ENGINEERING SUCCESS: UNDERGRADUATE LATINA WOMEN'S PERSISTENCE IN AN UNDERGRADUTE ENGINEERING PROGRAM

by

STEVEN R. ROSBOTTOM, M.Ed.

DISSERTATION
Presented to the Graduate Faculty of
The University of Texas at San Antonio
in Partial Fulfillment
of the Requirements
for the Degree of

DOCTOR OF EDUCATION IN EDUCATIONAL LEADERSHIP

COMMITTEE MEMBERS:
Mark Giles, Ph.D., Chair
Felecia Briscoe, Ed.D.
Gloria Crisp, Ed.D.
Encarnacion Garza, Ph.D.

THE UNIVERSITY OF TEXAS AT SAN ANTONIO
College of Education and Human Development
Educational Leadership and Policy Studies
December 2016

DEDICATION

This dissertation is dedicated to my loving family. Your belief in me has always provided me with the strength to attain new heights. I would like to thank my mom and dad for their constant support and their unwavering spiritual faith that has guided me throughout my life. Without them, I would not have been able to reach this point in life.

ACKNOWLEDGEMENTS

I am thankful to the chair of my committee, Dr. Mark Giles, for the guidance and support he provided me throughout the process. He always encouraged me to keep moving forward and pushed me through the toughest times of dissertation work. His direction and advisement guided me from the beginning to the end with immeasurable patience, wisdom, and dedication. Additionally, I would like to thank the members of my committee for each of their contributions: Dr. Briscoe, Dr. Crisp, and Dr. Garza. Their support and advisement contributed to increasing my intellectual thought. I am grateful for their guidance throughout the process. I am forever grateful to Lona George for her continuous support throughout the program.

December 2016

ENGINEERING SUCCESS: UNDERGRADUATE LATINA WOMEN'S PERSISTENCE IN AN UNDERGRADUTE ENGINEERING

Steven R. Rosbottom, Ed.D.
The University of Texas at San Antonio, 2016

Supervising Professor: Mark Giles, Ph.D.

The purpose and focus of this narrative inquiry case study were to explore the personal stories of four undergraduate Latina students who persist in their engineering programs. This study was guided by two overarching research questions: a) What are the lived experiences of undergraduate Latina engineering students? b) What are the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program? Yosso's (2005) community cultural wealth was used to the analyze data. Findings suggest through Yosso's (2005) aspirational capital, familial capital, social capital, navigational capital, and resistant capital the Latina student persisted in their engineering programs. These contributing factors brought to light five themes that emerged, the discovery of academic passions, guidance and support of family and teachers, preparation for and commitment to persistence, the power of community and collective engagement, and commitment to helping others. The themes supported their persistence in their engineering programs. Thus, this study informs policies, practices, and programs that support undergraduate Latina engineering student's persistence in engineering programs.

TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION

Many women college students are attracted to engineering programs throughout the country, but within a few years, a significant number of these students decide to change majors or drop out of the institution before completion. The number of women students completing engineering programs is low in comparison to the numbers who initially enter these programs (Mosses *et al.*, 2011). Further examination reveals a significant gender gap in the number of women completing engineering degrees. According to the National Science Foundation (2012), women represent only 19.2% of bachelor's degrees awarded in engineering, a percentage that has remained nearly stagnant over the past 20 years.

Problem Statement

Unlike some majors on college campuses, engineering is a male-dominated profession. Data shows that Latinas earn only 2.0% of all engineering baccalaureate degrees (NSF-NCSES, 2009). Therefore, Latina's are commonly underrepresented in engineering classrooms. More often than not, women receive the message that they are not capable of performing well academically in science, technology, engineering and mathematics (STEM) fields (Hyde *et al.*, 2008). For instance, in 2012, Latinas alone represented 6% of all bachelor's conferred in the United States (Snyder & Dillow, 2013). The National Science Board offered one other possible reason for their underrepresentation. In a 2007 National Science Board (NSB) report, it was noted that "Attrition is higher than average among women and minorities and that these groups were most likely to lack role models in engineering" (NSB, 2007). In addition, Stout, Dasgupta, Hunsinger, and McManus (2011) found that minimal visibility of women in professional engineering careers decreases women's identification of and participation in the engineering areas.

Let us move the argument one degree further. The connection between social stratification and higher education has been a topic for researchers for many years. Previous studies by Black and Smith, (2006), Eide, Brewer, and Ehrenberg, (1998), and Thomas and Zhang, (2005) have addressed how higher education can perpetuate or disrupt social stratification. Thomas and Zhang (2005) also suggested that the college students' choice of major influences their social mobility and occupational status.

Differences in major selection at the institutional level continue to stratify groups, in particular along male and female gender lines. This will then possibly lead to differential salary earnings and workforce opportunities for women. Several scholars (Rumberger & Thomas, 1993; Thomas & Zhang, 2005; Wolniak, Seifert, Reed, & Pascarella, 2008) have looked at how economic returns for the baccalaureate degree vary across college majors. In general, expected earnings for baccalaureate recipients seem to vary widely by major. Students majoring in engineering, the physical sciences, and more recently, health, tend to earn the most in their early post-college years, whereas education and liberal arts majors tend to earn a bit less.

Access to and entrance into the high status and high reward fields such as engineering continues to be limited for women. For example, women in 2015 only represent 19.2% of the bachelor's degrees award in engineering; this percentage has remained nearly stagnant for over 20 years (National Science Foundation, 2015).

The shortage of engineers in the United States can be partly attributed to the underrepresentation of women in engineering. Young women who initially select engineering majors have already weathered pervasive effects of stereotyping during early adolescence (Leslie, McClure & Oaxaca, 1998; Xie & Shauman, 2003). Although women have made substantial progress regarding equity in the workplace in the last three decades, they remain

underrepresented among engineers. As recently as 2009, women accounted for less than 11 percent of the nation's engineers (National Science Foundation, 2011). Engineering is the most sex-segregated, non-military profession in the United States (National Science Foundation, 2009), and among industrialized societies more generally (Charles & Bradley, 2009). In fact, engineering is the STEM field that has proven the most resistant to diversity (Burack & Franks, 2004). This problem will continue to affect all women who may want to pursue and complete an engineering degree.

This is why it is important to understand what factors and experiences change the outcome for undergraduate Latina engineering students who persevere to obtain an engineering degree. It is imperative that we understand their journey so we can better assist other undergraduate Latina students to achieve their dreams within engineering colleges nationwide.

Guiding Research Questions

This study was guided by two over-arching research questions:

1. What are the lived experiences of undergraduate Latina engineering students?
2. What are the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program?

Purpose and Focus of the Study

The purpose and focus of this narrative inquiry case study were to explore the personal stories of four undergraduate Latina students who persist in their engineering programs. By using this approach, the Latina engineering students provided thick descriptions of their experiences. In addition, the purpose of this study was to gain an understanding of the voices of those undergraduate Latina students who persist in their engineering programs.

The Rationale

The rationale for this narrative inquiry case study was not to generalize the results to all institutions of higher education. A number of specific and unique factors influenced the narrative inquiry case study. Instead, my goal was to identify strategies that may be particularly effective in increasing undergraduate Latina student's persistence in engineering programs. I focused instead on the educational successes, positive interactions, and experiences that influence engineering persistence for undergraduate Latina students in engineering programs. This narrative inquiry case study built on previous research that moves away from models of pre-determining academic factors and STEM departure.

Cultural –Social Educational Context

The cultural, social, and educational context according to Cech, Rubineau, Silbey, and Seron, (2011) suggested that in male-dominated professions such as engineering, women tend to be less likely to develop a professional role of confidence because of the need to overcome cultural biases that men are a natural fit for engineering and better at these professions. The problem also continues for women that meet the admission requirement when entering the engineering programs. In addition, other studies investigated the barriers women engineering students encounter. For example, Marra, Rodgers, Shen, and Bogue (2012) found that the lecture format that dominates many engineering courses, especially at the lower levels could be detrimental in that it potentially creates a barrier between students and instructors. Thus, it is easier to disconnect from one's engineering program, as voiced by the women in Johnson's (2007) study, which indicated how science professors inadvertently discouraged women. Research about the educational experiences of women in the science, technology, engineering and mathematics (STEM) fields have also focused on the deficit perspective. Hall and Sandleer

(1982) provided the following examples:

- discouraging women's participation in class; preventing women from seeking help outside of class;
- making disparaging comments about women; disparaging women's intellectual abilities; implying that women lack commitment;
- ridiculing scholarship that deals with women's perceptions and feelings, and making direct sexual overtures to women.

Seymour and Hewitt (1997) added to Hall and Sandleer's (1982) study by describing the coldness of the engineering classroom as based on sarcasm and ridicule by faculty. Additional research on student perceptions of the engineering field has found there is a significance in the role of student confidence levels as they progress through engineering programs (Besterfield-Sacre *et al.* 2001; Burtner 2004; Cech *et al.* 2011; French *et al.* 2005; Seymour & Hewitt 1997). According to Sax (2008), part of the disproportionate bachelor's degree attainment across gender is a result of the low percentage of women who select science, technology, engineering, and mathematics (STEM) majors. The percentage of departure is higher for women than men.

Institutions of higher education often viewed Latino/a enrollment in engineering programs through a deficit lens. While answering these questions was essential to narrowing racial achievement gaps and attainment disparities in science, technology, engineering, and mathematics (STEM), most empirical studies amplify minority student failures and deficits instead of achievements (Harper, 2010, p. 64).

Theoretical Framework

However, my study looked at undergraduate engineering Latina students through the

community cultural wealth theoretical framework developed by Yosso (2005). This framework guided the analysis of data focusing on undergraduate Latina student's persistence in their engineering programs. By using Yosso's (2005) community cultural wealth theoretical framework as a guide for my study, it contributed to the understanding undergraduate Latina students' perseverance in their engineering programs. Knowing the experiences and strategies of theses undergraduate Latina students instilled a sense of empowerment, confidence, and unity among the women that participated in the study.

Community cultural wealth situated in the framework of understanding the constructs that influence the success of women pursuing an engineering degree. Yosso's (2005) work expressed the need to provide a structure that reflected students that are traditionally marginalized and underrepresented, in this case, undergraduate Latina's persistence in engineering programs. Yosso's (2005) model addresses six forms of capital (aspirational, linguistic, familial, social, navigational, and resistant capital (Yosso, 2005). These forms of capital are not mutually exclusive or static, but rather are dynamic processes that build on one another as part of community cultural wealth. Each form of capital was theorized in the following form;

- *Aspirational capital* refers to the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers.
- *Linguistic capital* includes the intellectual and social skills attained through communication experiences in more than one language and or style.
- *Familial capital* refers to those cultural knowledges nurtured among families (kin) that carry a sense of history, memory, and cultural institution.

- *Social capital* can be understood as networks of people and community resources.
- *Navigational capital* refers to skills at maneuvering through social institutions.
- *Resistant capital* refers to those knowledges and skills fostered through oppositional behavior that challenges inequality (Yosso, 2005, pp. 77-80).

I used five forms of Yosso's (2005) community cultural wealth when exploring the academic and lived experiences of Latina undergraduate students that persist in their engineering programs.

I explored how undergraduate Latina engineering students utilized each form of capital and how it related to their persistence in the engineering program. Clandinin and Connelly (2000) narrative inquiry was utilized to acquire the life experiences of undergraduate Latina students that have persisted in their engineering program. Narrative inquiry attempts to capture the whole story, whereas other methods tend to communicate an understanding of studying subjects or phenomena of certain points, but frequently omits the important intervening stages (Webster & Mertova, 2007). In-depth interviews helped articulate the academic and lived experiences that undergraduate engineering students applied in correlation with community cultural wealth. Using this framework provided a new lens to analyze and understand how undergraduate Latina engineering students persist in their engineering programs.

Significance of the Study

This study is important to others because despite the abundance of studies that have looked at factors affecting the persistence and academic integration of students pursuing science, technology, engineering and mathematics (STEM) majors, few studies have focused primarily on the experiences of undergraduate Latina students that persist in their engineering degree. This

study is important because women and in particular minority groups, including African Americans, and Latinas, continue to be underrepresented in the engineering programs. The racial and ethnic composition of women enrolled in engineering majors in 2008 (among all students) included 10.7 percent white, 2.2 percent Asian, 2 percent Hispanic, 1.4 percent black, 1 percent foreign national, and less than 1 percent Native American women (National Science Foundation, 2011). This study sought to unpack how the undergraduate engineering experiences of these women influence their persistence to obtain an engineering degree.

As part of the scholarly contribution, the results from this study further opened additional dialog about undergraduate Latina students that persist in their engineering programs, adding a non-deficit view of their academic experiences. This study informs policies, practices, and programs that support undergraduate Latina engineering student's persistence in engineering programs. Increasing the number of undergraduate Latina students that persist in engineering addresses three major issues. First, is the need for more engineers in the field. Second, is the persistent underrepresentation of women in engineering, which is a matter of equity. Third, the lack of women's viewpoints in engineering design is a matter of expanding perspectives and community.

This study built on the previous limited research of undergraduate Latina student's persistence in engineering programs. My research concentrated on the educational successes that influence undergraduate Latina student's persistence in engineering programs. I challenged the models of student achievement that purport underrepresented populations as subordinate to the mainstream.

Therefore, the focus of my study was to understand the experience of undergraduate Latina students who persevere in their engineering program. I gained an understanding of what

motivates and guides their persistence. Thus, my study contributed in understanding what ways undergraduate Latina students' experiences influence their persistence towards an engineering degree.

Existing Knowledge

Currently, there is a gap in the higher education literature that explores how underrepresented women persevere in the male-dominated engineering majors. The existing body of literature (Crisp, Nora & Taggart, 2009; Dixson, 2011; Wang, 2013) has focused on pre-college indicators and the first year experiences. Other literature (Blickenstaff, 2005; Morris and Daniel, 2008) indicated there are barriers that women experience such as campus climate, which can cause a deficit for underrepresented women in engineering.

For example, Crisp, Nora, and Taggart (2009) have researched indicators that predict "success" for students in STEM majors. They researched pre-college characteristics to determine and predict the persistence of students within STEM majors. Other scholars (Daempfle, 2003; Kuhn, Cruce, Shoup, Kinzie, & Gonyea, 2008) researched the first-year experience to understand the persistence of freshman within the STEM majors. Bernold, Spurlin, and Anson (2007) found that when it comes to engineering programs, there is a consensus that mathematics is the largest obstacle-causing drop out in the first year.

Existing literature by Marra, Rogers, Shen, and Bogue, (2009) suggests that women with an interest in engineering enter undergraduate programs with high levels of self-confidence in academics, but these levels decline significantly during the first year. The single biggest drop in engineering enrollment occurs between the freshman and sophomore year. However, women past this point who commit to a major in engineering are as likely as men to graduate as engineers (Huang *et al.*, 2000). Moreover, women who do choose to leave after the first year

perform as well or better than their peers in their freshman-engineering classes (Atkinson & Mayo, 2010). In other words, competent women are opting out of engineering careers in their first year. There is currently a gap in the existing literature exploring undergraduate Latina engineering students' persistence beyond their first year. Through my narrative inquiry, I gained new insight on the experiences that contribute and influence undergraduate Latina student's persistence within the engineering major.

Researcher's Positionality

The focus of my study was to investigate the experiences of undergraduate Latina students who are pursuing an engineering degree. My life experiences have opened up doors that have shaped who I am as a person today. I have a bachelor's degree in communications a master's degree in Education. I am working towards the completion of a doctoral degree in education. I was a speech and debate teacher for eight years in a title one high school. During that time, I learned life lessons about education, people, and communities. Most importantly, it provided me the opportunity to see the world through an alternative lens. I am a strong advocate that people should be involved in the community or the focus of their study before they offer solutions or try to initiate change. This will provide the researcher the opportunity to gain an in-depth understanding of the phenomenon. Involvement is the takeaway term. I have witnessed over the years the one size fits all mentality. It is imperative that we start looking for solutions through individual case studies. We need to study the environment and be involved within them if we wish to make that change. Just like students in the classroom, they bring with them their own personal abilities and strengths. We should individualize and not generalize our findings. I never thought of myself an advocate for social justice or change. I always just felt a passion for creating opportunities for all students that I encountered inside and outside the classroom.

However, as I reflect on my journey I feel that social justice always motivated me. I have heard every person enters the world in the same way. This statement could be true. I believe not everyone has the same opportunities during their lifetimes.

I spent the last eight years as a full-time academic advisor in a Hispanic Serving Institution (HSI). I advised students in the College of Engineering at a state university in Texas. I am also pursuing a doctoral degree in educational leadership and policy studies. I have been fortunate through family, friendships, and job experiences to witness the strength and determination of strong women role models. My mom has always been a source of strength in our family. My mom followed her dream of becoming a nurse. She graduated with an LVN degree at the age of forty-six. Leading by example, she went on to earn her RN degree at the age of fifty-three. My mom's gift has always been helping others and she continues to be a contributor to society each day as a compassionate nurse.

My sister was a professor for 20 years at a university in New England. She taught and mentored students throughout her career as an educator. She had a gift in helping students and in particular women that were facing challenges. She mentored them to achieve their full potential. It was not until after her funeral when I learn about the tremendous positive impact she had on the students she mentored or just had a brief encounter with. It taught me that one positive brief encounter could change a life forever.

My oldest brother has always taught me the value of volunteering your time and helping others that are in need. He has been active in the Lions Club for 23 years and served as a YMCA council chair for 9 years and on the board of directors for five years. He has assisted those in need and he has accomplished this without needing recognition. I have been fortunate enough to grow up around family members that have instilled in me the importance of helping

others. I am a Caucasian male in my mid-forties. I would like to serve as an ally to women engineering students as they navigate a male-dominated profession.

While working as an academic advisor in the College of Engineering, I noticed the underrepresentation of women in engineering classrooms. The student enrollment in the engineering department is around 2500, women represent about 16%. Because of the small population of women, I had limited advising contact hours with women engineering students. I think it is important to explore what factors, issues, and experiences that help undergraduate Latina students persevere in their academic and career goals and what drives them to excel. I feel strongly that exploring gender issues may provide insight for understanding equality.

Conclusion

Increasing the number of undergraduate Latina's in engineering would greatly increase the size of the available talent pool. This study serves higher education leaders by offering an insightful understanding of undergraduate Latina student's persistence in engineering. Furthermore, it is imperative to retain women in undergraduate engineering programs who can contribute to technological/scientific advancement. I used the framework of Yosso's (2005) community cultural wealth to conduct an analysis of the personal experiences of four Latina engineering students. This study consists of five chapters. Each chapter provides a detailed account of my study in order to understand the undergraduate Latina Student's persistence in an engineering program.

Chapter 2 focuses on relevant literature that informs my study, including women pre-college factors, campus resources, classroom and campus climate, faculty and mentoring, peer groups, family influences. Chapter 2 then moves forward and describes the empirical research that supports my study of women's persistence in the engineering program. The chapter also

describes the primary theories and frameworks developed by women scholars focusing on the persistence of women in STEM majors. The chapter then concludes by reinforcing the purpose of the study.

Chapter 3 addresses the research design, methodological approaches, and the theoretical framework that was used to explore the experiences of women who persist in the engineering degree. Chapter 3 begins by explaining and defining qualitative research, narrative inquiry, and case study. Chapter 3 continues by sharing the researcher's positionality. The chapter also addresses the following areas: the two guiding research questions, the process of the Institutional Review Board, the research site, the participants, and the recruitment process. The chapter then explains the following: method used for data collection, calendar and time lines, data necessary to understand women's persistence in engineering, data sources, analysis of the data, validity and trustworthiness, ethical considerations, limitations of the research design, and in conclusion highlights the theoretical framework.

Chapter 4 provides the analysis and interpretations of the thematic findings. Chapter 4 begins by providing the participants profiles. The chapter will continue by providing an analysis of the data by describing the five themes that emerged from the interviews. The chapter will explore the themes of discovery of academic passion, guidance and support from family and teachers, preparation for and commitment to persistence, the power of community and collective engagement, and commitment to helping others. The chapter will also address how the participants incorporated the themes to address oppressive behaviors. The chapter will move forward, providing an insight to the participants and their connection to each of the themes. The chapter will conclude by providing a new concept for community cultural wealth capital, fortitude capital.

