. They are too close to the experience. There are not enough women in place to empower us to promote each other in a positive way." (Olga, 2nd-Year Biology)

She made a reference to study of war veterans and their sympathy for other veterans at five and twenty years after leaving the service. The level of compassion, she stated, was lower for someone more recently out of service because they have not been far enough removed from the experience. She connected this to women in academia and the lack of positive tools to support each other. She then shared a story about a postdoc in her current lab who was unsupportive. I thought, "You are that woman that I hope I never become." Her manners are ill. She was very condescending." (Olga, 2nd-Year Biology Ph.D.)

Olga also provided some advice for how to help students develop her sense of assertiveness and how to navigate complicated situations. She cautioned that everyone is different and "not everyone is like me and not anyone can be like me." She further elaborated on separating the emotional from the rational when having to address issues in academia. She elaborated,

I think that first someone has to understand a situation and dissect it into two different vessels. What part of this situation was an emotional part, and what part of this situation has to do with my intellectual well-being or contributions? For a student to communicate, they have to be clear about the difference. For the most part, minorities are not taught. Once they identify those things within themselves, and learn how to do that... When you have a situation that you are uncomfortable in, first the person has to resolve the intellectual merit of the situation. If that resolution still leaves

them uneasy, then they have to address the emotional part of the situation. If you come to a PI, who is by nature more rational, intellectual, Black and White, will avoid the emotional, then it will not be fruitful to come from that place first. Teaching someone how to take a situation and break it apart and say what part of this can be addressed with a positive outcome, as well, equally important is to know what outcomes you want out of the conversation. Hold them close to you, not demand them, but keep them in mind to know, “Am I leaving this conversation comfortably?” There must be a strong awareness and non-submission of the emotional part in that conversation. (Olga, 2nd-Year Biology Ph.D.)

The challenge for many women in STEM, particularly women of color, is a lack of a supportive environment. Although different than what the other participants looked for, Olga has connected with professors and found her support system, a network of helpful people at her graduate institution that understand her multiple roles as a mother and student researcher. Olga shared:

My experience so far at [graduate institution] has been, other than the current situation I am in, has been phenomenal. I am surrounded by women who have been inducted to PNAS or really high academies. Have published in high impact journals, they hold powerful positions within departments. They have been super great and accepting of my diversity. It is a very welcoming environment. My PI is very understanding and the fact that I have children I need to pick up, so I can't run long experiments on weekdays. I have to come on the weekend. They are sensitive to that. I think I would have not have had that if I had gone to say, Berkeley. When we say supporting diversity, it is so much more than supporting a color or a gender. (Olga, 2nd-Year Biology Ph.D.)

Annie, 4th-Year Biology Ph.D.

Annie's parents were migrant farm workers in the Central Valley of California. She grew up in Fresno, CA but moved to Long Beach, CA when she was young. While her parents were working class, Annie reflected on her privilege to be raised by parents who valued education and did whatever they could to ensure she had a good education. When her older sister was in middle school, she

was put in an ESL class and her mother decided to pull her out of that school because she was angry. She shared:

My parents drove us across town to attend school in a wealthy neighborhood. Every year the school would take us to the aquarium and on field trips. They said to get the best education we could and to do our best at whatever we did. (Annie, 4th-Year Biology Ph.D.)

She was a first-generation college student and did not learn much from parents because they did not go to college. Her mother has an associate's degree and her father has a HS diploma. Her first high school guidance counselor was supportive, but when she was reassigned to another, who was not as supportive, she was encouraged to "knock down" some schools that were more competitive. Despite having a sister who went through the process of applying to college, her sister moved away so she did not have the resource available. Annie went to bookstores on her own to read about college and how to apply.

I didn't go through the guidance counselors or teachers. I ended up taking out some of the more competitive colleges I wanted to attend because of the counselor. I just went to the bookstores and read for myself. I thought I wanted to be a doctor because my mom worked with them. In high school, I was good at science and math so I thought that meant I should be interested in being a doctor. (Annie, 4th-Year Biology Ph.D.)

Her dad wanted her to stay close to home when she was considering going to college. Her mom said, "Go anywhere you want to go because that would be better for you." Annie decided to attend a private university in another state because it was known for having a great medical program. When she struggled in classes and was not connecting to the university or faculty, a counselor at the undergraduate institution encouraged her to take a year off and study abroad, but to take classes at another US university. "I took general chemistry and felt overwhelmed. I got a C in the class. I was doing well in Math and Spanish. I just didn't connect with any of my professors." She got into a UC campus and left for

the summer. At the UC campus, she attended a transfer program meeting and attended a lecture by a professor in marine biology. “I got into a lab and the PI opened doors. I wouldn’t be where I am now.” (Annie, 4th-Year Biology Ph.D.)

When asked why she has not experienced as much adversity, she made the connection to the support she received from mentors, advisors, and professors who made a personal connection with her throughout her career.

The professors at my second institution cared about the whole student. I think they were more aware of what we were going through. I didn’t know what I was doing and they supported me. My PI also helped me avoid bad labs or toxic environments so I didn’t experience discrimination in undergrad. (Annie, 4th-Year Biology Ph.D.)

Her PI helped her construct her story when applying for fellowships, such as the NSF Graduate Research Fellowship Program (GRFP), a competitive fellowship program that grants funding to graduate students in master’s or Ph.D. programs in STEM disciplines. She elaborated:

She helped me by telling me my education was atypical of students. My family was migrant farmworkers, low SES, my family couldn’t help me financially... They continued to support me and looked over my personal statement, my application, and also I was maybe blind to issues in undergrad. My mentors helped me avoid toxic environments. I was also in a community of other minority students and the campus was more aware. My current PI is supportive of women in STEM. I see them [issues] now in graduate school. (Annie, 4th-Year Biology Ph.D.)

Her motivation is to support other students in their pursuit of a college education. “Mentoring is important. I had great mentors in undergrad. I want to be that for other students. That’s why I want to be a professor.” She is now involved in her graduate school with involvement in a diversity initiative to support graduate students, holds a leadership position in her student council, hosts journal clubs to discuss with other students, participates in town hall meetings to address issues, and serves as a mentor to undergraduate students as a GSR for summer

research programs. “I want to do my best. My PI went out of her way to support me. I know I can do this. I want to be a professor and I will.” (Annie, 4th-Year Biology Ph.D.)

Maria, 3rd-Year Engineering Ph.D.

Born in Tijuana, Maria started her education in Mexico and shared a variety of challenges in her education, such as switching schools, moving from private to public education, and having barriers due to language differences. Her interest in STEM developed from shared interests with her father and a propensity for understanding how things work. Maria’s parents went to college in Mexico, but were not able to help her navigate the education system in the US. As a first-generation college student in the US, Maria’s story highlights the challenges Latin@ women encounter throughout education despite performing well academically. She reflected on her early education,

In the fourth grade, we moved and I went to a new school. I went to two private schools in Mexico. One school focused on having fun while learning. We took a lot of field trips and had celebrations. My new school, was more focused on education and that is when I started to notice I was I was in the top tier, one of the ‘smarter ones’ in school. (Maria, 3rd-Year Engineering Ph.D.)

She also shared challenges of moving to the US. “With a big family, there are five kids, my dad moved to the US to get a better job. My mom decided she wanted us to move to be closer.” The family settled into a northern California agricultural town that was near a major city and had a four-year university in the area. Although being close to the campus, she said she had never been there. “I had never gone to [university]. It was right there. I guess it’s because my parents didn’t want me in sports like other students. I know they went there for that.” Part of her challenges were moving to a new school and then adapting to new environments.

When we moved to the US, I was going to a public school for junior high. A school counselor told my mom that she should move me to a private school, so my mom took me to a private Catholic school in the area. Later I went to a public high school. I didn't experience any discrimination in high school but it was a different environment. (Maria, 3rd-Year Engineering Ph.D.)

Maria also had encouragement to take more advanced classes compared to her peers at an early age. She also mentions that she felt more challenged in her other non-STEM courses. Maria shared:

I started taking advanced math classes. Actually, it was in junior high. I took algebra in junior high so I started with geometry in high school. I enjoyed chemistry and physics. I was not a fan of biology. It was still harder in other classes like history and writing. I didn't do well in those. (Maria, 3rd-Year Engineering Ph.D.)

There were multiple sources of inspiration when she was asked about her initial interests in STEM. Her father shared stories with her about her interest in engineering at a young age.

My dad told me that when I started riding a bike I had training wheels. My sister was ready to get hers off so my dad was working on it. I said I wanted my training wheels off too. My dad said no. He said that I went back later and found the wrench myself and took them off. I wasn't ready for the training wheels to come off, but I did it myself. He also told me that... We had VHS tapes back in the day. You know how the VCRs needed to be cleaned to work right? Well I remember watching my dad clean it and so I learned how. He said that I would disassemble them to clean it. I remember doing it just for fun to see the improvement in the quality. (Maria, 3rd-Year Engineering Ph.D.)

She also described how the shows she watched intrigued her and developed the interest in engineering.

I got interested in STEM by watching the show "How's It Made" because I was interested in the machines and how they construct things. When applying to college, I wanted to go into engineering. I didn't understand what engineers do. It's a big field. I am still learning. I talked to my dad about it to help decide. I just knew I liked thinking about how things worked. (Maria, 3rd-Year Engineering Ph.D.)

Maria shared that her strong interest in the sciences when asked if having family members in engineering influenced her decision. It did not seem her father and uncle's careers had an influence on her decision to go to college but it did help with deciding a major.

Even if I was not going to be an engineer, I would have still gone to college. My family would have supported me. I saw my dad as a provider for the family. That's why I thought about being an engineer. I also thought about being a math teacher. I could help people. I think my path would have still gone to the sciences. My uncle was also an architect so I had to figure out if I wanted to be a civil engineer like my dad or like my uncle. (Maria, 3rd-Year Engineering Ph.D.)