Chapter 5 will present a summary of the study and present the key finding that emerged from the data. The chapter will also highlight the limitations of this study, and offer recommendations for future studies. I will share my journey and reflection on the dissertation process and conclude with closing thoughts.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

This chapter was organized according to relevant theories and constructs used to conceptualize the current study. It begins with a brief history of women's representation in the engineering field. It consists of six subcategories pre-college factors, campus resources and families, classroom/campus climate, faculty, peer groups and family influences. Each one has shown to play a role in STEM persistence. The literature review then moves forward and describes the empirical research that supports my study of women's persistence in the engineering program. The chapter will also describe the primary theories/frameworks highlighting the theories/frameworks by women scholars about woman's persistence in science, technology, engineering, and mathematics (STEM) majors. It is important to acknowledge that literature on Latina students in engineering majors was limited. Therefore, it was appropriate to provide a literature review encompassing all women in science, technology, engineering, and mathematics (STEM) majors and understanding multiple theoretical frameworks. I then was able to narrow down the literature review to Latinas in STEM degrees and was able to select two lenses to engage in the analysis. The chapter concludes by reinforcing the purpose of the study and describing the theoretical framework of the literature review that guided my study.

Individual Factors That Have Been Researched

Several bodies of literature (Vogt, 2003; Blickenstaff, 2005; Byars-Winston & Fouad, 2008; Kim, Fann & Misa-Escalante, 2009; Riegle-Crumb, Farkas & Muller, 2006), inform my study. Traditionally, engineering has been characterized as a white, male-dominated profession. In the first half of the twentieth century, women represented less than 1% of the nation's engineering students (Vogt, 2003). From 1970 to 1981, the total number of women that received a bachelor's degree in engineering rose from 338 to 7,117; in contrast, men earning

bachelor's degrees rose from 44,434 to 56,951 in the same period (National Science Foundation, 1984). To put this into perspective, in 1976 women represented 1,443 of over 38,000 individuals who earned an engineering bachelor's degree. In 1987, 11,203 women received their bachelor's degree in engineering (National Science Foundation, 1990). The number of women earning engineering bachelor's degrees from 1993 to 1998 remained relatively static: from 10,453 to 11,797 (National Science Foundation, 2005). Since the formation of the National Science Foundation's Program for Women and Girls (PWG), the number of women graduating in engineering continues to remain stagnant, from 9,665 in 1991 to 15,282 in 2004 (National Science Foundation, 2005). From 1978 to 1988, the total number of women employed in engineering increased from 28,800 to 122,220 (National Science Foundation, 1990). Although that is impressive growth, it is imperative that we understand how those numbers relate to the industry as a whole. By 1982, women comprised 71,900 of the nearly two million working engineers (National Science Foundation, 1984). In 1986, women comprised 99,000 of the 2,440,100 working engineers. These datasets clearly demonstrate a gross underrepresentation of women in the engineering profession.

Women have been pursuing undergraduate degrees in science and engineering in growing numbers over the past decades, but they remain underrepresented among majors and baccalaureate degree holders in fields outside the social, behavioral, and life sciences (Sonnert & Fox, 2012). This insight was documented in the data collected by the National Science Foundation and the Commission on Professionals in Science and Technology (Commission on Professionals in Science and Technology, 2006; National Science Board, 2006). However, research that might explain the persistence of women in STEM degree completion is incomplete, particularly concerning what happens to students once they admitted to STEM programs. Several

explanations have been put forth to account for why women remain underrepresented in STEM, such as bias and gender stereotypes, biological differences between men and women, and lack of female role models in STEM fields (Blickenstaff, 2005; Ceci & Williams, 2010; Hill, Corbett, & Rose, 2010; Meinholdt & Murray, 1999; Seymour & Hewitt, 1997). Bodies of literature have explored a wide range of topics including pre-college factors, institutional fit, classroom and campus climate, faculty, peer groups, and family. All of which contribute to the understanding of women's persistence in the STEM field. Persistence is defined by the National Student Clearing House as the percentage of students who remain enrolled, regardless of the institution persistence is defined by the (*Report: Snapshot Report-Persistence-Retention, 2014).*

Pre-College Factors

This literature reveals the importance of research involving women's experiences prior to pursuing a degree in engineering. Research by Blickenstaff (2005) demonstrated a number of explanations for the continued underrepresentation of women in the STEM fields. For example, departure from the STEM pipeline differ by gender and race with fewer women and minorities persisting in the STEM pipeline, especially beginning in elementary school, continuing through higher education, and into the workforce (Blickenstaff, 2005). George-Jackson (2011) also concluded that academic preparation and performance in high school and college are also important factors to consider in regards to understanding enrollment and persistence patterns in STEM fields. Academic preparation, as measured by standardized test scores and students' performance in high school math and science courses are predictors of performance in college-level math and science courses and account for persistence in STEM fields (Elliott et al*.,* 1996; Wang 2013; Pascarella & Terenzini, 2005).

Studies of engineering retention generally focus on high school GPA, SAT math, and

ACT math scores as key predictors of engineering retention and graduation (Lotkoiwski, Robbins & Noeth, 2004). Students who enter an engineering college with more quantitative knowledge in areas such as algebra, geometry, trigonometry, pre-calculus, calculus, and physical sciences are most likely to succeed in engineering (Veenstra, Dey, Herrin, 2009). Women college students who succeed in engineering usually bring strong backgrounds in math and science. The existing literature has identified pre-college factors, but has not identified the experiences of women that persevere in their engineering major. My study attempted to fill this gap by focusing on the personal and academic experiences regarding the persistence of undergraduate Latina students in engineering programs.

Classroom/Campus Climate

According to Seymour and Hewitt (1997) over half of all women who major in science, math, or engineering switch to other majors before completing an undergraduate degree, a much higher drop rate than for men. Morris and Daniel (2008) suggested that one of the reasons for this continued trend is that women do not feel welcome in traditionally male-dominated career fields and college majors. The perception of being unwelcome can cause women to feel that they are being ignored, treated differently or sexually harassed (Morris & Daniel, 2008). In research that focuses on engineering education, evidence of a chilly climate for women students is more consistent.

Several studies, (Colbeck, Cabrera & Terenzini, 2001; Haines, Wallace & Cannon, 2001) compared men and women students' experiences with discrimination in engineering. This phenomenon was labeled the ''chilly climate'' by Hall and Sandler (1982) who contended that differential treatment positions women at a significant educational disadvantage in college classrooms and negatively influences their performance. My study focused on the experiences of

the undergraduate Latina students in their engineering programs. I was interested in how those experiences helped them to persist in the engineering program.

According to Seymour (1995) women, interviewees reported a rude awakening that caused doubts and uncertainties about their scientific self-competencies in college courses. Women who had performed very well in high school received high standardized test scores and entered their chosen majors feeling extremely competent and capable (Nauta, Epperson, & Kahn, 1998; Seymour 1995). Shortly after entering college, they felt isolated, intimidated, and insecure, questioning whether they were in the right place after all (Seymour, 1995). Seymour (1995) also noted that classroom dynamics had a ripple effect in that biased faculty also tolerated the open rudeness of male students or teaching assistants towards women in their classrooms.

Vogt, Hocevar, and Hagedorn (2007) found that women students in STEM-related majors reported higher levels of perceived discrimination compared to male students. Fouad (2007) argued that masculine images of professions such as engineering, as well as the perception of barriers, are a powerful force in shaping women students' educational and occupational decisions. With the chilly climate that has been referenced over the past 33 years by (Hall & Sandler, 1982; Colbeck, Cabrera & Terenzini, 2001; Haines, Wallace & Cannon, 2001; Seymour, 1995; Vogt, Hocevar, & Hagedorn, 2007; Fouad, 2007), I was interested in understanding how Latina students persevere in the present academic climate and if the engineering classroom environment is unchanged. Another body of literature that informs my study examines the role of faculty in the success of students.

Faculty

According to Vogt, Hocevar, and Hagedorn, (2007), while many faculty members deny that they are discouraging their women students, very subtle, often undetectable, biases seem to

have had a negative effect on young women in engineering. Furthermore, Aronson (1999) pointed out that individuals reared in a prejudiced society often overlook and fail to challenge endemic and insidious beliefs. Is it possible that woman's perseverance in the engineering program might be connected to faculty mentoring? Some researchers (Miller, 2002; Nora & Crisp, 2007) determined that mentoring could have a positive effect on students. They suggested that listening, identification of the problem, providing encouragement, and providing moral support are all parts of the mentoring experience. In addition, previous research by Astin and Sax (1996) identified the positive effects faculty may have on women's persistence in engineering. In addition to the pedagogy used in many STEM courses, faculty also can have an impact on women's interest and retention in STEM majors through their classroom interactions. Ideally, such interactions will promote student interest in STEM, especially if students view faculty as role models for their own future STEM careers (Shapiro & Sax 2011). Indeed, students who encounter role models within the scientific community are more likely to follow through on their initial science aspirations (Shapiro & Sax 2011).

Marx and Roman (2002) also suggest that women role models have more effects that are positive on women's math performance than do male role models. Xu (2008) found that because women faculty members are under-represented in STEM, women students have limited access to same-sex role models and mentors compared to men. Faculty and professional role models can help women students by bolstering their confidence and encouraging them to see themselves as successful in STEM majors and careers in the future (Kim, Fann, & Misa-Escalante, 2009). My study involved students' perceptions of the role of faculty as it relates to the persistence in their undergraduate engineering programs. In addition to the importance, those faculties have in the success of women students; the literature on peer groups also provides insight on my study.

Peer Groups

Peer groups outside the classroom play a role in women's lives and career decision making. Riegle-Crumb, Farkas, and Muller, (2006) examined how high school girls' friendship groups can influence their advanced course taking patterns, especially in the areas of math and science. Specifically, friendship groups that have a high combination of female friends and performance in math and science facilitate their persistence in advanced courses, such as calculus and physics. Thus, one could argue that for women there is a relationship between high school friendship groups and the math and science preparation courses. They often provide influence to one another when considering a career in STEM. Women peers can also serve as role models for younger females interested in STEM (Kahveci, Southerland, & Gilmer, 2007). Interactions with peers could provide women with an avenue to exchange information, find study partners, and create informal peer role models (Hyde & Gess-Newsome, 2000; Kahveci, Southerland, & Gilmer, 2008). Another consideration of peer culture is the impact that the proportions of women in STEM majors have on women's interest and retention in STEM programs. It might seem logical that women benefit from having more women enrolled in STEM majors; however, research on this topic has yielded largely mixed results (Shapiro & Sax, 2011). My research focused on undergraduate Latina students' perseverance in their engineering major and explore further if peers contribute to persistence. If peers can have an influence on women pursuing engineering, it seems reasonable to examine the role of the family.

Family Influences

Studies by Tang, Fouad, and Smith (1999), and Bandura, Barbaranelli, Caprara, and Pastorelli, (2001) found that parents contribute significantly to the academics of their children. Parental expectations, career-related beliefs, and encouragement all influence the child's

academic and career-related interests and goals. Byars-Winston and Fouad (2008) found that parental involvement influenced undergraduate students' math and science self-efficacy and outcome expectations, which affected students' interests. This study explored the influence of parents and or family in regards to women's undergraduates' educational pursuits. Another body of literature that informs my study focuses on academic culture and climate. A few studies (Burge 2006; Ware & Lee 1988) found that women who place a high priority on their future families are less likely to enter science majors. Women's desires for family-flexible professions are also negatively associated with their intentions to persist in male-dominated careers (Frome *et al.*, 2006, 2008). The literature is inconclusive as to how the family plans might relate to women's decisions to leave engineering for another STEM major. Eccles (1994) reported that engineering has a reputation for creating even more work-family conflict than other STEM professions. There appears to be a gender discourse by linking women's desire to have families to their persistence in engineering. Research has acknowledged the pre-college factors, campus resources, family, classroom/campus climate, faculty, peer groups, and family influences as they relate to STEM majors. I explored how this these factors might be related exclusively to undergraduate Latina students' persistence in the engineering programs by looking through the theoretical lens of Yosso's (2005) community cultural wealth.

The concept of academic self-efficacy provided a springboard for my research study, yet my research interests go beyond academic self-efficacy. Bong and Skaalvik, (2003), and Schunk, (1991) found that academic self-efficacy refers to the personal beliefs that individuals form specifically toward academic domains, and beliefs that they can successfully perform given academic tasks at designated levels. Insofar as it affects students' cognitive, motivational, and affective processes, including self-confidence, academic self-efficacy may play a role in

first-year women engineering students' decisions to enter and pursue the engineering major (Chemers, Hu & Garcia, 2001). Research by Chemers, Hu, and Garcia (2001) has shown that academic self-efficacy is related to students' confidence in mastering academic subjects. They indicate that students with high levels of academic self-efficacy "make greater use of effective cognitive strategies in learning, manage their time and learning environments more effectively, and are better at monitoring and regulating their own effort" (Chemers, Hu & Garcia, 2001, p. 56). The researchers have covered academic self-efficacy in abundance. Missing from the self-efficacy literature was the Latina engineering students' experiences towards persistence. I wanted to explore deeper the contributing factors that contribute to the Latina student persistence in the engineering programs. Through the lens of Yosso's (2005) community cultural wealth this study expands on previous research by exploring the aspirational capital, linguistic capital, familial capital, social capital and navigational capital of undergraduate Latina engineering student that persist in their engineering programs. Using this lens provides an in-depth comprehensive view. It acknowledges that there are multiple facets when it comes to undergraduate Latina student's persistence in engineering programs.

Empirical Synthesis of Empirical Studies

This study focused on understanding what influences the success of undergraduate Latina engineering students and their persistence in an engineering program. As a researcher, I recognize that other frameworks exist for studying this phenomenon (e.g., cultural capital, career perceptions or social capital, student engagement, critical race theory, validation theory); however, I first explored self-efficacy, academic self-efficacy together with community cultural wealth. Self-efficacy is a concept rooted in social psychology (Bandura, 1997). Recent data have shown that for women entering engineering, the skills gap has or is closing for both women

and men (Jacobs, 2005) yet we continue to see a low representation of women in engineering. Self-efficacy and academic self- efficacy thus offered a possible framework for exploring this phenomenon, which I first explored and highlight in this section. Looking through these studies, I found a further enhanced theoretical framework that addressed the lived experiences of the Latina student's persistence in the engineering program. These empirical studies provided the foundation to recognize the need to explore Yosso (2005) community cultural wealth.

Both women and men scholars have incorporated self-efficacy theory in order to gain an understanding of college students. Zeldin and Pajares (2000) employed a qualitative methodology to discover the role played by self-efficacy beliefs in the career and academic paths of fifteen women with STEM careers. They developed an interview protocol based on the theoretical sources of self-efficacy that allowed participants to explore the ways in which they felt their confidence developed without leading them to speak specifically about any one source in greater frequency than another. An analysis of these narratives revealed that social persuasions and vicarious experiences were critical sources of the women's self-efficacy beliefs and that they recalled those types of incidents to a greater extent than recalled performance accomplishments. The authors found familial, academic, peer nurtured influenced vicarious experiences and these influences were recalled primarily in terms of encouragement or vicarious experiences (Zeldin & Pajares, 2000). Those self-beliefs were shown to help develop the effort, persistence, and resilience required to overcome personal, social, and academic obstacles. In Zeldin and Pajares (2000) study, women consistently recalled experiences that involved an influential person, often during a critical time, who helped them, develop their beliefs about their capabilities while also developing their competencies. The findings of Zeldin and Pajares (2000) suggested that the perceived importance of vicarious experiences and social persuasions might be stronger for

women in male-dominated domains than were suggested by previous research.

A qualitative study by Hutchison-Green, Follman, and Bodner (2008) explored the self-efficacy beliefs held by students enrolled in their first engineering course. They addressed two questions: What experiences during a first-semester engineering course influence students' engineering efficacy beliefs? How do students interpret those experiences when forming their engineering efficacy belief? This particular study was designed to enhance their understanding of engineering self-efficacy belief formation among first-semester engineering students based on Bandura's (1997) self-efficacy theory. Participants who were interviewed prior to the start of the semester reflected on their high school experiences. Their experiences completed months earlier were largely confirmed successes marked with the students' successful graduations from high school (Hutchison-Green *et al.*, 2008). In contrast, mid-semester participants were forced to consider ongoing ENGR 106 experiences that had not yet come to a final endpoint. The differences identified in how the students discussed their experiences that shaped their engineering efficacy at different points in the semester might change the results. It may suggest that mastery experiences require some maturation time before a student is able to recognize them as such (Hutchison-Green, *et al.*, 2008). This is an important notion. It leads to the need to conduct a study looking at undergraduate Latina junior and senior students to understand their persistence within the engineering program.

In another quantitative study by MacPhee, Farro and Canetto, (2013) focused on the academic self-efficacy and performance of female and male undergraduates in STEM fields as well as those who were low-socioeconomic status (SES) and/or African American, Latina/o, or Native American. Academic self-efficacy, defined as confidence in one's ability to accomplish academic tasks, affects educational and occupational interests and expectations. Judgments about

oneself, including competence in various domains, entail learning from vicarious experience in a social context as well as verbal persuasion from powerful others (MacPhee, Farro, & Canetto, 2013). Specifically, their study assessed students' academic self-efficacy and performance longitudinally from the beginning of the program to and completion of a STEM mentoring program. Their findings suggested at the time of college admission, women perceived themselves as academically weaker than men, even though they had similar academic performance scores. Yet by graduation, women's academic self-efficacy was similar to men. Whether the problem is one of the women underestimating their academic skills or men overstating their abilities, the consequences are often more negative for those who are too modest rather than those who are too bold. MacPhee, Farro, and Canetto (2013), concluded that sex differences in academic self-confidence contribute to women's underrepresentation in STEM. I would argue that it is highly important to understand why women persist in order to elevate successful women in STEM majors. The framework of self-efficacy been used in both quantitative and qualitative studies and continues to be a highly regarded theory in understanding higher education STEM persistence. However, there are still other theories that have focused on Latino students.

In an effort to understand how to attract and retain Latino/as in engineering, Flores, Navarro, Lee and Luna (2014) studied quantitative longitudinal data to test a model based on the portion of Social Cognitive Career Theory (SCCT). Specifically, their study explored the role of engineering-related learning experiences in the development of engineering-related self-efficacy and engineering-related outcome expectations among a sample of engineering students at a Hispanic Serving Institution (HSI) and explored whether gender and race/ethnicity moderated the relations among these variables (Flores, Navarro, Lee & Luna, 2014). Their research found

performance accomplishments across time was significant for both genders, but stronger for women than men were. In regards to verbal persuasion, they found across time, it was significant for both racial groups, but stronger for Whites than Latino/as. Although family, friends, and professors appear to be verbally encouraging engineering students' progress in the field, regardless of race, such reinforcement and encouragement appear to be more prominent for Whites. Because women and Latino/ as are underrepresented in engineering fields, they have fewer opportunities to observe others who are like them succeeding in engineering roles and tasks. Flores *et al.*, (2014) data suggested that other women and Latino/as that the students do encounter who are engaged in engineering-related activities may serve as very powerful role models.

The literature review has been persistent in identifying self-efficacy as a highly regarded theory in understanding student persistence. However, it does not focus exclusively on undergraduate Latina's persistence. Including other genders and ethnicities, has the potential to overstate the outcomes that are extremely important in order to understand the Latina population. Therefore, my study focused on the framework of Yosso's (2005) community cultural wealth and the explored the area of intersectionality of undergraduate Latina's students that persist in an engineering program.

Critique of Empirical Studies

The following empirical research provided a foundation for my study of undergraduate Latina students that persist in an undergraduate engineering program. However, each study did encounter a few limitations that will allow for further research on undergraduate Latina engineering student persistence in the engineering programs.

Zeldin and Pajares (2000) employed qualitative methodology to discover the role played

by self-efficacy beliefs in the career and academic paths of fifteen women with STEM careers. A few limitations involved the participants in the study. The fifteen selected participants were derived from a combination of network connections and primary contact. The researchers also gained access to a large northwestern software company through personal contacts who then recommended women that might be willing to participate. This process could limit the diversity of the participant population within the study. In the sample, only two out of the fifteen participants were not Caucasian. Anyone referring to this study should exercise caution when making inferences about other women in similar situations.

The qualitative study by Hutchison-Green, Follman, and Bodner (2008) explored the engineering self-efficacy beliefs held by students enrolled in their first engineering course. The findings were compiled by using a thematic analysis of one-on-one interviews with twelve students enrolled in their first-semester engineering course. They selected twelve students from ENGR 106 introductory engineering course, which included seven men and five women. A major limitation of this study is measuring freshman undergraduate's self-efficacy within a three-month period. According to the Hutchison-Green, Follman, and Bodner, (2008) students should begin experiencing and confirming mastery as soon and as often as possible. I would argue those incoming freshmen are still adjusting to the college experience beyond the first three months of their education. The researchers also concluded that they believe that although men and women alike experience both positive and negative performance comparisons, men are more likely to focus on positive experiences while women tend to reflect on negative experiences. One should use caution and not generalize or make an assumption using such a small sample.

MacPhee, Farro, and Canetto, (2013) quantitative longitudinal study examined academic self-efficacy and performance among Science/ Technology/Engineering/Math (STEM) majors

who are underrepresented in STEM education and occupations. They looked at women, specific ethnic minorities, and low-SES individuals. However, a few limitations might have skewed the statistical results. One of the limitations of the study show there was an inadequate statistical power, and therefore they were unable to test the intersectionality of sex, ethnicity, and SES. A larger student population might have produced an adequate statistical power. Yet another limitation pertains to the measure used to assess academic self-efficacy. Although the What I am Like measure provides a comprehensive picture of college students' self-perceptions, it is not necessarily the ideal choice for assessing academic self-efficacy.

Flores, Navarro, Lee and Luna (2014) quantitative study explored the role of engineering-related learning experiences in the development of engineering-related self-efficacy and engineering-related outcome expectations among a sample of engineering students. The researchers used a Social Cognitive Career Theory (SCCT). This theory is a highly utilized vocational theory that explains the development of career interests, career choices. The study did focus on an HSI, which is also the demographic of my study. However, the study consisted of 574 participants 177 women, 397 men. Stated another way, males represented 69% and the women represented 30.8% of the study. A key limitation was the male population heavily influenced the study.

These empirical studies used self-efficacy as their framework. However, their focus consisted of an analysis of both genders, including all STEM degrees and first-semester experiences. The two most recent studies were quantitative studies, which did not provide the voices of the participants. Furthermore, research samples did not consider exploring an HSI as a research site. This further justifies the need for a qualitative study to explore exclusively the persistence of undergraduate Latina engineering students beyond the freshman and sophomore

years.

Understanding the application of self-efficacy and academic self-efficacy has contributed to understanding academic performance, which focused of both genders in STEM. However, if the Latina student's persistence in engineering depends on mastery skills and socialization with people only in the program, then the Latina student is at a great disadvantage due to the nature of the male-dominated engineering program. It is also important to acknowledge that the self-efficacy framework does not take into account the multiple identities within gender and race. With this understanding, I have chosen Yosso's (2005) community cultural wealth framework as the theoretical lens of the study.

Yosso's (2005), community cultural wealth framework draws upon an interdisciplinary knowledge based on migrant studies, critical race theory, sociology, and gender studies. The diffuseness of this approach responds to the need to adapt a diverse theoretical lens in order to reconceptualise approaches to retaining and supporting students from diverse backgrounds. Yosso's (2005), community cultural wealth has been theorized in relation to Hispanic students and communities of color within the USA, the capitals that Yosso's (2005) defines are not without cultural or ethnic specificity, but arguably, this framework has broadly considered application to other non-dominant and under-represented groups in society (Shea, 2015). This framework will address the Latina student's persistence in engineering.

This motivated me to dig deeper into my understanding undergraduate Latina engineering students and their persistence in an engineering program. Although I originally considered using self-efficacy as a framework, I felt there was a gap in the research that did not truly identify the Latina engineering student's voice. I have found that Yosso's (2005), community cultural wealth framework provided a more resourceful tool in understanding undergraduate Latina engineering

students' persistence in their engineering programs. With this as a focus, a qualitative study using Clandinin and Connelly (2000) narrative inquiry provided the ability to unpack the experiences of the undergraduate Latina engineering student as they persist in their programs. Clandinin and Connelly (2000) narrative inquiry attempted to capture all the intervening stages of the participants lived experiences.

Primary Secondary Theories

The primary theory/framework that guided my study was Yosso's (2005) community cultural wealth. Critical race theory influenced and shaped Yosso's (2005) community cultural wealth. Critical race theory (CRT) shifts the research lens away from a deficit view of communities of color as places full of cultural poverty disadvantages, and instead focuses on and learns from the array of cultural knowledge, skills, abilities, and contacts possessed by socially marginalized groups that often go unrecognized and unacknowledged. Critical race theory is a crucial component of Yosso's (2005) community cultural wealth.

I focused on women scholars to explore the notion of woman's persistence in STEM majors. I decided to incorporate Yosso's (2005) community cultural wealth theoretical framework because the literature suggests it was developed and grounded within my student population. I explored Trenor, Yu, Waight, Consuelo, Zerda, and Sha (2008) study on social cognitive theory to see if it translated to Yosso's (2005) community cultural wealth. I also explored the area of intersectionality. Intersectionality makes plain that the combined complexities of gender, race, class, and sexuality simultaneously affect the perceptions, experiences, and opportunities for everyone living in a society stratified along these dimensions (Cole, 2009). The lens provided an opportunity to explore multiple frameworks. In the process, Yosso's (2005) community cultural wealth became the primary framework that guided my study.

Critical Race Theory

The critical race theory (CRT) movement was a collection of activists and scholars interested in studying and transforming the relationship among race, racism, and power. Rooted in critical community and scholarly traditions dating back to W. E. B. DuBois (1903), CRT evolved out of critical legal studies in the 1980s as a movement seeking to account for the role of race and persistence of racism in American society (Delgado, 1995).

The aforementioned description of CRT as a critique of racism in the law and society emerged as a race-based critique growing from the National Critical Legal Studies conferences that took place at the Harvard and UC–Berkeley Law Schools in the early to mid-1980s (Crenshaw, Gotanda, Peller, & Thomas, 1995; Lawrence, 2002). According to Lynn and Parker (2006), this group of law professors and students began to question the objective rationalist nature of the law and the process of adjudication in U.S. courts. They criticized the way in which the real effects of the law served to privilege the wealthy and powerful in the U.S. while ignoring the rights of the poor to use the courts as a means of redress (Lynn & Parker, 2006). Out of this evolving critique of the role of law in society, the second strand of critical scholarship emerged through the writings of Derrick Bell, Mari Matsuda, Richard Delgado, Angela Harris, and Kimberle Crenshaw. These scholars argued that the critical legal studies (CLS) movement did not go far enough in challenging the specific racialized nature of the law and its impact on persons of color.

Critical race theory (CRT) scholars initially critiqued ongoing societal racism in black and white binary terms and focused on the slow pace and unrealized promise of civil rights legislation. They eventually advanced the framework to examine the multiple ways African Americans, Native Americans, Asian Americans, Pacific Islanders, Chicanas/os, and Latinas/os

continue to experience, respond to, and resist racism and other forms of oppression (Arriola, 1998; Caldwell, 1995; Wing, 1997, 2000).

Critical race theory (CRT) rose to prominence in the early 1990s, education scholars began to use it as a tool for explaining existing inequalities in education (Ladson-Billings & Tate, 1995; Tate 1997). Yosso, Parker, Solorzano and Lynn (2004) linked the origins of critical race theory (CRT) and education literature beyond legal discourse to ethnic studies, Marxism, feminism, cultural nationalism and other disciplines. They argued that the set of perspectives, propositions, and questions that extend from these discourses for the basis of what we now recognize as CRT in educational research and theory.

Solórzano (1997) identified at least five tenets shared by critical race theory (CRT) scholarship and has worked alongside a growing number of scholars to apply this dynamic framework to education. The first tenet is the intercentricity of race and racism. Critical race theory (CRT) in education starts with the premise that race and racism are endemic to and permanent in U.S. society (Bell, 1992; Russell, 1992) and that racism intersects with forms of subordination based on gender, class, sexuality, language, culture, immigrant status, phenotype, accent, and surname.

The second tenet challenges the dominant ideology. Critical race theory (CRT) challenges claims of objectivity, meritocracy, color blindness, race neutrality, and equal opportunity, asserting that these claims camouflage the self-interest, power, and privilege of dominant groups.

The third tenet is the commitment to social justice. Critical race theory (CRT) social and racial justice research agenda exposes the "interest convergence" of civil rights gains, such as access to higher education (Bell, 1980, 2004; Delgado & Stefancic, 2000; Taylor, 2000), and

works toward the elimination of racism, sexism, and poverty as well as the empowerment of people of color and other subordinated groups.

The fourth tenet involves the centrality of experiential knowledge. CRT recognizes the experiential knowledge of people of color as legitimate, appropriate, and critical to understanding, analyzing, and teaching about racial subordination (Carrasco, 1996; Delgado Bernal, 2002). CRT explicitly listens to the lived experiences of people of color through counter-storytelling methods such as family histories, parables.

The fifth tenet looks at the interdisciplinary perspective. CRT extends beyond disciplinary boundaries to analyze race and racism within both historical and contemporary contexts. CRT can be used to scrutinize the ways in which race and racism, directly and indirectly, affect ethnic minorities (Yosso, 2005).

Community Cultural Wealth

It is imperative that we can see the connection between Yosso's (2005) critical race theory and community cultural wealth. Critical race theory (CRT) recognizes the experiential knowledge of people of color as legitimate, appropriate, and critical to understanding, analyzing, and teaching about racial subordination (Carrasco, 1996; Delgado Bernal 2002). Critical race theory (CRT) challenges deficit thinking and understands the empowering potential of the cultures of communities of color. Critical race theory (CRT) and community cultural wealth shift the center of focus from notions of White, middle-class culture to the cultures of communities of color. Critical race theory (CRT) and community cultural wealth theory explicitly listen to the lived experiences of people of color through counter-storytelling methods such as family histories (Yosso, 2006). Indeed, a critical race theory (CRT) lens can 'see' that communities of color nurture cultural wealth through at least six forms of capital such as aspirational,

navigational, social, linguistic, familial, and resistant capital. Yosso's (2005) states critical race theory (CRT) research begins with the perspective that communities of color are places with multiple strengths. Yosso's (2005) community cultural wealth shifts the research lens away from a deficit view of communities of color as places full of cultural poverty or disadvantages, and instead focuses on and learns from these communities' cultural assets and wealth (Solórzano & Solórzano, 1995; Valencia & Solórzano, 1997; Villalpando & Solórzano, 2005). Yosso's (2005) community cultural wealth framework using the lens of critical race theory centering the research, pedagogy, and policy on communities of color and calls into question White middle-class communities as the standard by which all others are judged. This shifting of the research lens allows critical race scholars to 'see' multiple forms of cultural wealth within communities of color.

The first qualitative study focused on Yosso's (2005) community cultural wealth. Its focus was to understand the educational experiences of Latino college students. Luna and Martinez (2013) study used Yosso's (2005) theoretical framework of community cultural wealth model. Community cultural wealth shifts the view from a deficit perspective to assets that communities of color acquire. Community cultural wealth includes an array of cultural knowledge, skills, abilities, and contacts of socially marginalized groups that usually go unrecognized, acknowledged or celebrated (Yosso, 2006). For their study, Luna and Martinez (2013) focused on four forms of community cultural wealth. They explored four forms of community cultural wealth. The first form included aspirational or the ability to maintain hopes and dreams. The second form included familial or cultural knowledge nurtured among familia or kin that carry a sense of community history, memory, and cultural institution. The third form included social or networks of people and community resources. The last form included

navigational or skills for maneuvering through social institutions not created with Latinos in mind (Yosso, 2006).

They collected data over a span of a year. They had two focus groups with a combined number of seventeen participants. The participants identified as Latino, Hispanic, or Chicano. The study took place at a large public university in a southwest metropolitan city. They had two different focus groups that would participate in the open-ended questioning.

The study examined how a group of high achieving Latino college students used a variety of community cultural wealth, knowledge, skills, abilities, and networks to attain educational success. Several important findings emerged from the study. One key finding is that Latino parents largely shape their children's academic aspirations. Many students in their study reported not being aware; they could handle college-level work. What made the difference was the encouragement they received from their families that facilitated high educational aspirations and achievement.

The study also sheds light on the social and the navigational capital importance. For example, students reported learning about what classes they needed to take in high school to improve their opportunities for college, where to access financial aid and consciously seeking your own people for support. Relationships were very important to the success of the students. An important finding in this study suggested, lack of success in high school does not necessarily translate to failure in college.

In another study by Sandoval-Lucero, Maes and Klingsmith (2014) they used Yosso' (2005) framework of social and cultural capital, their study examined successful African American and Latina/o community college students. They collected their data by using focus group interviews with twenty-two African American and Latina/o undergraduates in an urban

community college all of which had a GPA of 2.5 or higher. The authors reveal how social and cultural capital gained from students' relationships and interactions with friends, family, faculty members, student affairs staff, and college support services influenced their successful college outcomes.

These community college students spoke to three major themes that contributed to their success as students. Those themes were: (1) relationships with faculty, (2) family support and (3) campus engagement and support.

The first theme focused on the role of faculty. Overwhelmingly participants in their study spoke about their instructors as being instrumental to their success in college. The number one theme echoed by all students related to the accessibility of their instructors.

The second theme in their study focused on family. They found that family played a critical role in the success of the student participants. The participants defined family in many ways. Some participants were children in a family unit, while others were parents themselves. The participants also defined support in a variety of ways; from allowing someone to live at home while in school, having a spouse that would handle the financial responsibilities. Family members also provided moral support and encouragement for schoolwork.

The third theme among all focus group participants in their study was campus engagement and support. The ways in which students connected to the campus varied from obtaining work-study jobs, to feeling connected in class, to having helpful staff members assist in their academic processes, and joining clubs and organizations.

The authors then looked at four forms of capital that Yosso (2005) community cultural wealth developed. They determined that aspirational, family, social, and navigational capital influenced their successful college outcomes.

Aspirational capital involves maintaining hopes and dreams for the future, regardless of real or perceived barriers (Yosso, 2005). Many of the participants in the study aspired to gain employment in an upper management position, or in occupations with high levels of responsibility.

Familial capital encompasses the cultural knowledge maintained among the family that carries a sense of community history, memory and cultural intuition (Yosso, 2005). Many participants in their study described the power of receiving encouragement and support from family members, which sustained them through their academic programs. The support they received, in turn, allowed the participants to view themselves as role models to their younger family members, which inevitably enhanced their overall family legacy in higher education.

Social capital involves accessing social contacts, networks, and community resources to help a student identify and earn scholarships, maintaining the tradition of "lifting as we climb" (Yosso, 2005). Many student participants noted how they gained social capital as they benefitted from the real world expertise as well as the access given to them by their faculty members, many of whom were adjunct faculty members.

Navigational capital includes the skills of moving through social institutions, such as colleges, giving the student the ability to be invulnerable and successful (Yosso, 2005). Many of the study participants who had attempted to enroll in college at one time, but were unsuccessful are now enrolled once again in higher education. Many have gained a new sense of navigational capital where they now have the skills to maneuver themselves through the sometimes-intimidating college system.

In conclusion, their study demonstrated that, contrary to popular belief, diverse families support their children's college aspirations, and students feel an obligation to meet those family

expectations about college completion. In fact, they determined family engagement was a source of support and strength as diverse students navigate the community college experience (Sandoval-Lucero, Maes & Klingsmith 2014).

A recent study by Samuelson and Litzler (2016) focused on two underrepresented groups, African American and Latino engineering students. The study explored similarities and differences at the intersection of race/ethnicity and gender. The assets-based theory of Yosso's (2005) community cultural wealth helped identify the cultural resources that the students develop in their families and communities and brought with them to their engineering programs. They examined four research questions: What types of community cultural wealth did African American and Latino students make use of in their engineering programs? How, if at all, did the different types of capital contribute to student persistence? What, if any, distinctions emerged between African American and Latino students? What, if any, distinctions emerged between men and women of the same race, and between African American and Latino students who are the same gender?

The design of their study was a qualitative analysis sample included interviews with thirty-one engineering undergraduates: 11 African American students (five women and six men) and twenty Latino students (eight women and twelve men). Seven of the twenty Latino students were from Hispanic Serving Institutions.

Their results suggested each type of community cultural wealth took various forms and contributed to student persistence. They found that students alluded to navigational and aspirational capital most often. African American men and women activated particular types of capital differently. Women with different racial/ethnic backgrounds also relied on different forms of capital or methods of activation. Students offered a number of community cultural wealth

examples.

Of the thirty-one students in their sample, 68% (21) described at least one form of navigational capital. A number of students in their study discussed qualities and competencies that contributed to their navigational success in educational institutions, mainly their own success in high school and engineering programs. They found common competencies included mathematical and analytical abilities, as well as the ability to learn things on one's own, manage one's time, build relationships with faculty, and ask questions. The authors found that 61% (19) participants in their study referred to one or more forms of aspirational capital. They found that student's career goals and aspirations functioned as capital in that they reflected an ability to maintain dreams for the future, regardless of real and perceived barriers. They also indicated that 39% (12) described familial capital as an important contributor to persistence. Several students described family support and encouragement as motivation to continue in engineering. Having their parents "saying I can do it" or "supporting me in whatever decision I make" was crucial for some students' persistence. Lastly, they found 39% (12) indicated a form of resistant capital as a contributing factor to persistence. Several students offered examples of resistant capital in the form of conformist resistance, the students' were motivated by a need for social justice, but they did not analyze oppressive systems.

The authors concluded that the types of capital are dynamic in how they interact with one another. Community cultural wealth (Yosso, 2005) is a useful construct for developing a deeper understanding of engineering persistence and the success of underrepresented students of color in engineering. Using the assets-based concept of community culture wealth avoids deficit-remedies that fail to overcome educational barriers faced by certain groups of students. Instead, it offers a unique approach to understanding the factors that support underrepresented minority

engineering student persistence by examining different types of capital that students develop within their families and communities (Samuelson & Litzler, 2016).

Social Cognitive Theory

Another study by women scholars used social cognitive theory as the framework incorporating mixed methods. Trenor, Yu, Waight, Consuelo, Zerda, and Sha (2008) emphasize the interplay of personal factors, environment, and behavior to explore the educational experiences of female students in an ethnically diverse learning environment. Specifically, they investigate the relations of ethnicity to female students' perceptions and experiences related to engineering, as well as their selection and persistence in undergraduate engineering major. This study is similar in regards to being researched at an HSI. The sample was divided into four major ethnicity groups: 1) African American or Black 2) Asian 3) Hispanic and 4) White. The findings produced five emerging themes. The first theme they found was that family influences affected major and career choice in different ways for students of different ethnicities; specific roles varied with parental education level and occupation. While school personnel encouraged participants of all ethnicities to pursue engineering, their influence proved more instrumental for Hispanic students. The second finding that emerged was White, African American/Black, and Asian students expressed a career in very general ways. Hispanic students were more likely to express their choice of engineering, specifically as a means of helping their immediate family or home community. The third finding suggested that the participants' sense of belonging contributed to a positive learning experience and eased the transition to college for students of all ethnicities. The fourth finding as noted through in the literature review that lack of academic preparation/study skills contributed to a difficult adjustment for some students of color. In addition, the fifth finding also supported by the literature review and found conflicting role

struggles exist for many students of color. Time management issues result due to financial obligations, commuting to campus, or both. The mixed method approach turned out to be essential in understanding the data. For example, in their quantitative study, they had five survey items related to perceived barriers. Tenor et. al., (2008) thought perhaps they did not address the most pertinent barriers faced by the participants. By adding a qualitative approach, they were able to explore additional information that might have been uncovered. They added interviews, which allowed the participants to express the perceived barriers that existed using an open-ended question format. This technique subsequently revealed that barriers for this sample related to financial worries, commuting, attempting to balance school with working, and lack of college-educated or engineering role models. Students of color reported conflicting role struggles and for some lack of academic preparation. This further supports the need for a qualitative narrative inquiry to understand the experiences of undergraduate Latina students that persist in the engineering major.