One of the unique experiences Maria shared was her participation in an early start program during the summer prior to the start of her first academic year in college. This program supported students becoming acclimated to the university to make social connections and take a few classes to acclimate to the academic environment.

I was admitted to this program at my undergrad. The [name] program through the academic success center was to get a group of students together. During the month, I was also in housing on campus and we were grouped by major. So, I was with other engineers in the program. I met people and quickly connected to the other students. I didn't feel alone. It was an EOP program so we were similar. You know, mostly minorities, so we were similar. We got to know each other and grew close pretty quickly. The advisors from the engineering department were also connected so I got to know them before school. I would then meet with them over the next four years. That relationship was very helpful because they knew... I felt like there was someone there I could connect with and find support. (Maria, 3rd-Year Engineering Ph.D.)

Maria's motivation to continue her education stems from a passion to keep working hard. The idea of quitting also came up when she reflected on her goals to get a Ph.D. She reflected,

I want to finish. I am not at the point yet where I am ready to stop. I want to do this for my family. I want to be there but I also want to finish this. I try

to remember why I am doing it. It gets hard. I have thought about quitting. Especially with the prelims. I had to think, “Do I want to follow this path.” It [quitting] comes up at least once a week. I want to meet my family’s expectations. I want to finish. (Maria, 3rd-Year Engineering Ph.D.)

Griselle, 3rd-Year Engineering Ph.D.

The oldest of two siblings, Griselle was expected to do well in school. Her mother, a single parent, only went up to sixth grade in her own education. Her mother supported her to continue her education but did not pressure her to go to college. “Do what you want to do. I will support you.” She was praised by teachers and supported to continue her education. The challenge was being told by multiple guidance counselors that she was not required to take math. Griselle also encountered academic challenges from the different messages she was receiving from teachers compared to the advisors. “My math teachers supported me to continue taking classes. They also supported me to go to college. Thankfully I kept going with the advanced classes in high school.” As the first in her family to think about going to college, she remembers having no idea what to do and what to choose for a major.

I didn’t know what STEM was when I was planning to enroll in college. There were three colleges at [undergraduate institution]. I didn’t know what to do. There were too many majors in the College of Letters and Science. My next option was to look at the College of Engineering. There were only about five majors so it was much easier. Chemical engineering. Nah, I don’t like chemistry that much. Electrical. No I don’t want to deal with electricity. That is literally how it happened. Oh, mechanical. That sounds cool. That is how I chose my major. (Griselle, 3rd-Year Engineering Ph.D.)

Griselle also addressed the school programs that helped her figure out the college system and how to find resources.

I got involved in EAOP because I went to underserved schools. That was how I learned about college. My advisor also told me she would buy me a [university] sweater if I graduated in the major. She told me that a lot of Latinos drop out of the major and don’t graduate in engineering. (Griselle, 3rd-Year Engineering Ph.D.)

As a first-generation college student, combined with her “underserved” school background, she quickly realized she was not prepared for the major. “I didn’t have the skills. I was not ready for it.” (Griselle, 3rd-Year Engineering Ph.D.) Griselle’s story also demonstrated the need for institutions to continue support for students with other non-academic resources. When asked about how she would change her undergraduate education,

I would have focused on my own mental health. It would be different. I didn’t graduate with a 3.0 because I had other issues I was dealing with... Anxiety and depression. I didn’t know what those were. I thought the struggle was normal. (Griselle, 3rd-Year Engineering Ph.D.)

After receiving her bachelor’s degree, she left academia for a job in industry working for 3 years. When she experienced more sexism and lack of support in her industry job, she reconnected with her professors from college who guided her to go back to school at her undergraduate institution.

They were really helpful. “If you want to go back to school, we will be here. We think you can do it.” So I decided to go back to get my Masters. Then after going back to get my Masters, my professors encourage me to get a Ph.D. It just developed. (Griselle, 3rd-Year Engineering Ph.D.)

When reflecting on her current PI, she is grateful for the chance to focus more on research.

I was lucky to be funded as a master’s student. My PI is great. I actually failed one of her classes in my master’s program. I think it’s a lot for graduate students to do research, TA, and take classes. I think we can handle two. Three is too much. At the end of the semester I asked her if I could work with her. I started just doing research with her and then a few months later she offered me to be funded. Even as a master’s student. Then I could focus on class and doing research. (Griselle, 3rd-Year Engineering Ph.D.)

Griselle also discussed the need for inclusive spaces for students of color and for women. As a woman of color, she shared that a gap exists between what students expect and what professors provide.

It starts from the top. They [professors] can create the environment. There should be training on equity with professors. My PI is a woman and I feel like I can go to her if I need anything. If I am having a problem with something she will listen. (Griselle, 3rd-Year Engineering Ph.D.)

The idea of being a mentor and becoming the support she received from her professors, Griselle stated that the importance of her role in academia feeds her ambition. She reflected on the help she has received from her mentors and wanting to give back.

My ambition is to be a professor. I would love to be here but I think anywhere in the UC system. I want to help others. I want to be a mentor and a leader. I want to help others like my professors helped me. I am involved in the community and I want to continue. Maybe I could do my postdoc somewhere else and then come back. Either way I want to be a professor. (Griselle, 3rd-Year Engineering Ph.D.)

The connections Griselle has made at her university have also contributed to her development and continued motivation in graduate school. When asked about her involvement on campus, Griselle listed the many organizations she is connected to and how it provided necessary support.

I am one of the founding members of SACNAS, connected to the Society for Hispanics Professional Engineers (SHPE) on campus, another group on campus that is mostly for STEM women of color, the Office of Educational Partnerships to do outreach in the community and work with the MESA Program, and then I also get support from the graduate division. There is also the Chicano Studies department and the chair has also provided support to me. (Griselle, 3rd-Year Engineering Ph.D.)

When asked about continuing through the end of her Ph.D., Griselle shared that it has not been easy up to this point in her education.

I think about quitting all the time. It's hard. I don't know if I'm capable of doing this. I want to be a professor to be there for student who may not have seen minority professors. I want to be that for other students. (Griselle, 3rd-Year Engineering Ph.D.)

Themes

Major themes were discovered through the participants' testimonios that reflect similar struggles around education, family, culture, diversity, as well as supportive elements along their path that kept them motivated to continue to graduate school. The four main themes are categorized with subthemes to better articulate the nuanced experiences of the participants. A few select quotes from participants highlight their perspectives in relation to the four overall themes: education challenges and finding my own path, describing the adversity they experienced in education; importance of family and the cultural significance of encouraging independence in the greater picture of community and family; gender differences, including the intersection of multiple identities with their cultural backgrounds; and becoming what I needed, revealing the participant's support systems to get where they are and the passion they find in being that support for others.

Education Challenges and Finding My Own Path

With the focus of this research study on the educational paths of Latin@ women, the first theme was about the challenges the participants experienced which emphasize the issues of access, diversity and representation, as well as highlighting positive experiences with undergraduate research programs and finding mentors in STEM. A few participants stated they did not experience many challenges in earlier education; however, after reflecting remembered instances they experienced second-hand as witnesses to racial discrimination and gender bias. Overall, the challenges and encouragements they received ultimately helped them find their own path in education and wanting to pursue a Ph.D.

Access and equity. The participants shared that community college was not equitable to a 4-year university in terms of preparation for the sciences and a

lack of resources in earlier education as well as higher education. Many Latin@ students who start out their postsecondary education at a community college are not successful at transferring to a 4-year university despite their aspirations to transfer (Yosso & Solorzano, 2006). Four of the 10 participants attended community college and shared the challenges they experienced, two identified the inequitable resources and inadequate preparation they feel they received compared to Ph.D. students who went to a 4-year university the entirety of their undergraduate career, and one shared that the transition was easier to move away from her family by attending a local community college first before leaving for a 4-year university. As a transfer student, Gloria felt behind compared to other students and recognized the difference in access.

The lab in community college is way different than a university. I felt jealous in a way because all of those other students that came here went to a regular university. They knew a lot more than I did, like more research. I always felt behind, because I was one of the oldest in my classes, and I felt like I was way behind. I believe the university is more established. Even [name of undergraduate institution] was still developing, the curriculum was being established, the courses I took in community college were helpful, but there weren't a lot that were about techniques that could be applicable. (Gloria, 3rd-Year Biology)

Other inequities exist in education such as resources and funding. One participant described her attendance at an elementary school science fair, where she saw students producing more than she experienced in some of her labs at community college. Her story highlighted the inequities in education given access to more resources and opportunities. Ellen shared the following about her experience:

We should do outreach to more students, like ones that want to participate in a science fair at school. When I go to science fairs, it's pretty obvious that there were projects that had an advantage because their parents had certain privileges... having parents that had an education, or had access to cool science stuff. This project involved HPLC [High-performance liquid

chromatography], and you need a fancy machine to do that. Come on, how could other students compete? If we start from a younger age with all students, that would change things. (Ellen 2nd-Year Biology)

Griselle also shared some of her challenges:

As a minority, you have to fight harder to make it in education. I didn't have the social capital to understand how to interact with professors, how to network with admin. It comes from being lower income. Being lower income and Mexican has made me more resourceful. We had to be very methodical about how we were going to get to the store. We didn't have a car. When we didn't have money, it requires you to find other minorities to connect. I am still navigating the system. (Griselle, 2nd-Year Engineering Ph.D.)

The funding found in private schools does not guarantee openness to explore STEM or any career requiring a college education. Beyond resources, one participant also shared that she was not encouraged to pursue the sciences growing up. Her private elementary and middle school attendance, although it provided access to funding for trips or supplies for the classroom, still lacked the development necessary for students of color to think about the range of careers. "I was never told I could be a doctor, lawyer, scientist... I never got those messages. Then you had the other kids whose parents were in those careers and they saw that as a possibility." (Olga, 2nd-Year Biology). Another participant also shared a similar concern but about more minority students, particularly Latin@ students, being pushed to other majors.