Intersectionality

Intersectionality makes plain that gender, race, class, and sexuality simultaneously affect the perceptions, experiences, and opportunities for everyone living in a society stratified along these dimensions (Cole, 2009). Intersectionality theory refers to the overlapping of social differences in the creation of unique social identities, such as the understanding that identities such as race, gender, and class exist in relation to one another (Carbado, Crenshaw, Mays & Tomlinson, 2013). An intersectional theoretical framework is particularly useful for understanding how and why women from a variety of social positions are more or less likely to pursue or commit to science and engineering and eventually pursue careers in these fields (Bruning, Bystydzienski & Eisenhart, 2015). This lens could provide an opportunity to expand

the notion of intersectionality within self-efficacy to explore women's persistence in the engineering major.

As Shields noted:

> Intersectionality first and foremost reflects the reality of lives. The facts of our lives reveal that there is no single identity category that satisfactorily describes how we respond to our social environment or are responded to by others. It is important, to begin with this observation because concern about intersectionality from a theoretical or research perspective has grown directly out of the way in which multiple identities are experienced. (p. 304)

The term intersectionality was first used by legal scholar Kimberle Crenshaw in her work on violence against women of color. Drawing on Crenshaw's foundation, Collins (2007), Dill and Zambrana (2009) identified four characteristics that define intersectional research and analysis. The first characteristic centers on the lived experiences of individuals, and specifically people of color and other marginalized groups. The second characteristic includes complicating identity and examining both individual and group identity. The third characteristic explores identity salience as influenced by the system of power and privilege and unveiling power in interconnected structures of inequality. The fourth characteristic includes advancing a larger goal of promoting social justice and social change (Collins, 2007; Dill & Zambrana, 2009).

Research by Lord, Camacho, Layton, Long, Ohland, and Washburn, (2009), used the framework of intersectionality theory; their study recognized that women of different ethnic backgrounds warranted disaggregated analysis because they did not necessarily share a common experience in engineering education. They conducted a quantitative longitudinal study. Their data source for their research used the Multiple-Institutional Database for Investigating

Engineering Longitudinal Development (MIDFIELD) drawing from more than 70,000 students who matriculated in engineering at nine universities. Quantitative institutional data analysis was the measurement used to conduct the study. They examined one research question: How does the persistence of engineering students (measured as enrollment to the eighth semester) vary by disaggregated combinations of gender and race-ethnicity? Their findings revealed that for Asian, Black, Hispanic, Native American, and White students, women who matriculate in engineering are more likely to persist in engineering compared to other eighth semester destinations. Of all groups, Native American women are most likely to leave the university and the least likely to persist in engineering. The low persistence of Native American women, in general, is troubling.

As Hancock (2007) has argued, intersectionality does not simply describe a content specialization addressing issues germane to specific populations. Rather, it also is a paradigm for theory and research, offering new ways of understanding the complex causality that characterizes social phenomena. Over the past two decades, feminist scholars of color have argued for a more nuanced and differentiated understanding of gender, asserting that "women" and "men" are not monolithic groups and that experience of gender cannot be understood outside of a wider prism of difference that accounts for race, social class, nationality, sexual orientation (Anderson & Collins, 2007).

In Lord's *et al.,* (2009) analyses of engineering persistence, she stated that failing to disaggregate data on women by race produces results that are not only erroneous an overgeneralized but also counterproductive, rendering minority women "invisible". According to Lord *et al.,* (2009), women in engineering do not necessarily share common experiences of marginality women of color may experience both sexism and racism, compounding their experiences of exclusion.

The authors provided an alternative lens to consider when analyzing data. The primary, secondary theories in the literature review helped me, explore different loans that were possible for analysis. I chose Yosso's (2005) community cultural wealth to explore Latino student's persistence in their engineering programs. The authors that used Yosso's (2005) community cultural wealth did not participate in the deficit framework. They intentionally focused on the success of the Latino students and provided an in-depth narrative of the interviews. The studies increased my focus and awareness of alternative possibilities.

Critique of Primary and Secondary Theories

Community Cultural Wealth

Luna and Martinez (2013) study offered a few limitations. The first is the sample size. The study took place in a metropolitan city with a population of 1.5 million people. The sample size included only eighteen participants using a purposeful sample. The findings may not represent the Latino population as a whole. Researchers should use caution not to generalize the findings. However, I see that this study was able to make a case the possibility that community cultural wealth can be a factor in student success. Due to the size of the Latina population in my study I believe that to add community cultural wealth to my theoretical tool box could provide me with an additional lens to explore women's persistence in an undergraduate engineering program.

Sandoval-Lucero, Maes, and Klingsmith (2014) study also presented a few limitations. It is suggesting that all community cultural wealth is the same when comparing genders. They also grouped ethnicities together. One of their limitations included the sample size and focused only on one community college. Their sample size was small considering they were researching African Americans and Latino's and both genders in each population. Thus, any conclusions

made from the study are limited in scope.

In the study by Samuelson and Litzler (2016), a limitation according to the author was that they did not set out to learn about community cultural wealth in the larger PACE study, and the interview protocol did not include questions that specifically asked about students' community cultural wealth. It included items that research indicated related to persistence and student experiences of the culture in engineering. They found that the students talked about the four types of capital in ways that indicated they were important contributors to persistence. However, the study is limited by not addressing the role of social capital. Social capital could unveil additional insight to engineering student persistence and its role in community cultural wealth.

Social Cognitive Theory

Trenor *et al.*, (2008) study has a few limitations. First, the research sample consisted of thirty-three percent participants that were in their first year at the university, 26 percent were in their second year, 13 percent were in their third year, 13 percent were in their fourth year, and 14 percent were in their fifth year and above. Many first year students were given the distinction of juniors or seniors by the university due to transfer credit hours. This would not truly identify their academic progress in the program. The researchers focused on only five categories of ethnicity. Ethnicity is multi-dimensional and complex, and ethnic categories should be used with caution. It could enrich the study by considering the intersectionality of the students.

Intersectionality

Research by Lord, Camacho, Layton, Long, Ohland, and Washburn, (2009) offer insight about intersectionality and the experiences of women in engineering. Lord's *et al.*, (2009) study

does not, however, address the intersectionality of the Hispanic population. In their study, the Hispanic students are a heterogeneous group comprised of Mexican, Puerto Rican, Cuban, Dominican, and Central American subgroups. This study does not take into account the different cultures represents and ethnicities within this population. The study also does not take into account other characteristics, such as nativity, the length of time in the United States, generation, and socioeconomic status that could have an effect on the populations being researched. According to Cole (2009), such attention is critical because failure to attend to how social categories depend on one another for meaning renders knowledge of any one category both incomplete and biased. However, Lord's *et al.*, (2009) large quantitative dataset is very useful in understanding what is happening, but adding a qualitative component would be useful in understanding what causes these differences, as well as the meanings students, attach to their engineering education experiences.

Lord's *et al.*, (2009) article offers a prime example of deficit thinking. They referenced Chapa and De La Rosa (2006) stating the proportion of Hispanic undergraduate students enrolling in engineering is gradually increasing. At the highest levels of engineering education, however, researchers claim that Hispanic status resembles less of a pipeline and more of a "pipette" (Chapa & De La Rosa, 2006, pp. 203–204). A pipette is a slender tube attached to a bulb, for transferring or measuring out small quantities of liquid. It is imperative to consider the terminology we include in our research as not to promote or incorporate deficit thinking. Harper (2010), suggests instead of relying on existing theories and conceptual models that repeatedly examine deficits, researchers should use anti-deficit questions in an attempt to discover how women manage to succeed in STEM. For example, how are engineering aspirations cultivated among undergraduate women who persist in engineering? Instead of

deficit-oriented questions, for example, why do few women persist in engineering?

Conclusion

Community cultural wealth (Yosso, 2005) offers a new form that expands on the notion of cultural capital. The six forms of community cultural wealth include aspirational, linguistic, familial, social, and navigational and resistance aspirational capital refers to the ability to maintain hopes and dreams for the future, even in the face of real and perceived barriers. Linguistic capital refers to the various language and communication skills students bring with them to their college environment. Yosso (2005) further defines this form of capital by discussing the role of storytelling, particularly for students of color. She argues that because storytelling is a part of students' lives before they arrive on college campuses, they bring with them "skills that may include memorization, attention to detail, dramatic pauses, comedic timing, facial affect, vocal tone, volume, rhythm, and rhyme." (p. 79). Yosso's (2005) familial capital refers to those cultural knowledges nurtured among familia (kin) that carry a sense of community history, memory, and cultural intuition. Yosso's (2005) explains that students' pre-college experiences within a communal environment come with the knowledge that campuses can help students leverage into positive experiences in college.

Social capital is a form of capital that Yosso's (2005) study defines as students' peers and other social contact and emphasizes how students utilize these contacts to gain access to college and navigate other social institutions. Navigational capital refers to students' skills and abilities to navigate "social institutions," including educational spaces. Yosso's (2005) further explains that students' navigational capital empowers them to maneuver within an unsupportive or hostile environment. Resistance capital has its foundations in the experiences of communities of color in securing equal rights and collective freedom. According to Yosso's (2005), the sources of this

form of capital come from parents, community members and a historical legacy of engaging in social justice. This historical legacy of resistance leaves students of color, particularly well positioned to leverage their higher education training to enter society prepared to solve challenging problems regarding equitable health, educational and other social outcomes.

I challenged the models of deficit thinking by also using the lens of Yosso's (2005) community cultural wealth. One of the foundational strengths of Yosso's (2005) community cultural wealth is that it criticizes the assumption that underrepresented students arrive at an institution burdened with deficits. Yosso's (2005) conceptualizes community cultural wealth as an alternative concept. According to Yosso's, "Cultural wealth is an array of knowledge, skills, abilities and contacts possessed and utilized by communities of color to survive and resist macro and micro forms of oppressions" (2005, p. 77).

Intersectionality

Although intersectionality is an important theoretical construct, I did not apply it as a tool of analysis. Shields (2008) stipulated that intersectionality theory is complimentary to qualitative studies for its attention to and awareness of multidimensional facets of identity. Shields (2008) defined identity as social categories in which an individual claims membership, such as race as well as the personal meanings associated with those categories (p. 301). I chose to focus on Yosso's (2005) community cultural wealth as my theoretical framework.

Chapter 3 addresses the research design, methodological approaches, and the theoretical framework that was used in the exploration of the experiences of women who persist in the engineering degree. Chapter 3 will begin by explaining and defining qualitative research, narrative inquiry, and case study. Chapter 3 will continue by sharing the researcher's positionality. Chapter three then addresses the following areas: the two guiding research

questions, the process of the Institutional Review Board, the research site and participants, recruitment process. Chapter 3 then explains the method of data collection, calendar and time-lines, data necessary to understand women's persistence in engineering, data sources, analysis of the data, validity and trustworthiness, ethical considerations, limitations of the research design, and offers a conclusion.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

This chapter addresses the research design, methodological approaches, and the theoretical framework that was used in the exploration of the experiences of women who persist in the engineering degree. Having an appropriate methodology was important if I was going to investigate the life experiences of women who persist in the engineering major. The methodology was the overall framework guiding research to gain knowledge.

According to Gough (2000), "Methodology refers to a theory of producing knowledge through research and provides a rationale for the way a researcher proceeds" (p. 4). The research design and approach are grounded by the purpose of the study and according to Creswell (2007), also by the "researcher's philosophical and theoretical stance" (p. 2).

Qualitative Research

Qualitative research has been defined in numerous but similar ways. Denzin and Lincoln (1994) generically define qualitative research as being multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. Other researchers have offered features of qualitative research, which include being naturalistic, involving descriptive data, being concerned with process, analyzing data inductively and making meaning of the data (Bogdan & Biklen, 2007). My study followed the following nine characteristics of qualitative research as identified by Creswell (2007):

1. Data is gathered through direct interaction
2. The researcher will serve as the main research instrument
3. Multiple sources of data will be gathered and examined
4. Data analysis will be inductive
5. Participants bring meaning to the experiences and the relationships being

examined

6. The research process will not be prescribed but rather will emerge, changing as necessary throughout the process in an effort to obtain the necessary information about the phenomenon
7. A theoretical lens will be used to examine different facets of the phenomenon
8. The researcher will interpret what they see, hear and understand
9. The researcher will report multiple perspectives and identify the factors necessary to portray an overall picture of the phenomenon

By using Creswell's (2007) qualitative research design, I uncovered the lived experiences of undergraduate Latina engineering women and their persistence in the engineering program.

Narrative Inquiry

The qualitative methodology I used for data collection was Clandinin and Connelly (2000) narrative inquiry. Narrative inquiry places a value on using individual lives as the primary source of data. In this type of research, it is important to understand how an individual has lived, made meaning, and constructed realities to serve particular purposes brought on by one's social position (Bloom, 2002). For Clandinin and Connelly (2000), "narrative is the best way of representing and understanding experience" (p. 18). In addition, the narrative analysis is particularly useful for providing an insider's view of a culture (Marshall & Rossman, 2006). They state that historically narrative inquiry has been favored by the humanities because of its "power to elicit voice" (p. 118). Narrative inquiry, fills the gap of "what happened" and "what it means". By using this qualitative methodology, it provided a space for Latina women to share their lived experience regarding persistence in a male-dominated engineering program.

According to Duff and Bell (2002), narrative inquiry rests on the epistemological

assumption that we as human beings make sense of our experiences by the imposition of story structures. That is, we select those elements of experience to which we will attend, and we pattern those chosen elements in ways that reflect the stories available to us. Although the notion of story is common to every society, the stories themselves differ widely which is one of the defining features of a culture. By using narrative inquiry, I was able to bring to life the stories of undergraduate Latina engineering women as they persist in their engineering programs.

In addition, narrative inquiry represents a sequence of mutually interrelated themes that, between them, formed a dense network of interconnected cross-references (Rosenthal, 1993). This created a thematic field that established the foundation to develop the analysis. The thematic field is defined as a sum of events or situations presented in connection with the theme that form the background or horizon against which the theme stands out as the central focus. I attempted to reconstruct the participants' overall lived experiences. I constantly reminded myself that the relationship between the overall construct and the relevant experiences must be conceived as reciprocal. According to Lieblich and Josselson (1997), the construct determines the relevancy of the experience and the cumulative relevant experience forms the construct.

The interviews provided the main data collection tool. To aid in this process I took active written field notes during and after the interview. I use the term *active written field notes* to highlight the active reconstruction of the events that may be taking place nonverbally and might not otherwise be seen or witnessed by the audio recording alone. Nonverbal messages can be as strong as the spoken words. I believe the field notes added to the spoken word during the analysis. Through narrative inquiry, I explored the undergraduate Latina's women particular experiences, thoughts, feelings, ideas, examples, and situations in regards to their lived experiences as narrated by them.

I chose this approach because I believe narrative inquiry allowed the data to present the Latina women's experiences holistically in all its complexity and add richness to the data. Narrative inquiry can be a powerful and valuable data collection tool. In addition, by implementing a narrative inquiry it provided a voice for marginalized groups. Canagarajah (1996) study argues that narratives function in opposition to elitist scholarly discourse and that their use in research offers an opportunity for marginalized groups to participate in knowledge construction in the academy. I chose the narrative inquiry approach because it provided the ability to bring out the individual stories of Latina women who persist in engineering programs. Furthermore, the analysis of their stories enabled the opportunity to fill the gaps that a quantitative analysis might miss.

Case Study

Case studies involve the studying of an issue by exploring the issue through one or more cases within a bounded system (Creswell, 2007). This bounded system could consist of an individual, a setting, an organization, an event, a program, a partnership, or of organizational change (Denzin, 1989; Freebody, 2003; Yin, 2009). These cases are studied over time and involve the in-depth collection of multiple sources of information which could include, but is not limited to observations, interviews, documents, reports, and artifacts (Creswell, 2007; Freebody, 2003; Glesne, 2011).

This narrative inquiry case study focused on undergraduate Latina women engineering students' lived experience at one university. The units of analysis were the student participants and their experiences in the engineering program. The case study consisted of interviews and observations of four undergraduate Latina women engineering students. The data collection incorporated observations, in-depth interviews with open-ended questions and field notes along

with a reflective journal (Johnson & Christensen, 2012).

Positionality

I have spent the last eight years as a full-time academic advisor. I advised in the College of Engineering at the University of Texas at San Antonio (UTSA). I am also pursuing a doctoral degree in educational leadership and policy studies. I have been fortunate through family, friendships, and job experiences to witness the strength and determination of strong women role models. I am a Caucasian male in my mid-forties. I would like to serve as an ally to women engineering students as they navigate a male-dominated profession.

While working as an academic advisor in the College of Engineering, I noticed the underrepresentation of women in engineering classrooms. With a student enrollment in the College of Engineering department around 2500 undergraduate students, only 16% are women. Because of the small population of women, I had limited advising contact hours with Latina engineering students. I felt it would be important to explore what factors or issues or experiences helped undergraduate Latina engineering women pursue their academic and career goals and what drives them to excel.

Guiding Research Questions:

This study was guided by two over-arching research questions:

1. What are the lived experiences of undergraduate Latina engineering students?
2. What are the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program?

As illustrated by Rallis and Rossman (2012) qualitative research is an approach to the study of social phenomena that is grounded in individuals' lived experiences. This qualitative study will provide a narrative of the lived experiences of the Latina women's persistence in their

engineering degree. I wanted to understand the deeper meaning of the undergraduate Latina women's experiences, and how they articulate these experiences (Rallis & Rossman, 2012). I used Yosso's (2005) community cultural wealth as a lens to explore their experiences. Within my toolbox, I was guided by Yosso's (2005) community cultural wealth and I looked for areas of Cole (2009) intersectionality which contributes to the analysis of undergraduate Latina student's persistence in an engineering program.

The underlying approach guiding the study was a narrative inquiry. In narrative research, the researcher studies the lives of the participants and asks one or more individuals to provide stories about their lives (Creswell, 2013). Using this approach allowed me to explore the participants lived experiences. Using in-depth interview methods, I explored the academic and social experiences of a particular group of students situated in a particular context (Lincoln, 2002). In this study, I explored the experiences of Latina women in their undergraduate engineering programs. The study's epistemological approach was anchored in the constructivist tradition, in order to construct knowledge, understanding, and meaning through human interactions (Lincoln, 2002). I used strategies developed by Charmaz (2000) by continually asking questions, using research notes, exploring hunches, making constant comparative analysis, and memo writing.

Institutional Review Board

Prior to data collection, the study was submitted for review to the International Review Board of the University of Texas at San Antonio, to ensure that appropriate research protocols were followed per the guidelines prescribed by the Office of Research Integrity. A complete application was submitted that consisted of a letter of invitation for potential participants (see Appendix D), and a sample of potential research questions that might be used

during the interviews with participants (see Appendix F) and informed consent form (see Appendix A).

Informed Consent

All participants were asked to sign an informed consent document so that they fully understood the nature of the study and their rights. As Creswell (2013) explains, the informed consent document should outline the following:

1. The right of participant to voluntarily withdraw from the study at any time
2. The central purpose of the study and the procedures to be used for data collection
3. The protection of the confidentiality of the respondents
4. The known risks associated with participation in the study
5. The expected benefits, if any, to accrue to participate in the study
6. The signature of the participant as well as the researcher (Creswell, 2013, p. 153)

The informed consent documents for this study are located in Appendix C.

Research Site and Participants

The research site for this study was a large public university in South Central Texas. Their mission is to be a premier public research university, providing access to educational excellence and preparing citizen leaders for the global environment. According to the Office of Institutional research (2014) there are about 28,000 students enrolled at this institution.

The data indicated that the undergraduate College of Engineering student population is 2,841 students. Within that population, 2352 are men and 489 are women. As of fall 2015 enrollment data provide by institutional research concluded that the College of Engineering race and ethnicity for women was 1 American Indian, forty-one Asians, 43 African Americans, 236 Hispanics, thirty-five non-residents, 3 Pacific Islanders, or more ethnicities, 3 unknown and

ninety-five Caucasians. The undergraduate engineering Bachelor of Science degrees awarded during the 2014-2015 academic school year were 18% for women compared to 82% for males. In addition, 12% of the College of Engineering faculties are women and 88% of the College of Engineering faculties are men.

Recruitment Process

My recruitment processes incorporate a purposeful sampling procedure to recruit and select four women engineering participants. These women recruits represented current undergraduate Latina engineering students. Johnson and Christensen (2012) state purposeful sampling allows the researcher to specify the characteristics of the population of interest and locates individuals with those characteristics. The logic and power of purposeful sampling lie in being able to select participants for an in- depth study. According to Patton (2002), "information rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry, thus the term purposeful sampling" (as cited in Patton, 2002, p. 230). Studying information rich cases yields insights and provides an in-depth understanding rather than empirical generalizations (Patton, 2002).

I utilized a criterion-based selection technique in order to identify participants who have the required criteria (Creswell, 2007). This technique was important because it identified participants that were persistent in their engineering programs. The participants provided rich in depth lived experiences that shed light on their experiences as undergraduate Latina women persisting in engineering programs. In order to gain rich data, it was important for me to establish specific criteria. The criteria for this study focused on four areas. First, the selected participant must be a full-time self-identifying Latina student. Second, the participant needed to be classified as one of the following sophomore, junior or senior. Third, the participant must

have a 2.5 or above cumulative overall GPA. Fourth, the participant needed to have completed calculus I, calculus II, physics I, applied engineering analysis I, and physics II.

I distributed flyers that indicated the nature of the research along with my personal contact information to the College of Engineering advisors. I asked them to distribute the flyers to Latina engineering students that engineering advisors advised. My email address and information regarding the study was included on the flyer. The students that were interested in the study and met the qualifications to participate in the study emailed me.

In addition to the flyer, a snowball technique was used to aid in identifying additional potential participants. Snowball sampling, according to Johnson and Christensen (2012), asks each research participant who volunteers to be in a research study to identify one or more additional people who meet certain characteristics and may be willing to participate in the research study. This turned out to be an important step because students are not required to meet with an advisor every semester. The snowball technique helped in reaching students that have not come into the advising office during the semester. Once I received emails from students that would willing to participate, I made sure they were able to participate in two interviews that lasted approximately 60 minutes each. I immediately had three students respond and used the snowball technique to recruit the fourth student. I then notified by email the other students that responded that all spots had been filled. The four participants were provided an informed consent document to review and sign before participating. Participants in the study included undergraduate women classified as juniors or seniors in the engineering program. The participants' had a 2.5 or higher GPA. All the participants in the study self-identify as a Latina.

Method of Data Collection

Data collection of case studies is not as routinized as other methods, due to the variety

of phenomenon studies under case studies (Yin, 2014). All interviews were digitally recorded. According to Creswell's (2013) recommendations, field notes should also be taken during the interviews to share any information that may not have been digitally recorded. I used the fieldwork methods that consist of participant observations, and two conversational interviews. Qualitative research tends to address research problems that require an in-depth exploration, where little is known about the problem, to produce a detailed understanding of a central phenomenon (Creswell, 2008). Consequently, the nature of the research question is dependent on the views of the participant (Creswell, 2008) and the observations of the researcher. Creswell (2007) stressed the importance of making sure the researcher stays focused on what the participants share and to be careful not to incorporate any research bias. As a researcher, I constantly reminded myself to be open and to remain flexible throughout the research process. This narrative inquiry case study focused on the stories of undergraduate Latina women engineering students' lived experience.

The data collection instrumentation for this study consisted of in-person, semi-structured interviews (two rounds), and researcher observations, of four undergraduate Latina women engineering students. The data collection process incorporated observations, in-depth interviews with open-ended questions and field notes along with a reflective journal (Johnson & Christensen, 2012). To facilitate this goal I used open-ended questioning. The interviews allowed the participants an opportunity to share their perspectives about their lives, and to disclose how they make meaning of the lived experiences. I focused on gaining highly elaborated descriptions of the participant's experiences by asking follow-up questions. As noted in Denzin (1989) thick descriptions make thick interpretation possible. My process was to have the participants reflect on their actual experiences so pure descriptions emerge. Throughout the

interviews, I continued to ask follow-up questions until the participants exhausted their descriptions. Throughout the interview, I tried to observe all potentially relevant phenomena. I took extensive field notes jotting down and highlighting any nonverbal communication that took place. I provided nonverbal communication description of facial expressions and body language that stood out during the interviews. I identified any nonverbal communication in my journal. I then included any sentence story description that I could connect with later within the interview transcript. The process was organic. I did not specify in advance, what I thought should be observed nonverbally. The journal process provided insight for the analysis of data.

Calendar and Timeline

I hoped that a diverse background of undergraduate Latina women would participate. For this study, the interviews averaged 60 minutes each. I conducted two interviews for each participant. I completed both interviews for all participants by the end of April 2016. I transcribed all data during the months of May and June 2016, and then begin analysis of the data. During the months of June, July, and August, and September I completed the research findings section and wrote the discussion, implications, recommendations, and the concluding sections of the research.

Interviews

The interviews took place at a campus location mutually agreeable with the participants. I used a semi-structured interview protocol that was purposefully developed to allow the interviewees the opportunity to speak openly. Characteristics of semi-structured interviews include the following: they are planned, the researcher uses an interview guide, they are both structured and flexible, the questions are open-ended, and they allow the researcher to follow the participant's lead into emerging new ideas on the topic (Merriam, 2014; Hatch, 2002). I guided

the storytelling process by starting with standardized questions followed by various probing questions. According to Hatch (2002), standardized questions generate data that can be compared systematically. Merriam (2014) recommends using this type of questioning to gather socio-demographic data from respondents and definitions of terms and concepts. The participants were first asked standardized questions. These questions then initiate probing questions that may evolve from the participant's responses in an attempt to develop a deeper understanding of their experiences. Clandinin and Connelly (2000) support and encourage interviews that turn into conversations because they aid the researcher in developing a participatory relationship with the participant. The interviews helped facilitate an understanding of how these women engineering students interpreted their experiences and how these experiences shaped their persistence in engineering.

I emailed the interview questions to each participant a week prior to their interviews. This provided an opportunity for the participants to reflect on each question. All interviews were audio recorded (with permission) using an IPad. After each interview, the recordings were transcribed. I transcribed the interviews in the months of April and May. I listened to each recording to check for accuracy and began my preliminary analysis. The transcribed data were coded to look for themes and sub-themes (Creswell, 2003, 2007). I read one transcript at a time. I looked for and highlight themes or codes that represent consistent phrases, expressions, or ideas that are common among research participants (Kvale, 2007). I then use constant comparative analysis on research notes, observations, and interview transcripts to identify recurring or unique topics (Strauss & Corbin, 2014). According to Jones, Torres, and Arminio (2006), constant comparative analysis engages the researcher in a process of collecting and analyzing the data simultaneously during stages of the data collection and interpretation process, and resulting in

the identification of codes (Jones, et. al., 2006, p. 44).

Data Necessary to Understanding Women's Persistence in Engineering

Understanding the data through narrative inquiry was extremely important. It provided answers to questions missing in the quantitative data. There have been multiple quantitative studies (MacPhee, Farro & Canetto, 2013; Flores, Navarro, Lee & Luna 2014; Lord, Camacho, Layton, Long, Ohland, & Washburn, 2009) which did not focus exclusively on Latina's persistence in engineering. The researchers in these studies were combining genders and multiple STEM majors to conduct their analysis. The use of qualitative narrative inquiry is about interpreting the threads of life woven into the fabric of our daily lives. These lived and told stories are ways we create meaning in our lives as well as ways we enlist each other's help in building our lives and communities. This in return helped in understanding the factors that influence women to persist in the engineering programs.

I also acknowledge the connection between critical race theory and community cultural wealth. Critical race theory (CRT) centers the research, pedagogy, and policy lens on communities of color and calls into question White middle-class communities as the standard by which all others are judged. This shifting of the research lens provided the researcher the ability to see multiple forms of cultural wealth within communities of color.

I was aware that community cultural wealth stems from critical race theory. However, the research site and the institution's population did not fit within the description of a predominantly white institution (PWI). The majority number of students enrolled by ethnicity at the institution included 14,408 or 50.1% Hispanic or Latino, 7,719 or 26.8% Caucasian, and 2, 439 or 8.5% Black or African American. The institution's mission statement reinforced the campus racial climate embracing multiculturalism by pure numbers. It stated:

"The university embraces multicultural traditions and serves as a center for intellectual and creative resources as well as a catalyst for socioeconomic development and the commercialization of intellectual property for Texas, the nation, and the world."

Therefore, my study focused on Yosso's (2005) community cultural wealth to guide the research.

Data Sources

Denzin (2012) suggested the use of multiple methods, or triangulation, to reflect and to secure an in-depth understanding of the phenomenon in question. By examining information collected through different methods, I was able to corroborate findings across data sets and thus reduce the impact of potential biases that can exist in a single study.

The data sources for this study included participant interviews, observations, field notes, member checking, and a reflective journal that helped answer each of my guided research questions.

Informal, in-depth interviews were conducted as a data collection method for its congruency with narrative methodology and the ability to obtain insight directly from participants through their own words about their own experiences as recommended by Creswell (2007). The interviews provided the foundation for my data collection. The interviews provided the data necessary to understanding the persistence of undergraduate Latinas in the engineering program. It was necessary to hear the lived experiences directly from their perspective. I used the interview guide approach. I developed topics to explore, but I remained open to pursuing topics the participant brings up. I identified a few broad topics framed as questions to help uncover the participants meaning or perspective but otherwise respect how the participant's frames and structures responses. This balance of talk, then, is in favor of the participant (Rallis & Rossman, 2012).

Two semi-structured, in-person interviews were necessary in order to provide an in-depth

description of their experiences. The first interview was guided by twelve questions. The second round of interviews consisted of six questions. The interview questions reflected back to the six forms of community cultural capital presented by Yosso (2005) and include; aspirational, linguistic, navigational, social, familial and resistant capital. This less structured approach allowed me to concentrate on the particular phenomena being studied. A full description of the interview protocols can be found in (Appendix B). The questions were designed to extract good, interesting, and informative narratives during each interview. The open-ended question format provided a space for both the interviewer and interviewee to engage in rich dialog and to facilitate informal discussion and offer a space for longer narratives to develop. By intimating informal discussion, I was able to provide each participant a comfortable space to speak freely.

The second interview also provided a space to reflect back to the twelve questions. This provided an opportunity for more in-depth understanding of the participants lived experiences. This less structured process provided an opportunity to ask addition questions that might have developed during the first interview. Interviews were audio recorded; naturalistic observation protocols were in place to gain an accurate description of observed events. The field notes were accounts describing experiences and observations that emerged during the interviews.

Field notes were employed to capture any extraneous information that was not directly obtained from interview responses. The method I used for collecting field notes was the "three column" method. I followed Leidens (2004) format where factual observations were recorded in the first column, analyses or interpretations of those observations are recorded in the second column, and post-observational reflections are recorded in the last column. I used this method to strengthen the analysis through triangulation. After completing the observation process, I could then compare, contrast, and compile the observations. I then compared them to the transcripts.

Some of these field notes included comments on the participants' demeanor, the tone of voice, and their body language. The field notes were referred back to when setting the scene for stories in chapter 4.

In addition, I incorporated member checking. Member checking was an extremely important process to make sure the participants' narratives were accurate. Each participant received their transcript via email and had the opportunity to review. Participants had several weeks to inform the researcher, whether corrections, changes, or additions needed to be completed. All the participants emailed me and acknowledged the accuracy of their transcript.

Rennie (2004) defined *reflexivity* as "self-awareness and agency within that self-awareness" (p. 183). Reflexivity, or self-reflection, is carried out in a number of ways. One of the most valuable is for the researcher to keep a self-reflective journal from the inception to the completion of the investigation (Morrow 2005). I kept an ongoing reflective journal of my research experiences, reactions, and emerging awareness of any assumptions or biases. These emerging self-understandings were examined and set aside to a certain extent or consciously incorporated into the analysis.

The use of interviews, observations, field notes, member checking, and a reflective journal provided a voice for the Latina engineering students that participated. Their voices were a powerful tool in understanding their persistence in the engineering program. Clandinin and Connelly (2000) suggest ways to discover deeper historical, cognitive and ethical dimensions that come from the lives of people, including how they are composed and lived out, where conversation is placed in research, and what aspects of experience requires studying. Given that reflection and action are between people telling their stories, co-participation and co-construction in the retelling requires researchers and participants to think together. According to Freire (1973):

> The thinking subject cannot think alone. In the act of thinking about the object, she/he cannot think without the co-participation of another Subject. There is no longer, an 'I think' but 'we think'. It is the 'we think' which establishes the 'I think' and not the contrary. This co-participation of the subjects in the act of thinking is communication. Thus, the object is not the end of the act of communicating, but the mediator of communication (p. 137).

Using Clandinin and Connelly (2000) narrative inquiry, it provided thick lived descriptions of the women's perspectives about their persistence in the engineering program. By focusing on Latinas, this study provided the ability to look at "we" described by Freire in hopes to help other women persist. By using interviews, member checking, observations and the researcher's reflective journal these resources helped me answer the guided research questions. This opened the door providing answers to questions that might not have been uncovered using a quantitative approach.

Analysis of Data

In qualitative research, the process of analyzing the data, primarily consists of making sense out of the text collected. Creswell (2007) suggests looking at qualitative data by starting with the specific and moving to the general. In addition, Creswell (2007) believes this process of data analysis required the researcher to create and organize files, read, begin to code, and write memos, describe the personal experiences and the essence of the phenomenon, develop statements, themes and categories; and determine how to interpret the data. This involves exploring the data by looking at all angles and being open to all outcomes that may arise. Creswell (2013) suggests the process is like, "peeling back the layers of an onion" (p. 195). For this study, the data analysis process was conducted concurrently with the data collection process.

Once the first interview was completed, the readings and analysis continue throughout the study.

The goal of the data analysis was to organize what was heard, observed or read by comparing, describing, linking or grouping information or breaking down the information in order to make connections or relationships or to make patterns or themes that unveil the results (Bogdan & Biklen, 2007; Gay & Airasian, 2003; Glesne, 2011; Johnson & Christensen, 2012). For the analysis of the narrative, I used the field notes, the recorded interviews, reflective journal, and the transcripts to begin my analysis. Creswell (2009) suggests the researcher should immerse themselves in the data by listening to the audio recordings and reading the transcripts numerous times to gain a comprehensive insight of the educational and lived experiences of the participants through their own voice, doing so reduces misinterpretations thereby increasing credibility. I followed Creswell (2009) immersion techniques. I started by listening to the audio recording multiple times while reading and re-reading the transcripts. This helped me identify key words and phrases that I might have overlooked during the initial reading. I carefully reviewed each interview transcript, reading each one separately and reading it again. This provided the best opportunity to understand each of the participants lived experiences through their voices. I then engaged in reading all the participants transcripts from each interview before I addressed singular codes or themes. I repeatedly read and re-read, listened and re-listened to all the participants' interviews a second time. I familiarized myself with the participant's language, inflection, and especially the stories. By doing this, it helped me identify particular themes that emerged in each narrative and provided a clearer scope of the lived experiences.

My choice of qualitative methods centered on answering the two research questions about what are the lived experiences of undergraduate Latina engineering students and exploring contributing factors that influence undergraduate Latina students to persist in an undergraduate

engineering program? After I used Creswell (2009) immersion techniques, I continue to immerse myself in the data by divulging deeper into the transcripts. I then changed my focus by proceeding to the analysis stage.

My qualitative data analysis included coding and searching for relationships and patterns until a holistic story can emerge. Janesick (2000) acknowledges that sociologists and anthropologists have shown us that finding categories and the relationship and patterns between and among categories leads to completeness in the narrative. For this study, I followed the coding process outlined by Tesch (1990):

1. Get a sense of the whole by reading through the transcripts of the interviews carefully.
2. Go through one interview transcript and ascertain the underlying meaning of the text.
3. Continue this process throughout the interviews where topics begin to emerge. Categorize these topics by type: major, unique, and leftover.
4. Abbreviate the topics as codes and while re-reading the transcripts identify the sections that represent a code. If new codes emerge, develop an abbreviation and continue to identify sections of the text that represent the codes.
5. Develop descriptive wording for your topics (codes) and turn them into categories. Reduce the list of categories by grouping topics that relate to each other.
6. Collect the data belonging to each category in one document.
7. Recode the existing data with the finalized topics.

The codes emerged from the data collected from the transcripts, and develop into categories and

themes that represent the undergraduate Latina student's voices.

I also incorporated Denzin's (1989) techniques for bracketing, which is to hold the phenomenon up for serious inspection. According to Johnson and Chistensen (2012), bracketing suspends any preconceptions or learned feelings that the researcher has about the phenomenon. This allows the researcher the ability to experience the phenomenon "as it is" (p. 184). When the researcher brackets their perceptions, they set aside their taken-for-granted orientation towards the phenomenon, and their experience of it becomes part of their consciousness. In order to understand the lived experiences of undergraduate Latina women's persistence in the engineering program, I followed the same five steps within my data analysis.

First, I located the personal experiences, or self-story, key phrases and statements that speak directly to the phenomenon in question. Second, I interpreted the meanings of the key phrases. I did this by analyzing the messages and sentences that connected to the phrases spoken directly by the participant. Third, I then obtained the participants' interpretation of these findings. This insured that my interpretations aligned with the key phrases correctly. Fourth, I examined the meanings for what they reveal about the essential, recurring features of the phenomenon that were being studied. Lastly, I offered a tentative statement or definition of the phenomenon in terms of essential recurring features that were identified in step four. By using Denzin's (1989) bracketing design, I had the opportunity to treat the data in all its forms equally. In addition, bracketing helped me identify points that may not fit. The construction phase enabled me to categorize, group, and cluster the data in order to interpret the data (Denzin, 1989). By using this technique, it assisted in expanding my coding system and assist in developing themes. In order to strengthen my categories and codes, I further used constant comparative analysis to look for statements and indices of behavior that occur over time.

In order to strengthen my analysis, I used Boeije (2002) constant comparative analysis design to look for statements and indices of behavior that occur over time. I first made comparisons within a single interview. At the start of this part of the research analysis, comparisons were explored with each interview. In the process of open coding, every passage of the interview was examined to determine what exactly had been said and to label each passage with an adequate code. I then explored the key phrases that were related to undergraduate Latina woman's persistence. I compared different parts of the interview, exploring and identifying the consistency of the interview as a whole. The aim of this internal comparison in the context of the open coding process was to develop categories and to label them with the most appropriate codes. This step proceeded the earlier categorized group and clusters that were developed to strengthen earlier findings.

By combining Tecsh (1990), Denzin (1989), and Boeije (2002) analysis techniques it provided a foundation to strengthen the coding process. It also provided an opportunity for the saturation of the data. The codes further aided in understanding what were the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program. I used codes such as casual conditions, interventions, consequences, and actions. In this way, it was possible to formulate the core message of the interview with the codes that were attached to it and to understand the interview including any difficulties, highlights, and inconsistencies. It allowed for the exploration of the interviews in order to interpret the parts of the interview in the context of the entire story as told by the undergraduate Latina engineering student.

Once I looked at all the transcripts together, then again, I ask myself the following questions designed by Boeije (2002). Is the first interviewee talking about the same categories as

the other interviewees? What do all the interviews tell me about the codes? What are the similarities and differences between all the interviews? What are the criteria underlying this comparison? What combinations of codes/concepts occur? What interpretations exist for this? This helped in understanding the undergraduate Latina woman's persistence in the engineering program.

Once the coding was accomplished, I then incorporated the use of a thematic analysis. The thematic approach helped me familiarize the datasets that have been coded and compared in order to generate themes. Thematic analysis is a search for themes that emerge as being important to the description of this narrative inquiry (Daly, Kellehear & Gliksman, 1997). The process involved the identification of themes through "careful reading and re-reading of the data" (as cited in Rice & Ezzy, 1999, p. 258). I searched for patterns within the data and those emerging themes, then became categories for analysis. This approach was necessary for the analysis because it represented the experiences of undergraduate Latina women that persist in the engineering program.

I looked for things the participants mentioned many times throughout the interview. I also searched for possible relationships among the categories in the data. I asked myself recurring questions, for instance: how has the narrative manifested? What are the key features of the narrative? What conditions bring about this phenomenon? What strategies do the participants use to deal with the phenomenon? By using the category system, I then made revisions and refinements within the data and search for sub-topics. As described by Silverman (2010), this provided the opportunity to check my hunches, follow leads in earlier open coding, and select the codes that demonstrate a theme among the participants. By combining the analysis techniques of Creswell (2009, Tecsh (1990), Denzin (1989), Boeije (2002), and Silverman (2010), it served as

techniques to enable saturation to occur within the data analysis.