Right now there are a lot more men in the sciences, and with Latinos, when I was in community college they were mostly in psychology, Chicano studies, a lot in criminal justice, but there weren't a lot in the sciences. I always wondered why but maybe they felt like they couldn't go into the sciences. (Gloria, 2nd-Year Biology Ph.D.)

Other students were fortunate to have a teacher or academic advisor who encouraged them to think differently about their future or consider other options.

Often, this pushes a student in a different direction. Lydia reflected on a teacher and assignment:

I think I had a few teachers that really motivated me to go to school pursue. I think one of them was a middle school teacher. Regardless of what the situation was, she really motivated you to want to pursue a higher education. She would make you do projects. Pick a scientist. If you want to be a scientist pick a scientist and do a poster about it. Pick a disease and do a poster about it. She was an English teacher so she would go out of her way to try to do these little activities to try to make you learn more of what's out there. (Lydia, 2nd-Year Engineering Ph.D.).

Annie reflected on one of her counselors:

When I was at my first university, I kept thinking, "I don't know if I am capable. Maybe I am not going to become a doctor." Thankfully that counselor gave me this other idea to go "abroad" because I am happy about what I am studying now. (Annie, 4th-Year Biology, Ph.D.)

Race and diversity, or the lack thereof. The participants highlighted issues of race in their experience, either from a lack of diversity in their secondary schooling and in higher education. The participants also shared that they felt isolated as one of the only students of a minority background in courses or in graduate school. "I definitely feel the imposter syndrome in graduate school. There were only eight or nine women. Of those, there were two Latinas." (Griselle, 2nd-Year Engineering Ph.D.) Another participant shared an example of when she experienced racism indirectly when someone made a comment to another graduate student. Annie shared,

Another graduate student made a comment that he didn't get into MIT because he wasn't a minority. "What about me? Does the think I got in because I am a minority? (Annie, 4th-Year Biology Ph.D.)

For some of the participants, racial discrimination was more of a challenge when they were younger. The socioeconomic connection to race was striking for one participant.

This one time me and my dad we went on a trip and he bought me some Converse shoes but they were fake. I got to school, I think this was in the sixth grade. People were like laughing at me. I mean they were comfortable, but because they were clearly not the real brand. This girl, she was a Korean girl, she told me, “Go back to Mexico.” I didn’t know what that meant. I just knew that that wasn’t normal. (Gloria, 2nd-Year Biology Ph.D.)

Another student reflected on her undergraduate institution and the lack of diversity she noticed in the sciences compared to other disciplines. This was Nitza’s experience,

I think that I’m used to not seeing Latina women in STEM. At the beginning, it kind of bothered me. I thought, there’s no Latinos here. Even just Latinos in general. I was used to not seeing many in my classes, and not just in lab. I would see them when I went to my Chicano studies classes. I needed a balance. “I need to talk to other people who look like me too,” and that is one of the reasons I minored in Chicano Studies. Then I knew that when I would do research, and I didn’t see many Latinos, then that was ok. (Nitza, 5th-Year Biology Ph.D.).

The same idea about the lack of minority students in STEM was shared by another participant.

Biology intro courses start in these very large classrooms. 300 or 500 people per class. It’s noticeable. I could tell that I was one of the only minorities. You could pick out the minorities in the room, even though people might not see me as a minority on the outside. It’s easy in a school where you have large classroom to look around and tell that it’s not very diverse. (Adriana, 7th-Year Biology Ph.D.)

When asked about mentors, the topic of faculty of color and the limited number in certain disciplines was raised.

At [undergraduate institution] there were only a few people of color and very few students. In undergrad, I felt more of the racism. In the Engineering department, there are no people of color in the faculty. There were some first gens, but no Blacks or Latinos. There need to be more people of color hires. (Griselle, 2nd-Year Engineering Ph.D.)

As a result of systemic racism, the limited faculty of color connected to a different aspect of challenge for the participants. Another aspect of the challenges

the participants faced was stereotype threat, or the fear of failing and fulfilling a negative group stereotype (Steele & Aronson, 1995). This was an interesting exploration for the participants as they reflected on the qualifying exams in their programs. One of the students still early in her program said she has been incredibly nervous and our follow-up conversation helped her overcome some of her anxiety.

You think about, “Can I do this? Is this possible?” I think about what if I don’t pass. How will people see me? Are people going to think I’m dumb? I think some people see me as weak. Maybe I can’t do this. (Ellen, 2nd-Year Biology Ph.D.)

She also shared that it was different for her peers who were not a minority.

I saw a post in a Facebook group with other grad students and this White guy asked why people were stressing about quals. He asked if people wanted to go on a trip over the weekend. It just didn’t make sense until you told me about stereotype threat. I was nervous about failing and this guy for whatever reason didn’t feel the same pressure. (Ellen, 2nd-Year Biology Ph.D.)

Another student shared her ideas around success and her ability to finish.

Language difference. Bilingual students have an additional challenge, something raised by many of the participants, having to navigate education as well as potential discrimination. The language difference for students at younger ages can create issues of discrimination, as one participant shares. She was made fun of in class when she was forced to read aloud. “Yeah, especially because they’ve [other kids] read quite a lot books in English. They made me read, I think it was ‘Pride and Prejudice’ and it had a Colonel, but it’s actually pronounced like kernel, so kernal is spelled C-O-L-O-N-E-L” (Lydia, 2nd-Year Engineering Ph.D.). This participant also shared that the language barrier can cause problems even in graduate school. Learning a new language or having complications with others can hinder their ability later in education when they encounter other students with

more complex vocabularies. The following are a few examples of the challenges they faced in education due to language differences. The first was shared by

Lydia:

In science some people like to [have] a really cool vocabulary, for example, there's a distinction between absorption and adsorption, so A-B versus A-D. So you got to know those meanings, but for me it's like 'this just looks like the same.' (Lydia, 2nd-Year Engineering Ph.D.)

Annie shared how did not know she was different:

I always fit in. I didn't realize I was different until I was in second grade and my teacher was Puerto Rican. My teacher asked me if I spoke Spanish at home. I realized that yes, I do speak Spanish at home but this was not the same for other kids. I didn't realize it but when my parents would speak to me in Spanish, I would reply in English. (Annie, 4th-Year Biology Ph.D.)

Maria reflected on the difference between Mexico and the U.S.:

I went to school in Mexico where everything was in Spanish. When I moved to the US, everything was in English. I understood everything but it was different. I struggled. Except in Math and Science because it's the same. That's where I was good. (Maria, 3rd-Year Engineering Ph.D.)

The language difference was exemplified in different contexts, and for some, also continues to be a problem in graduate school. For one of the participants, it was about her research poster and the professor stating, "This sentence. I don't fully understand what you are trying to say. I don't know if it's a language barrier thing or not, but it sounds like google translator to me" (Ellen, 2nd-Year Biology Ph.D.). This was similar for Maria as she reflected on her own need for extra time. "As you get deeper into research, I have to think about it in Spanish first. I learned math and science in Spanish. Sometimes I say things in Spanish and people ask what it means. It just comes out sometimes." (Maria, 3rd-Year Engineering Ph.D.) Another participant shared that she experienced issues with a language difference with her TAs. Serena shared,

I had a hard time communicating with my professors and my TAs. In community college, I had tutoring outside of class. It was one-on-one and I

wanted my tutor to help with questions I had. There were times where TAs, they didn't know what I was asking them, and they didn't answer my question. I had to overcome my fear of, "Oh, I'm not able to word my question in a proper way." I would ask my tutors to help. (Serena, 2nd-Year Biology)

With encouraging faculty mentors, graduate students can succeed despite language differences if they are given reassurance and the helpful resources. A unique experience shared by one of the participants challenges the idea that a language difference automatically creates a barrier to an education. Ellen has a mentor who saw her language difference as an area of growth, not as a deficit.

When I first joined the lab, I was like, one of my biggest weaknesses is that English is not my first language and I can't write. My PI is from Minnesota and he is the most amazing person ever. He is super into diversity and super supportive of me. He looked at me and said, "Well, we will work on it and you'll graduate being able to write." (Ellen, 2nd-Year Biology Ph.D.)

Undergraduate research and early exposure to careers. One of the inequities raised was a lack of awareness of potential careers. From not understanding what someone does in a STEM field, to not seeing themselves in potential roles. An experience shared by all the participants was in undergraduate research, either through a program or volunteering with a professor. These experiences provided necessary information and crucial support for students that for many, completely changed their paths. Annie reflected on her PI:

I was exposed to research and learned about scientists. My PI also offered me co-authorship on a research publication. She took me to a conference to present. Then at the conference I learned what I could do with a Ph.D. The SACNAS National Conference was integral to my decision between a Master's program or Ph.D. seeing other people and peers. I realized maybe I wanted to be a professor. (Annie, 4th-Year Biology Ph.D.)

Adriana gave her advice and suggested how she helps undergraduate students:

Having an active role in lab and learning more hands-on skills, where you're not just a dishwasher, and you're not just shadowing the graduate students... is so important because you don't really know... What does doing science mean? What does having your own project mean? Even

though MARC tried to facilitate that, as much as they could get us into labs, if they could screen the labs better or at least make sure that the student has a project. A real project. The undergrads I work with shadow me but I have them doing at least one technique. They can walk away from the lab and say, “I know how to do this!” and it’s not just washing dishes or following me around the lab. (Adriana, 7th-Year Biology Ph.D.)

Undergraduate research programs also provide a stipend to cover expenses to allow students to devote more effort and time to their research projects, as well as professional development opportunities in their new careers.

It allowed me to focus more time on research. I worked a part-time job as an alumni caller to get donations from previous students. With the fellowship, I was not required to work part-time to make ends meet. I was able to work more and really learn about the research. (Annie, 4th-Year Biology Ph.D.)

Another participant shared that through research she realized not only is she capable, but she was interested in pursuing research in the future.