During the final step of the analysis, I looked for the major themes. Themes emerged from the categories and were compared to the theoretical tenets of community cultural wealth, meaning I used the theoretical lens of community cultural wealth to gauge if emergent themes were representative of community cultural wealth. The purpose of this study was to analyze the persistence of undergraduate Latina students and their persistence in their engineering program through Yosso's (2005) community cultural wealth framework. In this process, I examined the applicability of community cultural wealth to explications of their engineering persistence.

Using Clandinin and Connelly (2000) narrative inquiry to explore the experiences of undergraduate Latina women's persistence in the engineering program allowed their stories to emerge. For my approach using narrative inquiry, I was committed to describing the phenomenon I was researching rather than trying to explain it. This is why the narrative inquiry was so important for this study. I was trying to explore the undergraduate Latina engineering experiences in regards to persistence in the engineering program. Through narrative inquiry, the undergraduate Latina women were able to share their life experiences. This enabled them the opportunity to describe their experiences using their voices. Their vital life stories came alive within the transcripts. Hearing their life experiences and reading through their transcriptions only reinforced the need for me to pull themes by lifting appropriate words and phrases from the transcripts so their stories could emerge.

Using the undergraduate Latina engineering students' own words only solidified the unique particularities of what the experience is really like for each of the participants. To enrich my descriptions and my understanding of the themes, I carefully attended to the nuances of each example of the common themes when they emerged. I analyzed and interpreted the text by

capturing the experiences in the words of the participants themselves. I then was able to move on to inductively identifying any common or shared themes that structure the stories of the undergraduate Latina engineering students. I also examined to see if the participants introduced any metaphors throughout the transcripts. Thinking there may be a theme that may emerge in a story that implicit metaphors.

I used a paradigmatic structure in the form of a matrix. The matrix was an effective way for me to bring together the common themes and individual themes. All aspects of the matrix stood in relation to one another. The variations of the themes remained explicit and meaningful at the same time that the common themes were identified and illustrated. The integrity of each narrative was also maintained, as it enabled me to move readily between individual themes and common themes. Using this form of analysis helped me present my finding in an appropriate paradigmatic structure that ideally allowed me to move between the particular and the shared or common elements.

Validity and Trustworthiness

Rigor characterized by validity and reliability ensures that findings accurately reflect the narrative study (Davies & Dodd, 2002; Sin, 2010). According to Lincoln and Guba (1985), rigor in qualitative designs is evident in a study's dependability, confirmability, credibility, and transferability. Together, all these verification strategies incrementally and interactively contribute to and build reliability and validity, thus ensuring rigor (Morse, Barrett, Mayan, Olson, & Spiers, 2002). Techniques enhance reliability and validity used in this study included member checking, follow-up interviews, and thick description of the participants' experiences.

The procedures I implemented for data analysis were closely aligned with the steps described by Clandinin and Connelly (2000) in regards to narrative inquiry data analysis. The

steps included the following: (a) transcription of data, (b) verification of transcript validity through participant member check, (c) multiple readings of the transcripts, (d) coding of the transcripts, and (e) thematic analysis.

Creswell (2007) recommends member checking, a technique that is used for establishing credibility in qualitative research. I utilized member-checking techniques in my study. The technique also required the researcher to seek participants' views of the findings and interpretations (Creswell, 2007). I applied member checks to allow participants to review and verify their answers. Lincoln and Guba (1985) have noted that the most critical technique for establishing credibility is member checking. To do this, I provided an email address for each participant. I sent an email letting them know when new information was available for their review. Participants reviewed transcripts, clarified answers for accuracy, and reflected on and responded to sections of the rough drafts of the study in order to increase the dependability of the data analysis including themes and findings. Multiple readings of the transcripts yielded notations, patterns, themes, and threads that develop into the research text. According to Creswell and Miller (2000), validity in qualitative research is defined as "how accurately the account represents the participants' realities of the social phenomena and is credible to them" (p. 124).

Lastly, I incorporated a personal reflective journal to provide additional insights into the research process. My reflective journal captured my detailed notes, reflections, thoughts, and emotions, within the case study. The journal provided me the opportunity to reflect on the interviews and recall the participants' thoughts and feelings and provided any nonverbal communication. The journal provided a visual picture of each interview.

Ethical Considerations

The ethics of narrative inquiry involve learning how to listen and receive stories followed by interactions with authenticity and respect. Confirmability refers to the researcher's ability to remain neutral and not contaminate the study with personal biases (Lincoln & Guba, 1985). I was aware that interview relationships are fraught with issues of power (Milner, 2007; Ryen, 2003; Subedi & Rhee, 2008). Many of which reflect the power issue in the larger society. Race, gender, class, primary language, age and sexual orientation all play out in the interview context. I was sensitive to the fact that since I once held a staff position within the department, I address this upfront with the participants. As a male, I constantly maintain awareness that some cultures in the world may feel that males have certain privileges and biases. Using open-ended interviews allows participants to introduce topics and to speak in their own words rather than in rigid categories dictated by me, something which feminist writers in particular have found politically attractive (Reinharz & Davidman, 1992).

It was important for me to acknowledge to the participants that we are both critical participants in the research and interview process. I also took steps to assure the participants that their responses will be anonymous and that they will choose a pseudonym. I was clear about the purpose of my study and reassured the participants that this is for my dissertation. By incorporating these techniques, it created a safe environment where the participants shared their lived experiences. I engaged in reflexivity to identify and acknowledge assumptions and presuppositions derived from previous personal and professional experiences in order to reduce the potential for bias in the study. I kept a reflective journal throughout the research process. This helped facilitate separation of any preconceptions during the research.

Limitations of the Research Design

This study, as a qualitative study, is not generalizable as the findings may be limited to the experiences of women within the context of this study. The study is limited by focusing on one university in South Central Texas. It is also a small sample size. The sample would not represent the full student population or the characteristics of the university population. The study is also focusing exclusively on Latina women. The study does not include all racial or ethnic groups in this study. The study is also not a longitudinal study and focuses on data collected in one semester. This study is also limited by focusing on only one of the academic majors in STEM. While the semi-structured interviews provided the women the opportunity to explain their lived experiences in their own words, utilizing different forms of data collection could provide further insight. As Patton (1990) notes, "There are no perfect research designs. There are always trade-offs" (p. 162).

Conclusion

I conducted this study to explore the personal stories of undergraduate Latina women who persisted in their engineering program. The importance of this study was to gain an understanding of the experiences that shape undergraduate Latina women engineering students' persistence to graduation. I used the theoretical framework of Yosso's (2005) community cultural wealth as a lens to my analysis to explore what might contribute to undergraduate Latina student's persistence in their engineering programs. This understanding could help increase the persistence of other Latinas who enroll in engineering programs. It created an awareness of the contributing factors that could possibly increase the number of Latina engineering graduates.

This study provided a resource that instilled a sense of empowerment and confidence among Latinas interested in engineering. As a researcher, I believe the voices of the Latina

engineering students provided an understanding of their lived experiences. My study contributes to increasing informed allies and empowers Latinas to pursue and persist in engineering programs.

Chapter 4 provides the analysis and interpretations of the thematic findings. Chapter 4 begins by providing the participants profiles. The study will then explore Yosso's (2005) community cultural wealth and the contribution it had on the Latina student's persistence in the engineering program. The chapter will continue by providing an analysis of the data by describing the five themes that emerged from the interviews. The themes that were developed from the interview data include the discovery of academic passion, guidance, and support from family and teachers, preparation for and commitment to persistence, the power of community and collective engagement, and commitment to helping others. The chapter will also address how the participants resisted oppressive behaviors. The chapter will conclude by providing an insight to the participants and their connection to each of the themes. The chapter will conclude by providing a new concept for community cultural wealth capital, which I call fortitude capital.

CHAPTER FOUR: ANALYSIS AND INTERPRETATIONS OF THEMATIC FINDINGS

Introduction

This qualitative, narrative inquiry case study explored the lived experiences of four undergraduate Latinas who had successfully navigated and persisted in their undergraduate engineering programs. The students in this study provided stories of their lived experiences that encompass their need to achieve for themselves and those close to them. Each of the participants embraces life with a passion. Their actions reveal academic persistence.

Student Profiles

The four students that participated in the study demonstrated a passion for engineering before they entered college. Each participant in the study self-identified as a Latina. Each participant attended different public elementary, middle and high schools throughout major cities in Texas. The participants in this study attended the same Texas University. For this study, three participants were juniors and one of the participants was a senior. They represented three majors within the engineering college. Rebeca majored in mechanical engineering and Julia majored in civil engineering degree. Miranda and Isabella majored in biomedical engineering.

Rebeca

Rebeca majored in mechanical engineering. She was twenty-one years old and classified as an undergraduate junior at the time of the interview. Rebeca's father graduated from college and her mother had some college experience. Her father has worked in the civil service sector for the last 29 years. Rebeca also has a sister that graduated from college while she was a senior in high school. Her sister has a degree in accounting and works with her father at the Veterans Administration. Her brother is currently attending a community college close to home. With her father's job, she highlighted that the family moved multiple times never living in one place

longer than three years while growing up. Rebeca spoke fondly about Florida. Reflecting back at my journal notes she lit up when she talked about Florida. Her experiences in Florida influenced her passion for engineering. She shared that her family was living in Florida until they were transferred to Texas during her 7th -grade year. Both communities were developing students by incorporating STEM programs. She pointed out STEM programs were only included in the high school curriculum. Rebeca shared that she as a passion for reading. She credits her dad for this gift. During family vacations, she mentioned she could read six to eight books just for enjoyment. Rebeca started playing softball when she was eight. She became a tremendous pitcher who was involved in club softball traveling the country with her family. Rebeca also has a passion for academics. During our interview, Rebeca thought it was important to acknowledge courses she completed in high school prepared her academically for college.

Julia

Julia majored in civil engineering. She was twenty-four years old and classified as an undergraduate senior. Julia's parents were supportive early on when she was in elementary school. Julia acknowledged she has always enjoyed building things. As a child, her parents bought her science kits and robot kits her dad always helped Julia build them. She also felt that in the beginning, her parents might have been a little weirded out at the fact she was a little boyish. She felt she came from a socially conservative family. Julia acknowledged that her dad was always encouraging and an active participant in her intellectual interests. Her parents paid for summer programs that helped to prepare her for academic success. She lived with both of her parents. Julia's mom was a strong advocate and instilled in Julia that higher education is extremely important so one can be independent and able to support themselves. Her father worked through college when Julia was in middle school and during the beginning of her high

school years. She remembers her dad would only study once everyone went to bed. He attended the same university that his daughter is currently attending. Her mom attended a private university in the same city. He wanted her to see it is possible to finish regardless of age or the circumstance. Julia attended a tier one university her first year of college majoring in electrical engineering before transferring and majoring in civil engineering. Through her connections with teachers and faculty, they provided her with opportunities to develop interests in environmental research, in particular, water resource research. Julia is hoping that she will be able to conduct research as a profession.

Miranda

Miranda majored in biomedical engineering. She is twenty years old and classified as an undergraduate junior. She lived with both of her parents and is an only child. Her parents played a major role throughout her life. Her parents were not able to go to college when they were Miranda's age. Miranda self-identifies as a first generation student. Her father was an engineering coordinator for a major computer company. He was involved with the technology side of the business. Her mom was a high school counselor's secretary who worked closely with students and administration. Miranda grew up in the largest major city in Texas. Since the third grade, she wanted to be a meteorologist. She loved learning about the weather and had a huge passion for it. She also had a passion for music. Miranda played violin from the sixth to about the tenth grade and then switched to cello for the last two years of high school. Her sophomore year in high school provided her with a new passion when she took a design class. When she took the class, she saw the potential of engineering. This was when she solidified that she was going to major in engineering and not meteorology. Miranda's parents visit her at school quite often. They visited three to four times a semester, or stop by on the weekends, or she will go home. She

is excited to have them in her life. She said, "its nice being close to them and having that support so close." Miranda is a very unselfish individual that enjoys watching other people's successes and she wants to be part of that success as well. Miranda became a peer mentor for the university mentoring program. Her determination to help people are not just words, but an active part of her life.

Isabella

Isabella majored in biomedical engineering. She is twenty years old and classified as an undergraduate junior. Isabella mother was an elementary school teacher. Her mother raised her in a single parent home. She is the older of two children. Her brother is currently in high school. Her father and aunt live in the Midwest. Her father has worked in the same factory his whole life and he is happy there. Isabella found she was the happiest when she was attending school. Isabella was fascinated with a science course she took when she was in the 7th-grade. This created the start of her academic journey, which motivated Isabella's STEM exploration. During high school, she placed into a magnet program, but did not feel it was a good fit. She requested to return to her regular high school campus. It was at that time found her passion for science and later for engineering. When she entered high school, she was enlightened by her love for science. Isabella's teachers had a major influence on her. Throughout the interview, it was obvious that Isabella is a people-person. She believed that working in groups and surrounding herself with diverse people, she could learn from them. Isabella had a passion for giving back and participated as a mentor in the university's mentoring program. Isabella spoke with confidence throughout the interview. She highlighted the wisdom she shared with mentees. Isabella stated: I would tell them "I do not believe in failure. She continued to say, I see failure as an opportunity to work harder. Isabella believed to have a positive attitude is important in life.

Personally, Isabela has a dream to get into University of North Carolina's Masters in Biomedical Science program and then continue for her Ph.D.

Research Questions

It is through these participants that I was able to explore their educational lived experiences and attain meaning from those experiences. The data were purposely collected and sought to answer two research questions: 1) What are the lived experiences of undergraduate Latina engineering students? 2) What are the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program? Through Clandinin and Connelly (2000) narrative inquiry, each participant shared their experiences that helped identify factors that have helped them to persist in their respective engineering programs.

While analyzing the data, it became clear that the participants responded to their lived experiences, drawing upon family, community, and peers and outreach programs. Many of the themes identified in the interviews paralleled Yosso's (2005) framework of community cultural wealth. Therefore, the findings were presented through the framework of Yosso's (2005) community cultural wealth. I found that Yosso's (2005) Aspirational Capital, Familial Capital, Social Capital, Navigational Capital, and Resistant Capital were all factors in the students' persistence in their engineering programs. Linguistic capital was also a factor for two of the participant's persistence, but to limited degrees.

The interviews revealed experiences that brought to life the voices of each participant that are often missing in the literature. Their enthusiasm to participate began with the first email and continued throughout the research process. Each participant openly shared their life stories and revealed valuable information about their persistence. Their openness to share during the interviews contributed to the realization that Yosso's (2005) community cultural wealth is a

common thread each participant exhibits.

Community Cultural Wealth and Self-Identity

Rebeca spoke about her ethnicity in length during the second interview. Using Clandinin and Connelly (2000) narrative inquiry the process created an opportunity for additional data to emerge. It highlighted the importance of Yosso's (2005) community cultural wealth and the need to shift the view from a deficit perspective to assets that communities of color acquire. Her story supported the importance of community cultural wealth encompasses an array of cultural knowledge, skills, abilities, and contacts of socially marginalized groups that usually go unrecognized, acknowledged or celebrated (Yosso, 2006). Rebeca's unrecognized ethnicity emerged through a story she shared during the second interview. Towards the end of the interview, she shared an experience she encountered when she received the email asking her to participate in my study. Clandinin and Connelly (2000) narrative inquiry provided the opportunity that Rosenthal (1993) discussed suggesting that through a sequence of mutually interrelated themes that, between them, form a dense network of interconnected cross-references. Self-identity emerged through the interview questions as a cross-reference. She interconnected her experiences with her own self-identity. She shared her experience, set within her personal, social context. Rebeca mentioned her friends were joking around with her and said: "that person is going to see you and be like, this is a mistake you're not a Latina." It turned out there was much more to the story. Rebeca said these comments happened to her when she was in high school too. She shared:

> "There was this one time they had all the Hispanic kids congregate in the cafeteria to attend a presentation to encourage us to go to college. The kids asked me, "Rebeca what are you doing here?" They are like, "You're so white. You can't be here." However, my

dad's side of the family is Hispanic; there is still that side of me. People do not see that they just say, "You're white."

Rebeca's dad is Hispanic and her mom is Caucasian. Rebeca believed she was stuck between both ethnicities. She shared how it was hard to identify with her family's ethnicities. Rebeca stated:

> "I have many Hispanic friends. I do not think they thought I could truly identify with them since I am not full Hispanic. It is hard because I like both ethnicities of my family. I like identifying with my dad's culture and my grandma's cultures because that is who I am. My peers always made me feel like I cannot identify with other groups as much as my mom's side because I look more like my mom. It is what it is."

Rebeca spoke to critical race theory and the role it plays in society. I found that although Rebeca shared examples of discrimination, and racism, Rebeca did not directly cite these incidents as part of the characteristics outlined in the critical race theory when discussing her peers. She did not express that the systems in place at her institution was discriminatory or exhibited characteristics of racism (Solorzano *et al.*, 2001) It highlights, however, the importance of understanding the diversity that goes beyond what the eyes can see. This leads us to the importance of Yosso's (2005) community cultural wealth framework. This chapter reports the data and analysis of a qualitative single case study that illustrated the educational and lived experiences of four Latina engineering students. The narratives derived from individual interviews and connected with a framework rejects deficit-based analysis.

Developed Themes

Data collected from the interviews was analyzed to create codes, and themes. I developed five major themes using the participants' voices and incorporating Yosso's (2005) theoretical framework of community cultural wealth. The five themes that emerged included 1) discovery of

academic passions, 2) guidance and support of family and teachers, 3) preparation for and commitment to persistence, 4) power of community and collective engagement, 5) commitment to helping others. I was also able to develop a new concept of capital, that I call fortitude capital. These themes summarized the experiences of the participants in the study and contributed to how they persisted in their engineering programs. Community cultural wealth was highlighted within these themes, displaying how the participants used their aspirational, familial, social, resistant, and navigational capital and how it contributed to the students' persistence in engineering. The first theme that emerged from my study is the discovery of academic passions.

Discovery of Academic Passions

I found that by incorporating Clandinin and Connelly (2000) narrative inquiry the participants shared mutually interrelated themes that, that became interconnected. Aspirational capital is a form of resilience, which allows both the individual and their children to 'dream of possibilities beyond their present circumstances, often without the objective means to attain those goals' (Yosso 2005, p. 78). Aspirational capital provides the possibility for cultural wealth, and during interviews, each participant displayed this capital early on in their academic journey. They often revealed moments of discovery where they were inspired by an event early on in their educational journey.

The discovery of academic passion was nurtured during their years in K-12. All of the women aspired to pursue engineering early in their life. Their educational communities and teachers guided their discovery of engineering. For example, Rebeca had an opportunity to be part of a club when she was in middle school that influenced her passion for engineering. She stated: "When I was in the 6th grade, I was in a robotics club. I knew then I wanted to be an engineer." Isabella said she was fascinated by science beginning in the 7th grade. She said, "We

learned the components of the cells, the basic science of the human body." This experience sets her path in motion. These opportunities assisted in their discovery of engineering. However, it was not until sophomore year in high school did she see how science would evolve into engineering. During the interview, Isabella said she was inspired in her sophomore year to consider engineering as a major for college. Isabella stated: "I knew I wanted to be an engineer my sophomore year in high school when I took a computer science course."

For the other women in the study, their discovery of academic passions for engineering began when they entered high school. Miranda acknowledged she knew engineering had to be part of her future. Her experience in the sophomore year turned out to be just the beginning. It opened her eyes to envision new options for her future. The courses in high school opened up brand new opportunities. The new aspirations are a collaborative effort that helps promote community cultural wealth (Yosso, 2005) throughout the educational community. Miranda remarked:

> "I was a sophomore in high school and I took an engineering design class. We worked with Auto CAD and Inventor. I really fell in love with the software. I really liked designing things. By senior year, it was solidified that I wanted to be a biomedical engineer."

Julia was also inspired to pursue engineering as a major by her senior year in high school. A local university paired a program with her high school that provided an opportunity to explore opportunities outside of the high school walls. Julia commented:

> "I knew I wanted to do engineering research my senior year in high school when I was participating in the UT Health Science Center research and design program."

Programs available in their communities inspired the participants. The programs were

offered through their public schools. Their elementary and middle school and high school years established a mindset towards engineering. This created a positive relationship between the community and the schools. Supporting Yosso's (2005) study that suggests students who are able to draw on social contacts and community resources strengthen their chances in attaining higher education. When their teachers, counselors, and administrators convey higher expectations, they typically translate into higher student aspirations (Farmer -Hinton, 2008). The next theme that flourished from my study was guidance and support from family and teachers.