I always thought, “No, I could never do that.” I think little by little you’ll start finding out more about these subjects or more about these careers and you’re like, “Oh, that’s what they are.” You start realizing, yeah, I’m capable of doing that. I think once you get more hands-on experience through research or bringing your own ideas to the table you start realizing, “Okay, I think I’m more capable than what I gave myself credit for,” and that’s when you think it’s not as bad as you thought and “I do want to do this.” (Lydia, 2nd-Year Engineering Ph.D.)

Graduate school experiences. The participants all shared being happy with their experiences so far in graduate school. A common thread among their experiences, and the reason for their satisfaction, has been the help guidance of a mentor. The support they receive in graduate school is crucial to their continued motivation.

In all seriousness, it’s gone through my mind to give up but every time something happens, something good happens to balance it out. When I told my PI that I got an internship, he was excited and told me to do whatever is best for my future. To not think about him or the lab. I think it’s really rare to get someone that looks out for your benefit and not theirs. Unfortunately

I have also encountered people like that and so I got really lucky. (Ellen 2nd-Year Biology Ph.D.)

Another student shared that her mentor in college helped put her on a good path in graduate school, but her other positive involvement at the institution helped her feel a sense of belonging.

The leadership I have had as Co-Chair for [organization] taught me to communicate, to use my voice, and the interactions with administrators on campus have been great. My development as a future professor... it hasn't just been in the lab. (Annie, 5th-Year Biology Ph.D.)

A different experience was about the lack of understanding from friends and family about the daily activities and expectations of graduate students.

People don't understand. My friends say I am exaggerating about my exam. I tell them, "No, people have told me it is the hardest thing that I am gonna do in my life." You go through a lot of emotional stuff and people don't understand what a Ph.D. entails and the hard work that is required. (Ellen, 2nd-Year Biology Ph.D.)

Other participants shared the challenge of moving away from family in graduate school or finding ways to focus on their well-being. This is a challenge for some students particularly if they did not move away for their undergraduate education. Maria shared her challenges:

When I went away for graduate school, it was hard at first. I grew a lot the summer before living in town. I was far away from my family. I know it was time for me to do things for myself. I love my family but I wasn't developing being so close. My PI has a big lab so there were more people to connect with. It was like the summer program before college. I met a lot of people when I got here. I went into grad school with a group. I wasn't alone. My PI is understanding and the other students are understanding. (Maria, 3rd-Year Engineering Ph.D.)

Griselle also shared her struggle:

It was important for me to find a supportive mentor and to connect with resources on campus. Since I had a hard time in undergrad, I make sure to be more mindful of my mental health now in grad school. I am just more aware of when I need to take time off and when I am too stressed or just need some time. (Griselle, 2nd-Year Engineering Ph.D.)

Lastly, Gloria also added:

There needs to be a workshop on how to search for help. I think navigating the system is hard. Also time management. Knowing how to balance everything as a grad student. Maybe it is just coming from my background, perhaps being Hispanic, but I think a lot of people struggle with asking for help. The things that can help them overcome the challenges, what resources they can have, they need the help sometimes and it's ok to get it. (Gloria, 3rd-Year Biology Ph.D.)

Importance of Family and Culture

Unique situations arise for Latin@ college students, particularly ones that are also first-generation college students, that are not experienced by students in independent-driven cultures. An internal conflict causes many Latin@ students to want to focus their energy on their own individual development while balancing the importance of family in many traditional Latin@ cultures. The other compelling issue is around Latin@ women leaving the home and not staying with family.

Independence but staying connected. The participants all shared versions of wanting to be an adult or become independent by getting an education. The mixed message throughout their stories was a conflict of still wanting to be connected to their families. Nitza shared her thoughts:

I started off commuting when I first started college. I was driving back and forth and living at home with my parents. Then later I decided to live off campus and got an apartment of my own. My family comes first. All the time. As an undergraduate, I always had conversations with my parents, like “Oh, I’m struggling in this, what do you think I should do?” and I always take their opinion. For graduate school, I started off campus in the university housing and did that for three years. When my parents were looking for a house, I thought “If I am going to be paying rent to a landlord, I should just pay my parents and help them with their house.” So, then I decided to move back in with them and still do. (Nitza, 5th-Year Biology Ph.D.)

Maria shared why she chose not to move away:

I was the top in my class in high school. There was this early acceptance for the top students. I didn't know where to go to college but I didn't want to be far. I wanted to stay close to still see my family. I didn't think I was ready to be away. I had only been in the US for six years. I had a lot to still learn. (Maria, 3rd-Year Engineering Ph.D.)

Another participant brought up a distinctive topic that is only experienced in more communal cultures. The importance of family also contributes to this different sense of what is a priority when school often comes second. Lydia shared:

I'm Mexican, I feel like my family is a very big thing so if something goes down with my family, I'll leave the education and go help them out. A lot of people don't have that mindset. They're like, "My mom's sick. What can I do? I just have to pull through finals and be okay," and I'm like, "Uh-uh, it's my mom, I got to go." We have such a strong connection. Out of my nine brothers and sisters, if something's going on, we all know and we all try to intervene and help. (Lydia, 2nd-Year Engineering Ph.D.)

Serena was also compelled to become an adult and be on her own. "I felt the need to go out of the nest and really become independent. For me, that meant being independent. I had to deal with renting a place and just providing for myself" (Serena, 2nd-Year Biology Ph.D.). Maria shared a similar connection to family and has a mentor who is understanding. She shared, "I don't believe she would be where I am without a mentor who I feels comfortable with." (Maria, 3rd-Year Engineering Ph.D.).

Giving back to family. Family is an important aspect of many Latin@ cultures, and therefore it was not a surprise when the participants shared the importance of being successful to give back to their parents and families. The following quotes express how the participants reflected on their parents. Adriana shared her thoughts about getting her Ph.D.:

I certainly questioned whether or not Ph.D. was right for me. Can I get through this? Moments make you question your own reasons for why you're in the program and if you can get through it. I have to do this

experiment over the weekend, but I could go see family. Those things are hard because you want to spend time with family and have fun. Doing it [Ph.D.] for myself and I put all of this work in and to not make my parents happy, but do it for them and show them that all the sacrifices and long hours wasn't for nothing. 'Your daughter has a Ph.D. Dr. [participant name]... For myself really, equally for my parents too. I wouldn't want to take it away from me or them. (Adriana, 7th-Year Biology)

Adriana also shared one of her hardest times during qualifying exams:

Written quals [qualifying exam] were a month of sheer anxiety. I'd cry myself to sleep and hope that I do well. Then the orals [exam] was the worst month and a half of my life, prepping for that. There was so much anxiety that I was going to let down my parents and that I was not going to do well. Just having a question and doubt of myself and my abilities. What if they'd make me quit. (Adriana, 7th-Year Biology)

Lydia expressed why she would feel bad if she failed:

Dude, I'm making my family go through quite a lot for me to go to school. I can't fail. If I fail, that's it. I made them work all by themselves. I made them do all this stuff. That's one of the things that motivates you. (Lydia, 2nd-Year Engineering)

Gloria explained why she wanted to finish:

I come from a family of immigrants. I do feel like I owe it to my parents to do well because they've been busting their ass with multiple jobs and just trying to have us... Let us have a good life growing up and getting us to the point where we can do better than they did and soon. (Gloria, 2nd-Year Biology Ph.D.)

Lydia described the importance of helping the family:

For me, it was motivation from teachers and some inspiration from my family because I know they work hard and at first you have the motivation of wanting to get a higher education to help your family financially. That's one of the motivations, but then after you're in it and you start learning more you're like, 'Okay, forget the money. It's not only about the money.' It's way more. I want to know something that nobody else ever thought of. (Lydia, 2nd-Year Engineering Ph.D.)

Maria uses her family during challenging times:

I want to finish. I want to do it for my family. I want to be there for them and I need to remember why I am doing it [pursuing a Ph.D.]. Especially when it gets hard. (Maria, 3rd-Year Engineering Ph.D.)

Family support for education, despite understanding or awareness, was a common theme among the participants. With a better understanding of the connections to families for Latin@ students, universities and administrators can find better ways to support students by also educating and including families.

At some point, I wanted to exclude my family because I felt I was not able to communicate with them about what I was doing. Maybe they wouldn't understand my life as a student, but I think it's important that they know or have an idea of what I do. You need the support from your family. You need to talk to them about what you do... in words they can understand. When I was doing the summer research program I was doing assays with kidney tissue. I remember talking to my younger sisters, and in words they could understand, I shared what I was extracting... I told them I was blending kidney tissue and that I was analyzing the separate parts. I'm trying to give them my... Somehow communicate to them my experience so they have an idea of what it's like. (Serena, 2nd-Year Biology Ph.D.)

There is additional pressure to be successful given the connection to family, especially in community based cultures. The fear of an entire family knowing of the "failure" was one of the concerns a participant shared.

I don't want to go back because I don't want to be the disgrace of the family and be like, "Oh look, she wasted five years and then came back to be a gardener." That's one of your fears but at the same time it's one of the things that you say. If I'm studying for an exam or something, where I feel I can't make it I'm like, "Oh, who cares? I'll just be a gardener." (Lydia, 2nd-Year Engineering Ph.D.)

Lydia also shared that the importance of family can be a source of motivation. She wants to continue her education as a role model and example to siblings. "If they look up to me then I have to show them that they're looking up to somebody good and not just a failure or something. You also want to push through for them." (Lydia, 2nd-Year Engineering Ph.D.). Once again, the importance of family and the pressure Latin@ students feel to be successful for their family creates unique experiences.

Decision and pressure to start a family. The pressure to start a family is experienced by many women who choose to have a career. This is especially true for women in academia considering further education and the busy life of tenure if planning to be a professor after graduate school. The additional pressure from cultural values around motherhood and being a wife, and the expectations of several family members, become more problematic for Latin@ women.

In the last week like four people from high school got engaged. My grandma asks me, “Are you dating? What about getting married?” It’s pressure that I already have from seeing other friends getting engaged, but family expects you to start your own family. (Ellen, 2nd-Year Biology Ph.D.)

One participant shared her feelings that becoming a mother would mean giving up her career due to family pressure and the lack of support she would have for going back to work.

There are some things from your culture and your family that expect you to become a mother. You better be in your house, better not go outside. Imagine if I told my mom, “I want to go back to work,” and the baby’s three weeks or something. She’d be like, “tas loca, this is your baby.” (Lydia, 2nd-Year Engineering Ph.D.)

Another participant reflected on the benefits she has experienced having parents who support her pursuing her education. Even some of her relatives would not be as supportive, and how she would have a different life now if she had those relatives for parents.

If I was from a family that was more traditional, more conservative it would be a problem. I wouldn’t be allowed to be doing the things I am doing, and I have family that is Orthodox. To me, I have been lucky because I’m not too close to that side. I don’t know how they would react to me doing the work that I do. It would be absurd that I would be doing anything outside of basically having babies and staying home to take care of the house. (Adriana, 7th-Year Biology Ph.D.)

The importance of having a family of their own can be equally as challenging for Latin@ women as balancing commitments to parents and siblings.

One of the participants reflected on this pressure while considering her entire life plan, and the age at which she would be done with her Ph.D., then a postdoc, and finally trying to get tenure.

For me like, as a woman, being Hispanic, I always have that thing where, when are you going to get married thing, and that's super hard. People are making fun of me, like "Oh when are you going to get married" and they keep on asking me. They say it jokingly, but at the same time people say, "You're getting too old to get married, you're not going to find a man." I get that from my mom too. It's a struggle. Okay, I might even do a post doc. If I do a post doc I won't finish until I'm 35. Okay, and if I go into academia, I'm not going to get tenure until I'm in my early 40's. So when am I going to have children? When is it the right time? Being a Hispanic woman, that pressure you get from your family. I'm the only one who doesn't have kids, so I feel like an outsider. (Gloria, 3rd-Year Biology)

Gender Differences

Science, or more specifically biological and life sciences, tends to have more gender equity compared to other disciplines. One participant called it the "Biology Bubble" (Adriana, 7th-Year Biology Ph.D.) where students tend to be represented more equally with men and women. Another participant shared that maybe gender is not a significant issue for her because she is in biological sciences.

Maybe because I see a lot of females in biological sciences, I just think, "Oh, it's fine. It's accepted, it's okay." Before I joined a lab, when I thought of scientists, I thought of a male. When I was in undergrad, my lab was all females. All the postdocs were females. And the PI was female, (Nitza, 5th-Year Biology Ph.D.)

This participant also works under a female PI and most of her current lab is also female. This story highlights the topic of being in a lab with all women versus the experiences of women in a lab with mostly men. The context of this experience changes what some women would experience in terms of support or even just casual conversation. The issue of gender is something all women

encounter in male dominated spaces despite their ethnicity or race. One of the participants in engineering shared a different perspective than the other participants about being one of the only women in different labs.

One time I got really bad cramps. I was looking at the computer screen and I sat down, and I was like, “Oh my god. That hurt so bad.” The guy came from the other side of the lab and said, “What? What’s wrong, is the data bad? Why did you make that face?” I said, “Oh no the data looks fine. Nothing is wrong.” How could I tell him I made that face because I am on my period? I couldn’t just say nothing. I said, ‘Oh no, I just made that face.’ With males it’s just different. You also don’t want to cross the line between professionalism and I don’t want to insinuate anything. That’s one of the biggest things that I would sometimes want to act more manly so they won’t disrespect me. (Lydia, 2nd-Year Engineering Ph.D.)

The example above highlights a naturally occurring body function for most women, and despite the best of intentions given inclusive labs and professors, can hinders their comfort in a lab. Not wanting to not cause men discomfort, these occurrences can lead to further discomfort for the women who may feel more distancing from the rest of the group. The challenge for women in spaces dominated mostly by men, is an environment, possibly perceived but likely very real, that lacks understanding and support. For the participants in biological sciences, particularly ones in a lab with all women, a different perspective was shared that challenges the idea that STEM is not for women. Other engineering participants shared similar concerns around gender.

I didn’t have any discrimination in high school. It wasn’t until I was in college. I remember I was the only girl on a team in one of my classes. I tried to give my ideas and they kinda ignored me. They would say, “I don’t know if that would work.” I was still thinking I was right but I would agree. “I guess you’re right. That is a simple solution.” I guess it’s my mentality to not be pushy. It comes from my parents and my culture. They taught me to be more humble and to help others. I don’t like confrontation. (Maria, 3rd-Year Engineering Ph.D.)

Another Engineering participant brought up that in industry, there are often less women and women of color at all levels. The gender discrimination she felt was more pronounced in industry than in academia.

When I worked in industry I felt more of the sexism. It was different. When I had professors I could talk to... I guess it was more inclusive. I have my advisor now in grad school who is a woman. I can talk to her about... I feel more supported. If I have any issues because of my gender or my race, I can go to her. In industry, as a woman of color I felt like an outsider. I didn't feel like anyone was there to help me. I wasn't progressing or advancing in my career. (Griselle, 2nd-Year Engineering Ph.D.)

Intersection of identities. The theory of intersectionality describes much of the discrimination the participants felt in their education. Crenshaw (1991) developed the theory of intersectionality to describe the systemic discrimination women of color experience concurrently due to simultaneous identification with multiple groups of social subordination. The weaving together of multiple identities for the participants highlights unique experiences because they identify as Latin@ and as women. The challenges and discrimination described below are unique as they would not be experienced by a man or by a White woman, at least not as overtly as the student's experiences.

The intersection of identities can create compounded issues in academic settings. One student shared an interaction she had with a female professor, who the participant said was likely making a joke, but the interaction highlighted the issue of stereotypes for Latin@ women. The participant had completed one of her tasks in the lab, removing the ice from a refrigerator, and was returning a vacuum after borrowing it from another lab. The PI from the lab said, "Oh you're coming in to clean" (Ellen, 2nd-Year Biology Ph.D.), uncovering a possible assumption that she was not part of the lab, but the custodial staff coming to clean a space. This demonstrates the unique experiences for Latin@ women in academia, as this

would not likely be the conversation between a professor and a White student, either male or female, and only came about because of her gender combined with her racial identity. This also brought up the challenge for students to not bring up issues due to the fear of “burning a bridge you might need later.” She acknowledged that there is a time and place for things and knowing that is hard as a first-year grad student. It is a delicate balance of wanting to address issues without causing too much of a problem but knowing they cannot stay quiet about issues they are experiencing.

Do I lash out on this person, or do I educate them that it might be hurtful? If I had said something... I feel like you come off as being someone that's really, I don't want to say picky or special, but sensitive.' (Ellen, 2nd-Year Biology Ph.D.)

The stereotypes of different cultures and upbringing can be very apparent depending on the background of the PI. One of the students mentioned this when she was discussing her flexibility in picking an assignment in the lab. Her PI asked her to pick one of the tasks that each student would be responsible for completing. When she said she did not have a preference, the PI told her, “you're always like this. Is this because you're Spanish? Is this from your upbringing? You need to choose” (Lydia, 2nd-Year Engineering). Lydia also identified that the PI identified as Asian and possibly held preconceived ideas, referring to her as Spanish.

Becoming who I needed. As a means of reflecting on their own experiences, part of this study asked participants to reflect on the support systems and factors that contributed to their continued pursuit of education. Many of the participants shared ideas of mentorship from professors during their undergraduate education. Others shared that high school guidance counselors or TAs in college were the ones who directed them to their path. Overall, the participants shared that part of their purpose in pursuing a Ph.D. is to be a role model and example for

others. Mentorship and encouragement from people within the participant's disciplines is crucial to their development and belief that they can also be successful in their chosen career path. For many of the participants, the mentor in their education has helped them at critical points in their careers especially when things came up with their families.

I remember I almost cried in her office. I thought she would have turned me away or something, maybe I would have quit. But the fact that she was understanding and said, "I understand this is going on. I believe in you and you go get the help you need, to go to the counseling center if you need to talk to someone." It made me think, "Ok I can do this." I need to be strong for my family. (Nitza, 5th-Year Biology Ph.D.)

A professor can provide students the care and guidance necessary when they are questioning themselves or making important decisions.

My current PI is very supportive of women in STEM. During rotations, he helped me avoid toxic environments and helped me find people who were more supportive. If I didn't have this network and someone to guide me, I would have had different thoughts about my future, and many students get lost. I want to be a professor to be the example for other students, the students who may not have the support system I had. (Annie, 5th-Year Biology Ph.D.)

Olga also shared her perspective about the mentor role and her attempts to build up the confidence and the identities of the undergraduate students she mentors.

When I mentor younger students at the undergraduate level, if they are minorities, I tell them 'If this is who you are, this is who you are. The world is not going to change if you keep changing for it.' I really try to stay true to that because it's important to be honest to them. There is some level of performing you have to abide by, but that is determined by that person. (Olga, 2nd-Year Biology Ph.D.)

Although it helps to have someone they can relate to, it is also important to know that people can be mentors without identifying similarly to the student. "If there were more women faculty who were of my race or that knew that there's struggle with it, with our culture, then it would make things easier" (Ellen, 2nd-

Year Biology Ph.D.). Ellen also shared one of the most inspiring messages in all of the testimonios from a mentor who did not identify as Latin@ but cared about her future. When she was considering transferring from her community college to a UC campus, her mentor, who identified as Black, told her, “You’re sort of like a flower and in order to bloom, you need proper sun and water. I want to be your sun and water” (Ellen, 2nd-Year Biology Ph.D.)