Guidance and Support from Family and Teachers

Using Clandinin and Connelly (2000) narrative inquiry in this study was important. Following the guidelines of Clandinin and Connelly (2000) narrative inquiry, my study placed value on using participants' lives as the primary source of data. It provided a space for the whole story to emerge. Through this process, the participants' stories in this study highlighted the various forms of family and parental support that contributed to their persistence. Family played an important role for the women as they became interested in engineering degrees. Family connections were frequently referenced throughout the study. For example, familial capital was referenced over 115 times among all participants. Participants referenced their father fifty-three times as a source of encouragement, guidance, and support. This supports the findings of Zeldin & Pajares (2000) study, which revealed women were influenced by the encouragement of their family. Their analysis revealed social persuasions were a critical source for the women self-efficacy in their study. According to the participants, parents were instrumental in helping them form high aspirations. This made clear how integral familial capital was in their development. Early on, the participants' families did not know that their child would pursue an engineering degree in college. However, the families, nurtured their child's aspirations. Through Yosso's

(2005), familial capital, the participants were developing capital that would be influential to their persistence in academia. Familial capital is "cultural knowledge nurtured among *familia* (kin) that carry a sense of community history, memory, and cultural intuition" (Yosso, 2005, p. 79). The participants shared how instrumental their parents have been throughout their lives. Their family support included encouragement, and high expectations in the form of stories or advice or acknowledging and supporting their intellectual interests from an early age.

Rebeca explained that her dad was already planting the seed about a future career. He wanted her to envision her future. She stated:

> "Dad started us young thinking about what we wanted to do in the future. He took us to college campuses when we were in elementary school. He wanted us to experience what is out there. He wanted us to be aware of the opportunities."

The participants' narratives emphasized the family struggles and triumphs as expressed through storytelling. Julia's parents knew the hardships and the struggles they had growing up. They did not have the same opportunities and they wanted me to have a better life. Julia's mom shared her wisdom through stories that hit close to home. Julia shared:

> "My mom always believed she had some issues growing up. Her mother could not support herself. She emphasized, you need to pick a career so you can support yourself, and you need to be able to stand alone in case something happens or if you have a husband and your husband walks out. She has been a tremendous support because she knew I would stand on my own two feet with a degree in engineering."

Her eyes and her facial expression just spoke volumes to the impact that story had on her. I captured Julia's quote and described her nonverbal facial expression in the field notes. It was highlighted in my reflective journal. She had a somber expression and I noted that she appeared

to internalize her words. She held this story close to her heart. I believe it contributed to her persistence.

Through narrative inquiry Clandinin and Connelly's (2000), I was able to gain insight into her family culture. According to Clandinin and Connolly (2000, p. 20) "Narrative inquiry is stories lived and told," I collaborated with participants by actively involving them in the research (Clandinin & Connelly, 2000). The participants were engaged in living, telling, retelling, and reliving their stories. The narrative inquiry provided the tool for the participants' stories to unfolding chronology. The participants shared their experiences, set within their personal, social, and historical context, which developed through their lived experiences.

With Julia's family, the family histories were shared through stories. Julia lived with both of her parents while growing up. In addition, both parents supported her interests. Julia shared that during childhood she had an interest in and really enjoyed building things. Her parents would buy her science kits and robot kits. She said, "She loved building the science kits with her dad." She felt empowered from an early age because her dad always supported her interests. She pointed out that her dad just did not acknowledge her interests, but he was an active participant. Her dad celebrated her successes when they completed a science kit. Her father also took a hands-on approach in showing her the importance of an education. He wanted to show his daughter anything is possible with hard work. Julia explains, "My dad worked through college when I was attending middle school and in the beginning of my high school years. He said he wanted to do it because he wanted to show us that it is possible." Julia's experiences supported the findings of Byars-Winston and Fouad (2008) that parental involvement influenced undergraduate students' math and science self-efficacy and outcome expectations, which affected students' interests.

Guidance and support from family provided the foundation for Miranda to persist. The family had a strong influence on Miranda. Her unselfish look at life speaks volumes of who she is as a person. Miranda's aspirations to persist in engineering inspired her need to honor her parents. She understands the sacrifices they have made so she could be where she is today. Miranda stated:

> "My parents were not able to go to college when they were my age. I am their only child. My parents have given so much over the years. I want them to know that they did a great job raising me. I wanted to show them how thankful I am for them. The one way I can do that is to really work hard, not only for myself, but for them."

Miranda went on to say she learned how to work hard through watching her parents. She insisted they always led by example. She stated: "I have always learned to be determined because my mom has always pushed and encouraged me to do that." Miranda self-identifies as a first generation college student. The U.S. Government Printing Office (2014) defined a first generation college student as an individual whom neither of their natural or adoptive parents received a baccalaureate degree.

For Miranda, her mom was an asset to her. She said, "My mom was determined to help me apply for college." Miranda's mom was a major advocate helping her navigate the landscape of higher education. Her mom, who had never attended college, was able to assist her daughter by using the social capital developed through her job. Yosso's (2005) described social capital, as the way that people network with each other and the community. Miranda's mom was a high school counselor's secretary. Miranda shared:

> "My mom would go out of her way asking her colleagues' questions on how to navigate the admission process. Many of the counselors at her job had kids of their own going

through college, so she was able to confide in them."

In addition, Yosso's (2005) familial capital contributed to Miranda's guidance and support from family and teachers. Yosso's (2005) familial capital references "cultural knowledge carries a sense of community history, memory, and cultural intuition" (p. 79). Through the strong family bond, participants' learned the importance of maintaining a healthy connection to the community and its educational resources. The familial capital for the participants' continues to grow so they can assist future generations. Yosso's (2005) familial capital expands the idea of family to varied forms of kinship, such as immediate and extended family, close friends, neighbors, etc. Miranda's familial capital included her cousin. Her cousin also assisted in helping Miranda gain a solid understanding of the processes and expectations so she could navigate through higher education. Miranda stated: "My cousin, at the time, was also in college. She went to a state university. She had gone through similar things so my parents and I would talk to her and her parents as well. They helped us through the process."

Once Miranda was attending college, her familial capital Yosso (2005) continued to increase. Miranda was attending a university that is far from her hometown. Although she was on her own, her parents visited her often at the university. Her father always provided her with encouragement and emotional support. She acknowledged there was one difficult semester where she questioned if college and engineering are really worth it. She stated:

> "I actually had a part of the semester where it was very hard. I was going through a really tough time just getting through school, and being able to get my motivation back up because it was just so difficult. Then I got a text from my dad, and he was just like, "I just want you to know you've accomplished so much more than I could ever imagine. You just make us so very proud." I will forever remember that text."

Rebeca also shared the same parental guidance and support in the form of encouragement and emotional support from her father. In engineering, there is a strong possibility you may need to repeat a course due to a poor grade. This can become an emotional struggle if you had not failed a course before. Rebeca was fortunate to have a father that could guide her to persist and move forward. When she was having difficulties with dynamics, Rebeca stated:

> "My dad told me, do not stress out over it. You can just retake it and its fine. We have all been there, your uncle and I have been there, and your older sister too. You just got to get through it and everything is going to be okay. He told me he was proud of me."

Not all of the participants expressed positive emotional family support. Isabella grew up in a single-parent household. She has had contact with her father, but he lives in another state. However, it is important to acknowledge that she believes that the negative household environment has contributed to her persistence throughout her academic journey. She felt both her parents quit on her. Isabella commented:

> "They both stopped parenting me and were not there for me emotionally. They would be like "Here, whatever you need. Go away. Handle it yourself. My mom helps me financially. She pushed me through school. She made many sacrifices. She wants me to be able to live on campus so she does help me financially."

Isabella's financial support has helped her persist. Isabella gained resiliency from the experiences in her household. According to Hassinger and Plourde (2005), resiliency was defined as "the ability to cope with adversity and overcome the most challenging circumstances" (p. 319). Isabella was able to address her familial struggles and turn them into a positive source for perseverance. These findings suggest that familial support in the shape of emotional encouragement and financial support had contributed to the lived experiences of these

participants. The findings in this study were consistent with the study by Sandoval-Lucero, Maes and Klingsmith (2014) suggesting that participants in their study found that family members support and encouragement helped them sustain through their academic programs. Yosso's (2005) familial capital was a vital part in the participants' academic achievement towards persistence in their engineering program. In addition, Yosso's (2005) social capital also influenced participants' persistence.

Social capital was influential to the persistence of all the participants in the study. Yosso's (2005) describes social capital as networks of people and community resources. Social contacts provided each participant instrumental and emotional support to navigate through the educational system. The participants in this study credited their teachers, K-12 engineering courses, and summer programs as key contributors that developed their academic passions. Historically, Latina students and families utilize their social capital to maneuver social institutions, such as K-12 and higher education, then in turn provide the information they learned from navigating the system back to their social networks (Yosso, 2005).

Rebeca's middle school teacher provided her guidance and support in helping her discover her passion for engineering. She spoke with such enthusiasm and painted a picture as if it just happened yesterday. It was obvious that it had a major impact on her life. Rebeca recalled:

> "When I was in the 6th grade, I was in a robotics club. I really, really, really liked it, so ever since that time I knew wanted to be an engineer or somewhere in this field. The club I participated in was the Robotics Club Jubilee BEST. BEST is an acronym for something. We built a robot that could hang up and take down laundry. You had to compete against other students at other schools and there were regional competitions. We made it all the way to finals. I was able to go to Auburn University when I was in the 6th

grade. Out of sixty teams, we came in the top 10."

The BEST, in the title of the Robotics Club Jubilee, stood for Boosting Engineering Science & Technology. The middle school teacher was promoting and initiating social capital by exposing Rebeca to STEM through the Robotics Club Jubilee BEST. The program also increased her social capital in regards to higher education by holding the competition at a university and not at a middle school cafeteria. This exposed Rebeca to the landscape of higher education and contributing to her knowledge of future educational opportunities. The enthusiasm in her voice supported how transforming that experience had on her.

Data showed Julia was able to access valuable resources through her community. The summer before middle school Julia spent her time in a classroom. Julia had an opportunity that would accelerate her math placement once she entered middle school in the fall. While other kids were playing outside during the summer, she was preparing for her future. She stated:

> "I was involved in a summer math program. My parents had to pay for it, but my parents were always ready and willing to put their money in if they thought it was going to help me achieve something great. They taught me everything I needed to know to be ahead in math. By the time, I was in middle school, I was taking geometry. There were only eight students in the class. However, they were all interested in math. I loved it. I learned a lot. It carried over into high school because I was then able to take calculus II. I was the only Hispanic student in the program."

Yosso's (2005) social capital applied to the academic persistence of Julia. As defined by Yosso (2005), "social capital can be understood as a network of people and community resources" (p. 79). In addition, as I worked through the narrative inquiry it became clear the participants' shared their stories through Clandinin and Connelly's (2000) three-dimensional space of past,

present, and future. They were able to look backward to remember experiences and stories from earlier times. With Clandinin and Connelly (2000) narrative inquiry, the participants brought to fruition the importance of being able to access valuable resources through the community, which developed with the guidance and support from both family and teachers. Her social capital elevated academically by being able to participate in a program offered by the middle school she attended in her community.

For Miranda, Isabella, Rebeca, and Julia, Yosso's (2005) social capitals were evident in their persistence towards engineering. Their teachers provided their social capital by providing them educational resources. Their teachers developed the participants' social capital by incorporating STEM courses into their curriculum created new opportunities for all the women. By offering STEM courses, the teachers were able to guide and expand their students' knowledge and help them develop new aspirations for their futures. These enrichment programs were important to their academic persistence. For example, Miranda took a course in high school where the teacher opened doors to the discovery of engineering and ignited her passion. She stated:

> "I was a sophomore in high school and I took an engineering design class. We worked with Auto CAD and Inventor. I really fell in love with the software. I really liked designing things. By senior year, it was solidified that I wanted to be an engineer."

Isabella's Advance Placement (AP) biology high school teacher influenced her and ignited a passion in her for science. Isabella stated: "In high school, I ended up falling in love with basic biology. My greatest memories from high school were taking science courses. Biology and chemistry were awesome." That biology teacher contributed to Isabella's social capital by exposing her to higher education. The teacher took the class on a field trip that year.

The teacher wanted her students to see how the knowledge they were gaining in the classroom could provide them new and unknown opportunities for their future. The field trip provided a rich, authentic and salient real life experience to enhance Isabella's knowledge. Isabella stated:

> "My Advance Placement (AP) biology teacher in high school took us to hear Ph.D. a professor from the local university. My teacher wanted us to have the experience of what the biology field is like. It was a college lecture, and I never got bored. It was worth every minute. I even took notes throughout the lecture."

All the participants were developing an educational culture from an early age. Each one of the participants were fortunate to have a community that had ties with a university that paired with their local high school's teachers. Paired together they were able to introduce and provide the students to the field of engineering. Through the guidance and support of the teachers, the outreach programs were able to help the women make connections between their high school math and science courses and the profession of engineering.

For Miranda and Julia, their high school teachers worked together with their local universities to promote students' interests in the engineering field. Miranda took full advantage of this opportunity. She commented:

> "My senior year in high school, I ended up taking another engineering class that was a collaboration with the local university. The course counted as my fourth science that I needed to graduate. We did a various amount of team projects mostly mechanical engineering and electric circuits. Our major grades were presentations. I gained skills that would help me in college. It was very beneficial."

These collaboration programs increased student involvement within STEM. Julia also shared a similar story during the interview, which spoke volumes of the confidence that she gained by

participating in a summer program. She noted:

> "I was part of a high school summer program that offered scientific research design with the local University Health Science Center. It provided a research-mentoring component. I presented my research at the University Health Science Center Research Conference. I was the only high school student there!"

For Miranda and Julia, the teachers guided them by involving them in high-quality coursework that collaborated with local universities. Thus, the collaboration supported the participants' academic and emotional development. It created a culture of student achievement and college preparedness. The teachers' guidance and support provided an academic foundation to prepare the participants to persist in future higher education course work. Julia continues to search out research opportunities to nurture her passion for research.

Rebeca shared a similar experience on how she was inspired to get involved in engineering. She stated: "When I got to high school, we had a STEM program. I did all the engineering courses they offered in high school. The teacher for the engineering class took us on a field trip to visit Samsung." The programs developed throughout the K-12 experience were the beginning of the women's persistence in engineering. In order to persist, there must first be a foundation that provides a direction. For Rebeca, her love for engineering continued throughout the summer. She stated:

> "We lived in a college town. We lived down the street from a major state university. Every summer I went to at least one engineering camp. They had general engineering camps and women in engineering camps that I went to."

All the women in my study participated in K-12 engineering oriented programs. These experiences increased their academic preparedness. It also created a space for the participants to

develop a new vision for their future. It also instilled the importance of math and science, which are foundation subjects for the engineering degree. The programs also assisted the students as they thrived in their Advance Placement (AP) courses. The next theme that emerged from my study is the participants' preparation for and their commitment to persistence.

Preparation for and Commitment to Persistence

Many contributing factors assisted in participants' persistence in engineering. Their preparation for and commitment to persist was evident throughout the interviews and the field notes. Each of the women knew the importance of math and science. This mindset was developed and reinforced during their K-12 education. Each student in this study decided to enroll in Advance Placement (AP) courses while in high school. Preparation was a key term used throughout the interviews as a contributing factor to their persistence in engineering. As stated in the literature review, George-Jackson (2011) also concluded that academic preparation and performance in high school and college were important factors to consider in regards to understanding enrollment and persistence patterns in STEM fields. Rebeca emphasized in the interviews that persistence in engineering is not just something that happens when you enter college. She acknowledged: "I did a lot of preparing for college. I did Advance Placement (AP) calculus, and Advance Placement (AP) physics. I took them in high school to be better prepared for when I would take them in college."

Isabella also believed it was important to go beyond the standard high school curriculum. Isabella stated: "I doubled up and took Pre –Advance Placement (AP) chemistry and physics and Advance Placement (AP) biology senior year." Miranda also stated that she thought it was important for her future and took dual credit courses and an Advance Placement (AP) biology course during junior year in high school. Julia's participation in the summer math program

between elementary and middle school provided her the ability to take calculus II in high school. The summer program also prepared her so she could enroll in Pre- Advance Placement (AP), and Advance Placement (AP) science courses.

One realization that continues to develop throughout their academic careers is that learning is a continuous process. For the participants,' learning does not cease once the regular school year ends. Miranda highlights this point after her senior year in high school. Miranda received her acceptance letter from the university, however; she was required to take a math placement test. Once again being prepared she took the test prior to the fall semester. During the interview, Miranda mentioned: "When I took the math placement test I didn't place into calculus I. Therefore, in the summer I took calculus I at a community college, then I started in calculus II in the fall semester." Miranda knew preparation was a key to her persistence. She was committed to putting forth the extra time needed to prepare for calculus II. Isabella shared a similar story during the interview. She explained how she took the math placement test in the summer required by the engineering department. She acknowledged:

> "I had only placed into college algebra and I did not pass the chemistry placement test. So that summer I decided to take the CLEP exam for calculus I and take general chemistry at the community college at home that summer. I earned credits for both. I took calculus II the first-semester freshman year. This made sure I was progressing in the program to graduate on time."

Isabella also knew preparation was a key to persisting in the engineering program. She was committed to persist. Her first priority was taking the CLEP exam for calculus I. Then she enrolled in the community college during the summer before her first year to take chemistry. Her commitment allowed her to enroll in calculus II her freshman year. The participants in this study

support the findings of previous studies. They affirmed that math and science preparation was a key component to their persistence in engineering. This finding supports the study by Veenstra, Dey, and Herrin (2009) suggesting that students who enter an engineering college with more quantitative knowledge in areas such as algebra, geometry, trigonometry, pre-calculus, calculus, and physical sciences are most likely to succeed in engineering. Both Miranda and Isabella surpassed this finding by being enrolled in calculus II their first year.

Participants in this study emphasized that you must always take the initiative and move forward early. They highlighted through their actions that in order to achieve persistence you must first have a constant plan and goal and these goals must renew over time. Their lived experiences of persistence involved the discoveries of their own aspirations. These aspirations nourished through guidance, encouragement, support, preparation, and sacrifice that revealed the theme of preparation for and the commitment to persistence. The next theme that emerged is the power of community and collective engagement.

Power of Community and Collective Engagement

Social capital played a major role in the persistence of participants. Given the reputation that engineering is an intensively competitive major, it was surprising to find that camaraderie over-shadowed the competitiveness of peers. The power of community and collective engagement was a consistent theme pulled from the interviews. The participants' persistence identified how their community and collective engagement influenced their persistence in engineering.

The participants reported working together closely with both female and male peers on academic assignments. Peers were referenced frequently throughout the study. In this study, social capital and navigational capital were counterparts of one another. During the interviews,

the participants referenced their peers 123 times as a source of support, motivation, and resourcefulness. The findings in this study validate Hyde and Gess-Newsome, (2000), Kahveci, Southerland, and Gilmer, (2008) that interactions with peers could provide women with an avenue to exchange information, find study partners, and create informal peer role models. The data showed a range of navigational strategies that assisted in their persistence in the engineering program. Their university community was instrumental in helping them with emotional support as well as navigational support throughout the institution.

Rebeca and Isabella were able to participate in a new freshman engineering housing program. It consisted of one floor in a university dormitory and space was limited. The premise was to connect engineering freshman who would take a couple common courses together. Rebeca was excited to share her experience about the engineering dorm. She thought it was a tremendous program that helped her persist the freshman year, from the very beginning it brought in a social community. Rebeca commented:

> "One floor just had freshman engineering students. You were able to meet people in your classes. You were able to meet your own people, that had the same ideas, and goals, and struggles as you. I was able to work together and bond with them. Our Resident Assistant's (RA) were engineering students so we got to look up to the people that were older than us and in higher level classes. It was a good community. I would have stayed if they offered it for sophomores. I was very sad to leave."