Shadow-Beast (Anzaldúa)

There is a rebel in me – a shadow-beast. It is a part of me that refuses to take orders from outside authorities... It is that part of me that hates constraints of any kind, even those self-imposed. (Anzaldúa, 1999, p. 38)

Anzaldúa described the challenge some women feel, even at a young age, when their personalities and characteristics clash with cultural and gender norms that push young women into the stereotypical, traditional roles of mother and wife that Chicana Feminists fought against (University of Michigan, 2007). Their individual goals contradicted the community or family expectations to give back to the family and help with childcare or by working, rather than focusing on schoolwork or even moving away for college. The concurrent identities led to them developing sense of determination. This sense of internal motivation and courage to go against what society expects, was illustrated by a few participants.

I’m not going to do it just because you say so. It has to be my choice (Nitza, 5th-Year Biology Ph.D.)

If you tell me I can’t do something, I’m going to try even harder (Olga, 2nd-Year Biology Ph.D.)

I’m very stubborn. I like to follow through. If I say I’m going to do something I have to finish it. No matter what the issue is. I am going to do what I say and what I want. (Griselle, 3rd-Year Engineering Ph.D.)

The family pressure is there. I just won’t let it get to me. I think if I would have let that affect me, I wouldn’t be here. I think of what is expected of us as women. My friend has baby fever. She even thought of dropping the program. I mean, I want to find a partner eventually. Have a family... but I

thought, “Whoa. That would never be me.” I wouldn’t drop my program for a man. Ever. I am going to get my degree. (Ellen, 2nd-Year Biology Ph.D.)

Advice for Future Women in STEM

One of the final questions in the interview protocol was intentional to give advice for future women in STEM. The question was left open for all women in STEM not just Latin@s to be a collection of empowering messages. Some of the participants also reflected on messages they would have liked to receive. Others wanted to emphasize the importance of finding a mentor or using the resources or programs available. Below are the messages and advice they wanted to share.

Support Systems and Mentors

The following quotes relate to the support systems and the mentors the participants shared helped them navigate the education system or kept them focused on their goals throughout their path.

Sometimes, I was ready to give up. If it hadn’t been for the advice I got from my mom and my housemates, it would have been much harder. I think I would have finished my degree anyways because that is was my goals. I had set my mind to, “No matter what, I want this.” (Serena, 2nd-Year Biology Ph.D.)

Get a PI that you gel with is most important, honestly. If you can’t stand the PI but you love the field and it’s the most exciting project you’ve ever heard of, get out of there because being miserable with your boss is the worst idea. When they’re going to have to sign that paper before you leave. Yea, getting a PI you feel comfortable around is really... that should be at the top of the list. Worry about being amazingly interested in the subject after. (Adriana, 7th-Year Biology Ph.D.)

I would say look for mentors. If it’s not inside the lab, go outside the lab. (Nitza, 5th-Year Biology Ph.D.)

Find a mentor who supports you. (Maria, 3rd-Year Engineering Ph.D.)

Form a good social support system. Whether it be family or friends. To get through those hard moments. And to never feel alone. (Nitza, 5th-Year Biology Ph.D.)

Be intentional about your advisor. Form your team. They say it takes a village to raise a child. It takes a village to raise a Ph.D. student. (Griselle, 2nd-Year Engineering Ph.D.)

Keep Going and Don't Give Up

The following words of advice serve as encouragement for future women in STEM to continue working hard and overcoming challenges.

Stay strong, don't give up. You're more capable of what you think you are capable of. (Lydia, 2nd-Year Engineering Ph.D.).

Don't compare yourself to other people. (Serena, 2nd-Year Biology)

Generally, study and do the hard work and get it done. (Adriana, 7th-Year Biology)

For women in STEM. I'd say don't get discouraged by stupid things you hear from people and honestly women can do anything men can do. It's ridiculous to think otherwise. (Adriana 7th-Year Biology)

A female does not have to be in an all female lab to feel accepted. They can find females in other labs and they can reach out to them. (Nitza, 5th-Year Biology)

Being a minority and having less resources to achieve your goals, personal and academic, is a real challenge. You have to be strong and look for help. Just keep trying. Sometimes things don't work out and you just have to accept how it turns out. If you keep trying, I think that counts a lot toward achieving your goals. (Serena, 2nd-Year Biology)

If you're having trouble with something... Find someone to confide in, to talk to. Even if that means visiting the health center, the counseling center, I did that myself when I was going through my oral exams. It was to the point I couldn't focus because I was having so much anxiety. (Adriana, 7th-Year Biology)

If you want to pursue it [education], the only person stopping you is yourself. (Maria, 3rd-Year Engineering Ph.D.)

For their own sanity, to not feel pressured to compare themselves to others and say, "You know I need to be finished in four years because that person finished in four years and they published like four papers, and I need to do the same." Everyone's different. We don't work well under pressure. People try to stay strong and the more pressure the better I am. No that's not true. You're going to have a mental breakdown. (Nitza, 5th-Year Biology)

General Advice

The following advice comes from several places of wisdom from the participants. Some of the participants shared what helped them and others shared how to take advantage of the educational opportunity if future students plan to go to graduate school.

Be a GSR [graduate student researcher, a mentor for undergraduate student]. Mentor undergraduate students. Interact with administrators. Leadership. Be part of student council. Learn to communicate. (Annie, 4th-Year Biology Ph.D.)

Advice from my own experience. Get to know professors. Didn't know what office hours were. Go and talk to them [professors]. Constantly interact with people. Get out of your shell. Ask questions. Be more comfortable talking about issues. (Annie, 5th-Year Biology Ph.D.)

Every time I think about giving up, something good happens to balance out the bad. You have to keep going to have those moments. You will see the results and it's awesome when you see them. (Ellen, 2nd-Year Biology Ph.D.)

I studied a lot. I worked my [expletive] off and it didn't come easy. It helped to be in a field that you like and I do like biology. (Adriana, 7th-Year Biology Ph.D.)

Summary

As current Ph.D. students, some still at the beginning of their programs, the participants have unique perspectives to contribute to the literature on first-generation college student success, Latin@ students throughout education, and the overall academic challenges in STEM disciplines. Although many highlight some of the obstacles they encountered, they also provide inspiring, motivational experiences that speak to the literature and previous studies around resilience and the empowerment of women from feminist theory. The stories from the participants also demonstrate the variety of experiences around culture, race, gender, and education and examples of intersectionality where multiple identities

are experienced concurrently. The unique challenges of simultaneous systems of oppression, along with mentorship and family support, have forced the participants to develop what one called “thick skin” to be tough and not give up on their goals. Lastly, the advice from the participants reflections speak to their multiple identities and sources of support coalescing into a new way of being and how we can encourage future women in STEM to be successful.

CHAPTER 5: CONCLUSION AND IMPLICATIONS

This chapter discusses the overall purpose of the study along with a discussion of the findings with connections to the literature. The discussion is also connected to the testimonios of the participants given the importance of their lived experiences using the CRT framework. The main purpose of this research was to document the lived experiences of current Latin@ women in STEM doctoral programs. Due to the small population of Latin@ women in STEM in advanced degree programs, the challenges and accomplishments of the participants inform future practice in supporting more Latin@ college students to continue their education. This study also served the purpose of encouraging further development of resilience in the participants by reflecting on their own adversity and overcoming obstacles throughout their education. The researcher purposefully chose current Ph.D. students to support their continued education through reflection and critical discussion about the need for more women of color in STEM.

This qualitative study focused on experiences of Latin@ women in higher education, including their previous educational experiences, family upbringing, cultural and gender identification, and how their lived experiences supported or challenged their goals of receiving a doctorate. Combining multiple views from LatCrit and Chicana feminism, the study uncovered many truths from the participants through their testimonios. The 10 Latin@ women were asked a series of questions to provide their testimonio based on their family, educational path, development of resilience, and the factors that contributed to their continued education despite systemic barriers. The four research questions below were used to create the interview protocol around specific topics to elicit the participants

experiences and provide suggestions for how to make the educational process more accessible, to identify the cultural and social factors that support Latin@ women in STEM and address factors that challenge their development, and finally to encourage more women to seek a Ph.D. in STEM.

1. What are the stories and lived experiences of Latin@ women in STEM education?
2. What cultural and social factors affect Latin@ women in STEM Ph.D. programs in California?
3. How do systemic factors around race and gender contribute to the resiliency of Latin@ women in STEM disciplines?
4. What do Latin@ women say can be changed about education to continue their pursuit of a doctorate?

The first question was answered by documenting the testimonios of the participants. These narratives were compiled by the researcher mainly using quotes from the participant and minor additions or edits from the researcher to enhance the structure and flow of the testimonios. The second and third research questions were answered throughout the testimonios and then later addressed through themes regarding shared experiences with quotes from multiple participants throughout the sections. The testimonios highlight collective experiences as well as providing differing views on the education system, where they received support from family, and whether they experienced discrimination based on race or gender, or no discrimination at all. The last question was addressed through the final aspect of the protocol asking participants what they need now to be successful in graduate school, and more telling, what is the advice they provided to future women in STEM doctoral programs. Posed to the participant as a general question to any woman considering a STEM career, some

the suggestions and universal advice speak to the development of resilience, whereas other pieces of advice address the changes that could be made in the educational system or aspects of it. A brief discussion of testimonio and the impact of this study will be provided prior to a discussion of the findings.

Testimonio

Framed by CRT and Chicana feminist theoretical frameworks, the use of testimonio served many purposes throughout the study and contributed to different views about gender and culture. The testimonios, or lived experiences in the form of a narrative, reflect the broad range of educational and family backgrounds of the participants. Narratives, or storytelling, provides many benefits to the participant in research as they reflect and establish their truths within the context of the situation for which the story developed, their emotions, and their viewpoint at the time (Delgado Bernal, 1998). This methodology elicits the stories and lived experiences of underrepresented minorities, also provides a challenge to dominant narratives in society and more specifically in education through counter-storytelling. As exemplified in some of the testimonios, the counter-storytelling from the participants testimonios challenge stereotypes that exist for minority students or for women of color in STEM. With experiences throughout the participants' education, the testimonios produced both challenges to the dominant narrative and internalized thoughts about why they are motivated to fit the dominant narrative.

The semi-structured interviews, that created a space for sharing and for the researcher to listen rather than create dialogue, encouraged the participants to share their testimonios around many perspectives and experiences given multiple identities, family structures, support systems, and institutional environments. There were times during each interview when the researcher explained concepts for clearer understanding, provided context for questions, or encouraged the

participant to elaborate on specific stories or to take a moment to reflect more on the emotional responses to their lived experiences. The elaboration on stories and time to process produced more in depth accounts of stories as well as the impact on the individuals.

Importance of Family

As an additional challenge to the dominant narrative, the positive support from parents and family was expressed as a major factor for the students' success and motivation to continue their education. The stories of one or both parents encouraging the participants to do well in school and pursue their college education challenge stereotypes of Latin@ communities and parents who are not supportive of education. There was only one student who provided a story of her father questioning her plan to attend college, but only from a negative perspective of education that the participant would have struggled and the college was not meant for her to be an easy success. This relates to the development of resilience as McMillan and Reed (1994) found that parental support and high expectations contribute to the student working to meet high expectations for themselves. The family support therefore is crucial for Latin@ students to know they can achieve their goals. The existence of financial responsibility is common for working class or low socioeconomic status families. The unique experience for Latin@ communities is the expectation from parents for children to contribute to the family to relieve financial pressures. This was evidenced by the one participant who was told to not go to college to help the family business due to financial instability. She was encouraged to stay at home to help make money by working instead of focusing on her education. Still, this one negative experience around educational support from a parent provided more depth to the stereotype, as it is not an issue of supporting their child's education, so much as a protective factor

for the child to not experience discrimination. Parent education, and not understanding the college system, was also raised in many of the testimonios. As many of the participants' parents did not go to college and a few did not finish high school, the message was still for the participants to continue their education and they were supported in their decisions to pursue a STEM degree.

Mentors and Inclusive Environments

One of the overwhelming responses was the importance of a good mentor. The support of a professor who understands diversity and encourages women of color, despite other educational barriers, made an incredible difference for the participants both in their undergraduate education as well as in graduate school. A good mentor serves as a crucial gatekeeper to resources, funding, networking, graduate school preparation, conference attendance, grant application support, and also challenged some of the participants to consider their options for continued education. This important reflection led a few of the participants to think about their own purpose for pursuing a Ph.D. and becoming a professor to mentor undergraduate students in the future. All of the participants shared how important it is for an undergraduate student to get experience in research before applying to graduate school and to gain necessary skills and be more prepared. In graduate school, this has taken the form of having an inclusive environment that understands and supports women pursuing a STEM degree. As the professor sets culture in lab, the participants shared positive experiences with other graduate students as well as feeling supported when issues arise.

Academic Resilience and Stereotype Threats

A noteworthy finding was that the development of academic resilience stemming from the support of both parents and family, as well as teachers and

counselors. The participants' experiences also support the idea of critical academic resilience (Campa, 2010) with different factors and sources for the development of resilience due to multiple sources of oppression. The students cited the differing parental support, either of the mother or father, that helped the participant believe they could continue their education. The complex support system for Latin@ women given cultural and social norms, underscores one of Campa's (2010) principles for critical resilience when young women find support from their mother as well as their father due to the role of the matriarch in the home. Since Latin@ women are likely to experience discrimination, either due to gender, race, or a combination of any identity factors, it is important to acknowledge where they can gather strength to overcome challenges.

Intersection of Identities

The participants also shared experiences with overcoming multiple, concurrent sources of oppression. The theory of intersectionality (Crenshaw, 1991) informs these experiences given that the participants live in multiple identities and are not able to separate their gender from their ethnic or cultural identity. The example of the participant conducting her lab assignment who was asked by a professor if she was there to clean the lab was a result of the student being both Latin@ and a woman. This combination of racism and sexism, despite its intention, created a dynamic not experienced by most college students, i.e. male or White students. The potential short or long-term impact of the comment for the participant, who already felt unsure of her abilities and whether she belonged in the Ph.D. program, cannot be understated. This participant expressed her real concerns about her abilities while preparing for qualifying exams. Steele and Aronson's (1995) theory of stereotype threat, the fear of confirming negative group stereotypes that causes students to underperform, was addressed during the

follow-up conversation and the student was relieved to know that she was experiencing a real reaction to the pressure. The incident with the professor impacted her confidence with negative thoughts about being in a Ph.D. program, was reinforced by other aspects of her educational experience, and is related to the attrition of women in STEM due to sexist and racist environments.

Implications for Practice

The varied experiences from the participants demonstrate the diversity of our educational institutions, as well as similar structures or environments that hinder their success. Although there are adaptations to consider with differing campus climates or programmatic differences, the recommendations from the participants, combined with the literature, can make positive, impactful changes to the experiences for Latin@ women and women of color in STEM disciplines. The universal impact of these changes will also encourage further development for programs at multiple levels of education to support students and challenge systems of oppression that have led to the lower college enrollment of URM students and graduation data that does not correspond to the demographics of the United States. With CRT, it is crucial to address institutionalized forms of oppression, such as racism and sexism, that create inequities in society. There are also development opportunities that will require faculty and administrators to analyze their own biases, stereotypes, and institutional practice that have hindered the success of women of color in STEM.

The men in faculty positions need to become better allies in challenging the racist and sexist environments. Without this acknowledgement and the will to change, the current system will go unchallenged and women will not reach faculty positions. For this to happen, men need to challenge their own sexist views, whether they are aware of them or not. Ignorance of these issues does not justify

the dynamics that continue to exist in education. Universities and university administrators must then be willing to enforce new policies or hiring procedures for faculty to be educated on these issues. Training and professional development should include diversity and inclusion training for faculty to be more aware of problematic language, behavior, and the power dynamics that impact students' ability to challenge systems of oppression.

An additional recommendation from this study is to support mentorship development with faculty. The participants' experiences highlight the importance of having supportive, guiding mentors who helped them navigate the graduate school process and avoid some of the discrimination others experienced. Universities can enhance this development with development plans and opportunities to share experiences with new faculty. This training should also incorporate mentorship skills development with how to create environments where students do not feel excluded. This does not constitute a need for faculty to not challenge graduate students academically or with new development. The challenge is for faculty to better understand their role in serving as a mentor for students who may not be aware of their own path or how to navigate the graduate school experience.

A positive aspect from this research is to continue or enhance previously funded programs in earlier education as well as in secondary and postsecondary education. These are intended to serve URM students and provide any student with undergraduate research experience. Many of the suggestions from the students were about preparing students in the sciences better to make earlier decisions and get experience throughout their undergraduate education. A few of the participants wanted to know more about their fields and the breadth of opportunities available to make better decisions about what to study in graduate

school, or whether they should pursue a Master's Degree or Ph.D. Despite their wishes to have more experience, they were privileged to have research experience and be a part of programs and internships that exposed them to research in their disciplines. These programs are not available to many students due to funding constraints at most institutions. This exposure to research helps students make better decisions about their careers and provide more connections to faculty. The other aspect of these programs is the social connections students will experience with other academically focused students with similar goals of graduate school. Institutionally, administrators can find unique opportunities to connect the resources for students as there will not be enough opportunities for all students to pursue research. This can be a framework of tiered experiences with research from attending other students' presentations, to smaller workshops about career options, to more in-depth involvement in a summer research program. The goal is for students to be more aware of career opportunities and to network with other students and faculty. In addition to access and mentorship by professors, these programs also provided necessary preparation for graduate school and opportunities to attend conferences to present their research projects. These experiences, usually provided to graduate students, offer the early preparation to conduct research and opened doors to other opportunities with connections to professors. The undergraduate research programs the students participated in also supported their understanding of what a Ph.D. entails, as well as optional careers in STEM.

For college and university administrators, the programs the participants mentioned provide academic and professional development support, but institutions can provide the necessary mentorship and social development in STEM disciplines. Administrators also need to challenge systemic barriers such as

racism and sexism. They can be better advocates of change at institutional levels by implementing policies that support students of color. A better understanding of STEM education paths and the barriers for women of color will help administrators to make better decisions for programs, hiring and training policies, or in the development of new resources for women of color. The inclusion of women and women of color in the discussions is also important for the development of future programs as they are often left out of these crucial decisions. As was discovered in the findings, the involvement of family and parents in the process can better support students when they experience challenges. For summer research programs, this can be extending invitations directly to family members to support the students and to become more familiar with their educational path. Educating family and parents about the educational process will also provide necessary information for students to seek support and understanding when they continue to graduate school.

Implications for Research

This research needs to be replicated with other students to continue sharing stories about the challenges for women in STEM. Replicating the conversational and transformational aspect of this study will also encourage other women of color to develop resilience and continue their education. The participants for this research study are currently enrolled in Ph.D. programs at five UC campuses designated as HSIs which create unique experiences. The participants also have varying experiences with public and private elementary and secondary education, as well as mixed experiences with community college attendance. Future research should focus on the experiences of Ph.D. students at HSIs compared to students at other UC campuses to see if the campus climate issues and stereotype threat are more prevalent at other institutions. This information can help inform students as

they make decisions to pursue a post-baccalaureate degree in California. Since this research was intended to provide an overview of the lived experiences for Latin@ women in STEM, future research could focus on the differences in educational background and at varying levels of education, such as students in a master's program versus those in Ph.D. programs.

This research also emphasized the need to address multiple identities for the participants through the interview protocol and the information shared in the demographic questionnaire. As intersectionality influenced much of the question development, the need for further exploration into how each of the identities, or the combination of multiple identities, affected the educational aspirations of the participants such as the intersection of religion with race or gender, needs to be examined. With more research developing on the impact of immigration and citizenship on Latin@ families and individuals, this should be addressed more in future research to understand how this may influence some of the findings. The process of citizenship, either for themselves or assisting family members, can be a long, difficult journey, and could impact a student's focus on education. The participants who were born in another country had a challenging transition to the educational system here, and although none mentioned the issue of citizenship, one participant stated that she was lucky to not have to deal with that process. The participants with parents who attended college in Mexico were not familiar with the educational process here in the United States and struggled to navigate the system. There was some discussion about starting a family and having children, but the topic of sexuality was not discussed. The heteronormative language around getting married and having children in the Latin@ community could also be an emphasis in future research. Only one participant shared that she had a disability, but that was only mentioned briefly before she changed the subject. The researcher

assumed a lack of comfort and did not want to press her for more information on that topic. The issue of access and equity in education tends to neglect disabilities and the conversation around accommodations. Some of the participants spoke openly about mental health, but there were none with visible, differing abilities. An important aspect of future research should be around access for differing abilities both visible and invisible, such as learning or cognitive differences.

One participant was curious to know what other participants had experienced in their undergraduate programs or in other disciplines. Future research could also emphasize the need for more networking among current Ph.D. students using focus groups for participants to interact with others. The engaged conversation could also serve the additional purpose of fostering a sense of community and belonging while discovering others' experiences in STEM. The self-reflection would also create more internal development of resilience when other experiences of gender bias or racial discrimination are shared by participants. The majority of the participants in this study were in the biological sciences, which is representative of the different disciplines as more women are in biology and mathematics. There were a few participants pursuing an engineering Ph.D. and having participants from technology, mathematics, or other science programs could create more nuanced dialogues. The focus groups could then be split with some sharing experiences in the same discipline and other groups could be mixed with participants from differing disciplines.

Conclusion

Indigenous like corn, the Mestiza is a product of crossbreeding, designed for preservation under a variety of conditions. Like an ear of corn... she is tenacious, tightly wrapped in the husks of her culture. Like kernels she clings to the cob...she holds tight to the earth...she will survive the crossroads. (Anzaldúa, 1999, p. 103)

The many identities and life experiences of the participants in this study have provided an abundant amount of information through their testimonios. The challenge to future women in STEM is to be resilient, to be confident in her abilities to overcome obstacles. The idea of crossroads restricts individuals to paths taken by others but women in STEM will pave their own paths and navigate new directions. Additional research into the experiences for Latin@ women, as well as other women of color in STEM, can further inform policies and programs through all levels of education to better support them in their academic and career journeys. The experiences of the participants inform more than just their own goals, but the goals and dreams of their families, as well as students they will mentor in the future.

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APPENDIX A: INTERVIEW PROTOCOL

I have planned this interview to last approximately one hour. During this time, I have several questions that I would like to ask that will provide information about Latin@ women in STEM disciplines. As a critical form of research, your story will inform future practice in supporting women of color in STEM. In education, as in other areas of society, systems exist that create barriers for underrepresented students and people of color. This is particularly true for women of color in advanced degree program. Personal narratives provide a wealth of information about a person. This is your opportunity to share anything that you feel is important to your identity and lived experiences.

I would like to record our conversation today to facilitate note-taking. Please sign this release form agreeing to be recorded. In addition, you must sign a form to meet our human subjects research requirements. This document states that: (1) all information will be held confidential, (2) your participation is voluntary and you may stop at any time if you feel uncomfortable without a negative consequence to you, and (3) I do not intend to inflict any harm. Thank you for agreeing to participate.

1. To start, please share a little about yourself and a brief family history?
Growing up in Latin@ cultures, people have different experiences with education and family support. How supportive was your family of you going to college and now continuing your education?

2. Now moving on to your education, when did you first realize you wanted to study a STEM discipline (science, technology, engineering, or mathematics)? What made you interested in this area? What made you want to major in this area? How did your interest evolve throughout your education?
3. Please share some of your experiences as a Latin@ woman in STEM. How did gender affect your experiences and educational aspirations? How did your socioeconomic background affect your educational experiences or aspirations? How did your racial/ethnic identities intersect and affect your educational experiences or aspirations?
4. Tell me about any discrimination or gender bias you encountered throughout your education, such as gendered comments or differences with assignments compared to male students. Did you ever feel the need to adapt or change to be successful in your discipline/major?
5. Women of color are the least represented groups in STEM. As a Latin@ woman in STEM, what has helped you overcome adversity (obstacles) in your career? What would you have liked to change about your undergraduate experience in STEM? How can universities better support women in STEM?
6. What has been your experience in graduate school so far? Please share a few experiences that highlight what you have encountered. What challenges or obstacles have you encountered?
If participant says that he/she had no obstacles, ask: Why do you believe you did not experience any obstacles? What would you say contributed to your positive educational experience? Could you provide

examples of individuals you knew who may have experienced barriers to believing college was possible?

7. In what ways did your racial/ethnic background affect your interactions with faculty within your department? In what ways did your gender affect your interactions with faculty within your department? In what ways did your socio-economic status affect your interactions with faculty within your department? If your race, gender, or class did not affect your interactions with faculty, why do you believe this was the case?
8. Please share any times you felt you might not continue your program or graduate? To what extent did family, school experiences, or mentorship mediate your path in academia? What helped you stay in school? If you never wavered, what helped you maintain your motivation?
9. As you continue your Ph.D. program, what resources do you think will help you continue and be successful? Please describe any social networks, community, university organizations, and/or professional associations. Please describe any programs/fellowships/research opportunities and any university departments or resource centers.
10. What is your perspective now after reflecting on your educational career? How do you feel you will continue your career path?
11. Based on your experiences, what advice would you give to future women in STEM?

APPENDIX B: CONSENT FORM

You are being invited to participate in a research study about the experiences of Latina women in STEM (science, technology, engineering, mathematics) disciplines. This study is being conducted by Jorge Luis Arroyo from the Doctoral Program in Educational Leadership at California State University, Fresno (Fresno State), in fulfillment of the doctoral degree.

You were selected as a possible participant in this study because you are currently enrolled in a STEM Ph.D. program at one of the selected institutions in the University of California system. You have also self-identified as a Latina woman as acknowledged by a university staff member or professor, who provided you with information regarding the study.

There are no known risks if you decide to participate in this research study. There are no costs to you for participating in the study. Your participation will consist of an in-person, one hour interview and a follow-up 30-45 minute phone interview. The information you provide will be used to uncover trends in postsecondary education. You will also be asked to complete a demographic questionnaire that will take approximately 20 minutes to complete. The information collected may not benefit you directly, but the information learned in this study will inform practice for university administrators and benefit future students. Your participation in this study is voluntary. You will be compensated with a \$25 gift card after completing your in-person interview.

Any information that is obtained in connection with this study that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. If you decide to terminate the interview, you

may do so at any time without any negative consequences. No one will be able to identify you or your answers, and no one will know whether you participated in the study. Individuals from the Institutional Review Board may inspect these records. Should the data be published, no individual information will be disclosed.

If you have any questions about the study, please contact Jorge Arroyo, jarroyo@mail.fresnostate.edu, (831) 515-8282 or Susan Tracz, susant@csufresno.edu, (559) 278-0347.

The California State University, Fresno (Fresno State) Review Board has reviewed my request to conduct this project. Questions regarding the rights of research subjects may be directed to Kris Clarke, Chair, CSU Fresno Committee on the Protection of Human Subjects, (559) 278-4468.

I agree to be interviewed and audio taped.

Signature _____ Date _____

Name Printed _____

Researcher Signature _____ Date _____

APPENDIX C: LIST OF LATIN@ WOMEN AT NASA

Name	Role at NASA
Adriana C. Ocampo Uria	NASA HQ Science Mission Directorate, Program Executive.
Lydia Del Rio	Research and Program Management and Center Full Cost Program Analyst at Kennedy Space Center.
Dr. Ellen Ochoa	Astronaut, Director of Johnson Space Center, first Latina in space in 1993
Nitza Margarita Cintón	Chief of Space Medicine and Health Care Systems Office at NASA's Johnson Space Center
Dr. Serena Auñón	Astronaut, began working as a flight surgeon. Will be second Latina in space in 2018
Gloria Hernandez	Researcher in supersonic aerodynamics at NASA's Langley Research Center.
Olga D. González-Sanabria	Scientist and inventor currently Director of the Engineering and Technical Services at NASA's Glenn Research Center
Annie Delgado-Holton	Program Specialist for NASA and a member of LATINA (Leading and Advocating Together in New Arenas).
Griselle LaFontaine	Information Technology Specialist
Maria Lecha	Aerospace engineer at NASA

APPENDIX D: DEMOGRAPHIC QUESTIONNAIRE

Please complete this questionnaire with demographic, parent, and academic information to the best of your ability.

Personal Information

Year of birth: _____ Gender: _____

Ethnicity: _____

Marital Status: _____

Sexual Orientation: _____

Your 1st language: _____

List languages you speak: _____

Place of birth: _____

Place you were raised: _____

First Generation College Student: Yes No

(Defined as the first in your family to receive a four-year college degree.)

Parent(s)/Guardian Information

Primary language spoken at home: _____

Parent 1 Relationship (Mother, uncle, grandparent, etc.): _____

Highest Education of Parent 1/Guardian: _____

Occupation of Parent 1/Guardian: _____

Parent 2 Relationship (Mother, uncle, grandparent, etc.): _____

Highest Education of Parent 2/Guardian: _____

Occupation of Parent 2/Guardian: _____

Academic Information

Graduate Education: Irvine Merced Riverside Santa Barbara Santa Cruz

Year in PhD Program: _____ Discipline of study: _____

Emphasis (if applicable): _____

Undergraduate Education

University/Institution: _____

Major: _____ Minor: _____

Community College (if applicable): _____

GPA: _____ Did you switch your major? Yes No

If changed major, what was your original major? _____