The freshman-engineering dorm provided both Rebeca and Isabella the power of community. Rebeca felt that the engineering dorm contributed to her persistence. Rebeca's connection to the power of community and collective engagement was evident as she spoke about her freshman experiences. She was enthusiastic when talking about her freshman experience in the engineering

dorm. She remains friends with the students she met her first year in the engineering dorm. Rebeca did not miss a beat when she said, "The engineering dorm was probably one of the best programs the university offered freshman engineering students. You got to meet people in your classes and study together."

Isabella was enthusiastic when I asked if she lived in the freshman-engineering dorm. Isabella explained how her peers helped with persistence. Incorporating Clandinin and Connelly (2000) narrative inquiry, Isabella was engaged in telling, retelling, and reliving her experiences. Her experiences revealed the theme of the power of community and collective engagement. She stated: "Our engineering floor would stay up and study together. When we were struggling with a class, we would try to help each other out." These students were able to build a network/community of supportive individuals. As a unit, they were reassured that they were not alone in the process of earning an engineering degree. Her freshman-engineering dorm community heightened the students' collective engagement by placing upperclassmen engineering Resident Assistant's (RA) in the dorm. Isabella stated

> "I lived on one floor that was just freshman engineering students. The Resident Assistant's (RA) were upperclassmen engineering students. The Resident Assistant's (RA) were helpful. They would tell us when engineering events were happening and get us involved or tell us about tutoring opportunities."

Rebeca and Isabella were able to build a network/community of supportive individuals. By living in an engineering community, they were reassured that they were not alone in the process of pursuing an engineering degree. They were empowered to persist in their programs with the community network that they engaged in.

Isabella became friends with Miranda, who would frequently visit the freshman-

Engineering dorm. Miranda felt socializing in the freshman-engineering dorm helped her persistence during her freshman year. Miranda stated: "I met Isabella, she lived on the engineering floor, so I would spend a lot of time there doing projects, and studying for engineering classes." These students were able to immediately gain social capital, which provided them the power of community and collective engagement their freshman year. It was evident that the students' involvement in an engineering community provided resources that supported their academic and emotional needs.

The Biomedical Engineering Department developed a cohort-based program. For two of the students in the study, Isabella, and Miranda, they felt the power of community and collective engagement was a major contributing factor to their persistence in their program. For Isabella, it was an academic extension once she was no longer able to be part of the freshman-engineering dorm. The dorm only catered to incoming freshman. Being part of an engineering cohort offered her additional social and academic support for her engineering program. This created an additional community in which they could engage with socially and academically. Isabella elaborated on the importance of the cohort to her: "When we study, we study together. I think that has been a major part of our success." Miranda also shared the significance of the cohort; she was convinced it helped her persist through the program. She spoke about the cohort with such conviction. I could sense that her cohort had already developed a strong bond and that they unified for a common goal. Miranda's face lit up as she spoke: We went through everything together. We asked each other questions. It is a big support system." Without hesitation, she continued to explain the importance of their social connection in regards to persistence. Miranda commented:

"This is a huge thing. It has always been about the group. We all want to succeed, and at

least in my class we are not in a competitive state of mind. It is more of, we want to make sure everyone gets through because we know it is difficult. We really work together."

The power of community and collective engagement is the foundation for Isabella and Miranda persistence in their engineering programs. Isabella also identified her cohort as a reason why she had persisted in the engineering program. She acknowledged the cohesiveness of the cohort as a major contributor that helped her through difficult courses. She explained the strategies they used to persist in the difficult courses:

"When we did not understand a concept taught in class we would help one another. As a cohort, we assign different sections of the chapter and we make up review questions. It is impressive. To think thirty-seven or so students get together to do that. That has honestly saved us."

As defined by Yosso (2005), social capital is described as the networks of people and community resources that can help a student navigate through social institutions. Navigational capital is the skill to maneuver through social institutions. These two capitals, run parallel to one another when it involves these Latina students' persistence in the engineering programs.

Professors, teaching assistants, and tutors encompass the university community. Therefore, we acknowledge them though the theme of the power of community and collective engagement. Professors, teaching assistants, and tutors have influenced the participants' persistence in their engineering programs. Instructors and tutors were referenced frequently throughout each interview. Professors, teaching assistants, and tutors were referenced twenty-two times as being an important connection to their persistence in the engineering program. Kim, Fann, and Misa-Escalante (2009), found that faculty and professional role models helped women

students by bolstering their confidence and encouraging them to see themselves as successful in STEM majors and careers in the future. My study, however, narrowed its scope to understanding the persistence of four undergraduate Latina students' persistence in their engineering programs. My study found that developing a purposeful connection with faculty also contributed to the persistence of the participants. The power of community and collective engagement was a major theme. Julia spoke about the importance of one of her professors. She shared:

> "Dr. Steel was always in his office. He had snacks and stuff for students. I did not pass his course the first time I took it. He always encouraged me and other students to talk with him outside of class. He had office hours, but he was there almost all the time during the day. His door was always open if a student needed assistance."

Isabella also credited her professor's approachability and his knowledge of campus resources as a contributing factor to her persistence within the engineering program. This is a prime example of the parallel between social and navigational capital. Isabella stated:

> "Dr. Alliede influenced me. He said, "I know it's a very difficult course, but in the end, it will be very rewarding." He encouraged me to go to tutoring and I did. The Engineering Department offered tutoring."

Miranda found that the power of community, which included a teaching assistant, and attending study groups with her peers, was a contributing factor that influenced her persistence's in courses needed for the engineering program. Miranda stated:

> "Whenever I was not doing well, I would go to tutoring. I would push myself to read and to do the extra work. In biology, my TA was very helpful. She was always available to help with questions. We also formed study groups. I am a huge fan of study groups. I know I needed to put more study time into it outside of class and I did just that."

Rebeca also found that her peers were important when it came to persisting in difficult courses in her engineering program. She commented on the power of community and collective engagement: "I found resources to help. I found an upperclassman engineering student that helped us with the difficult classes."

In the interview, Julia confided how one professor helped develop her love for research. Julia was able to draw on the power of community and collective engagement through the connection she had made with that professor. Knowing Julia's abilities and passion for engineering the professor suggested she apply for a particular college internship and scholarship. The professor elevated Julia's potential and helped her sustain high levels of achievement through the research internship opportunity. With the support of Dr. Green, Julia persisted. Dr. Green contributed to the development of new aspirations for Julia's future. Julia stated:

> "Dr. Green, she taught me EA1 the first time I met her. I applied years later for a $1,000 Scholarship. Dr. Green suggested I should apply. In addition to the scholarships, recipients were eligible for paid summer internships at USDA agencies and a research experience at UTSA research labs. I was selected for the scholarship and I was able to research native Texas grasses and biofuels. This will help me persist beyond my degree. I can include my experience on my resume."

Dr. Green presented an opportunity that would help Julia increase her academic portfolio. Julia's social capital increased having Dr. Green as an advocate in her community network. Julia once again was influenced positively by her connection with Dr. Green. Julia's dedication to the internship/scholarship provided her with an additional opportunity. The internship strengthened Julia's engineering aspirations, providing new hopes and dreams for her future as a researcher. Julia's support and collaboration with Dr. Green increased Julia power of

community and collective engagement. Dr. Green contributed to Julia's navigational capital by introducing Julia to a professional academic conference. Julia also shared:

> "Dr. Green took two of us to Washington, DC, for a research conference. Other universities were there. A research grant paid for our trip. We attended lectures and made some connections with other university students".

This comment is in line with Hurtado (2009) study that students benefit greatly from knowing key faculty and professional staff who can serve as resources and grants them access to opportunities such as funding, internships, and research. Dr. Green and Julia's collective engagement fostered a powerful community for academic success. Throughout the lived experiences of all the Latina students, outreach programs helped in their engineering persistence.

Rebeca's professors provided her the foundation that she needed to be competitive in obtaining an internship. Her father's social capital played an influential role throughout her life. Rebeca attended at least one engineering summer camp each year while growing up. Throughout her life, she was always enriching her education by participating in programs outside the classroom. This structure continued into college. Her father suggested she browse USA Jobs to look for a summer internship. My field notes, reflective journal, and the transcripts together reinforce the importance of social capital and family capital. The field notes highlighted how nonverbal communication is just as powerful as the words spoken.

I asked Rebeca, did you find an internship? The smile on her face answered the question before she even spoke a word. She gushed: "I just got offered an internship position with the Air Force yesterday. My dad is super ecstatic for me. It is the same Air Force Base, where he had his first internship." She continued to describe what the internship would involve. Rebeca explained:

"It is like an all-around internship. A little management, a little bit of recruiting for high school students to bring awareness to the opportunities STEM has to offer them. We are also shadowing actual scientists and engineers that do work for the Air Force."

The internships provided the opportunity to build her social capital through the new experiences she gained and the people she met. In return, she could give back to the community and inspire other women or girls who have interests in STEM.

The participants' persistence was tied to their discovery of academic passion, guidance, and support of family and teachers, preparation for and commitment to persistence, and the power of community and collective engagement.

In my study, participants recognized that their academic achievements placed them in a unique position where they could contribute their knowledge to support other Latina students. Each of the participants was involved in some type of formal or informal mentoring programs, engineering outreach programs, or they were leaders in their professional engineering societies.

Commitment to Helping Others

Now that these Latina engineering students had successfully navigated and persisted in their engineering programs, they felt a tremendous sense of responsibility to share what they have learned and accomplished to help others explore engineering as a degree. Giving back to the community was referenced over 15 times in the interviews. Yosso (2005) explains that, as a cultural wealth, familial capital extends well beyond the concept of kinship and extended family. It includes a responsibility for the welfare of the community, and a focus on the collective, not the individual well-being (Yosso, 2005).

As suggested in the literature by Kahveci, Southerland, and Gilmer (2007), this study also

found that women peers serve as role models for younger females interested in STEM. All participants shared their commitment to helping others. They were committed to helping younger students discover their love of engineering. They are now becoming ambassadors to promote engineering to a new generation. They are now providing social and navigational capital to others outside their circle. For example, Julia is now reaching out to elementary girls in the community to inspire them to consider engineering as a profession. Julia remarked;

> "I volunteered for Introduce a Girl to Engineering Day. I ran a stand that was trying to teach 4th and 5th graders neutral buoyancy they would build their own boats. It was so much fun. These parents taking their girls to this, introduce a girl to engineering day. I did not have that introduction when I was younger. This was a really happy day."

For Rebeca, she was able to provide social capital to high school students. In return, she was able to reinforce why she works so hard to persist in her engineering program. She highlighted that when you give back or help others, it will always come back two fold. Her experience as a camp counselor only validated her statement. Rebeca shared her commitment to helping others. She stated: "I was a college camp counselor for Engineering. I was able to help inspire high school students to think about engineering and STEM. I was glad I did this because it also reinforced why I'm doing this and why I love it so much." By her commitment to helping others, Rebeca is now providing social capital to future women engineers. She feels self-empowered knowing that she has not only persisted in the engineering program, but she has the ability to help others to do the same.

Miranda also has a commitment to helping others. Miranda was a university peer mentor. She believed in the mentoring program from experience. Miranda stated:

> "It helped me persist early on in the engineering program. I had a biomedical

engineering (BME) peer mentor. He was a big influence for me. He was always there for me. I was able to ask questions. He helped me through stressful times. I think it is important to have peer mentors that correlate with the students major. It is easier because we share some of the same experiences."

Becoming a peer mentor herself was just a natural transition. Miranda explained that in high school they only tell students, "college is different or college is harder." She pointed out that they never explain how you will deal with that, or what you will need to do differently once you are in college. Miranda said: "That is why it is important to me to be a mentor I can fill in the gaps." Miranda self-identified during the interview as a first generation college student. Through social capital, she was able to persist and navigate her institution. She now has developed social capital of her own and is inspired to share her knowledge with others. In her own words, her passion for inspiring others is extraordinary. She is committed to helping others. Miranda commented:

"I am a peer mentor here on campus. It has been very rewarding. I just absolutely love it. I just love helping people. I have always been in a position to be a role model. My younger cousins also look up to me."

Miranda believes that you need to be involved if you want to create change. In order to expand her own experiences, she became involved in a professional engineering society. She acknowledged that being persistent in her program involves much more than classroom success. In order to persist, you must be involved in organizations that support your programs and help you grow as an individual. Miranda joined the (BMES) Biomedical Engineering Society. She stated: "I was the secretary one semester. I then became the president of the professional society. We had two faculty sponsors. We worked with faculty because they were able to help us with making connections outside of our university." She continued to develop her own social capital,

but she also facilitated social capital for other students. Isabella has followed suite and has developed her own social capital by joining the (BMES) Biomedical Engineering Society. Isabella was very excited to share during the interview that she just became Vice President for BMES.

Students in this study continue to develop their social capital networks. Their determination to be involved in formal and informal programs that support their programs showed a commitment and belief to their own aspirations. Each social capital network the students were involved with contributed to their persistence. The themes of the power of community, and collective engagement and the commitment to helping others had emerged from the interviews. The emerging themes had an influential role in the participants' persistence in the engineering program. However, despite all this support, some of the participants are still encountering oppositional behaviors.

Combined Themes That Assist Persistence during Opposition

Data has shown that Latinas earn only 2.0% of all engineering baccalaureate degrees (NSF-NCSES, 2009). Therefore, Latina's are underrepresented in engineering classrooms. Hyde *et al.*, (2008) suggested more often than not, women receive the message that they are not capable of performing well academically in STEM fields. During the interviews, the participants shared the challenges that they encounter. Most importantly, they shared how they were able to navigate obstacles to continue to persist in their engineering programs. Resistant capital refers to the knowledge and skills fostered through oppositional behaviors that challenge inequality (Yosso, 2005 p. 80). Yosso's (2005) resistant capital was limited in explaining the success of the study participants. Students were able to identify stereotypes and yet resist internalizing those stereotypes.

The participants were able to persist because they incorporated their guidance and support from family and teachers (familial capital) and from the power of community and collective engagement (social capital) to persist beyond the oppositional behaviors. In this study, resisting actions sometimes included reminding themselves that they had the ability to succeed in the engineering program. For example, Miranda shared experiences from when she entered the engineering program her guidance and support of family provided her the mindset to reach beyond the inequity. Miranda commented:

> "I feel sometimes women may feel intimidated to do this major. For such a long time, women are not supposed to do this. Especially as a minority, it seems like we are not supposed to reach for these things. However, my parents never taught me that. You are a woman, a Latina and going into engineering. You can do it. They saw it as a positive."

Miranda, with the guidance and support of her family, was able to turn the challenges of the major into a positive. She communicated her perspective of the situation with such a positive attitude that reflected how she felt empowered to persist in engineering. In addition, she continues to empower other Latina women by participating as a peer mentor. That means she is providing the power of community and collective engagement to future Latina engineers. The opposition is not suppressing her, she is engaging it for the betterment of others.

Rebeca shared her experiences in the engineering classroom. She mentioned there were only five girls in her classes. She felt the opposition to her abilities from some of her male engineering classmates. She said: "In many of my engineering classes, it felt like the males did not take me seriously. Even if I make better grades they still thought they were better than I was." Rebeca was able to draw on the power of her softball community to excel beyond the mindset of some of her male classmates and it helps her persist in the engineering program. She

noted her experiences as a softball pitcher and explained how it helped her navigate beyond the academic oppression. As she shared her story, I was intrigued how it connected to two themes in my study, preparation for the commitment to persistence, and the power of community and collective engagement. The lessons she learned in her softball community, assisted her commitment to persist within the engineering program. Rebeca stated:

> "Being a pitcher, you have to be able to focus. You cannot get riled up. They do not want somebody who's going to get flustered on the mound. They need someone who is really calm, cool headed. If a person hits a home run off you, they want someone on the mound that can bounce back. They do not want someone who gets flustered and cannot keep going. I learned a lot of focus and being strong through softball. I learned to persevere."

Rebeca applied the same lessons she learned in softball to help her persevere through the oppositional behaviors that some male classmates had towards her.

Julia had also come face to face with male peers that are verbally oppressive. She acknowledged that for the most part, her experiences with peers have been positive. She concluded that this is not true for all. As Julia spoke, I witnessed through her nonverbal communication that this topic had hit a nerve. She did not hesitate to explain. Julia explained:

> "The male students will make jokes if I am the leader, which I am in most of my group projects. Sometimes they make jokes about me being a bitch. I'm not really a bitch, but bossy. It is harder for female engineers."

As a researcher, I had to dig deeper to understand how one persists with peers making these comments. Julia was participating in this study because she had a proven record of persistence in the engineering program. Before I could ask another question, she added: "People don't see it because all they see are the exceptions and not the norm. I persist because I want to do well for

myself. I know I am capable and I am really good at math as long as you have a goal in mind you can keep going." Two themes emerged through Julia's statements. She incorporated preparation for and the commitment to persistence and guidance and support of teachers. She knows from prior classroom experiences that she excels in math and that drives her determination to persist.

This study examined transformative resistant capital to see if it converted to motivating Latina students' persistence in engineering. Through the use narrative inquiry, the participants' stories identified that there was an awareness of gender bias amongst some of the male classmates. However, the participants did not express this form of resistant capital as an explanation for their persistence in the engineering program. When faced with oppositional behaviors the participants' used the themes of guidance and support of family and teachers, preparation for and the commitment to persistence, and power of community and collective engagement to persist beyond any gender bias they experienced.

Conclusion

The study's findings confirmed that the participants engaged in the following five assets found in Yosso's (2005) community cultural wealth model: aspirational capital, familial capital, social capital, navigational capital, and resistant capital. The various forms of community cultural wealth (Yosso, 2005) emerged from the participants' interviews and were analyzed for this study. Although specific forms of capitals might have had more influence at any given point in their journeys as Yosso (2005) suggests, the forms of community cultural capital converged and interacted with one another. The combinations of theses capitals and their lived experiences were influential in developing persistence.

Isabella said something that was profound during the interview that just encompasses how the power of community and collective engagement is the pinnacle of persistence. She

Stated: “Our success must reflect the university’s success and the program’s success.” For these persistent students, they embrace the notion of community, family, and education.

This study supports previous research findings by Gonzalez, Stoner and Jovel (2003) that suggested, Latina college students who were exposed to higher levels of social capital starting in elementary school and high school, influenced their perceptions and was beneficial to developing college opportunities, increasing their chances of attending a four-year university. My study supports previous findings from the literature and also contributes to Latina students’ persistence in engineering programs. For the participants in this study, the discovery of academic passions in the engineering field developed early in their schooling. Their home communities developed the participant’s social capital, which was influential to the discovery of their academic passions and their aspirations and persistence. Educators in their home communities introduced them to science, technology, engineering, and math at an early age. Each participant had the guidance and support from family and teachers. Those teachers and family members created an academic environment that assisted in developing the participant’s aspirations and academic passions. The K-12 educators guided the participants in the discovery of future STEM opportunities. They inspired the participants through the 6th-grade robotics club, summer programs, and field trips. By offering these experiences, the participants were able to develop and nurture their aspirations for engineering. The combination of social capital and familial capital created a culture at an early age that would create an abundance of support that would only grow with time.

My study also connected with Veenstra, Dey and Herrin (2009) study that suggested students who enter an engineering college with more quantitative knowledge in areas such as algebra, geometry, trigonometry, pre-calculus, calculus, and physical sciences are most likely to succeed in engineering. The participants’ primary and secondary educational communities

created social capital that developed into navigational capital. All the participants in this study enrolled in Advance Placement (AP) math and science courses in high school that would prepare them for college engineering curriculum. The participants in this study converted their social capital and navigational capital by persisting in their Advance Placement (AP) courses. Their successful completions of Advance Placement (AP) math and science courses provided them the academic foundation they needed to persist in their engineering programs.

A surprising finding emerged that centered on how influential the fathers were with developing the persistence of participants. Although the role of fathers and their connection to Latina success has had limited exposure in the literature, their father's influences were accentuated in this study. Fathers had a significant impact on them, thereby transforming and believing in their daughter's abilities and encouraging success and persistence. Their fathers were instrumental in providing emotional support to their daughters. These counter stories dispute the myth of the Latino patriarchal family of machoism stereotypes often associated with Latino fathers. This study, therefore, challenges some of the negative perceptions about Latino fathers. The voices of the participants' highlighted how fathers contributed to their persistence.

Data also showed that participants were able to access valuable resources by combining Yosso's (2005) social capital with navigational capital. The freshman-engineering dorm provided both Rebeca and Isabella social capital when they started their first year. This aided in their persistence in the engineering program by providing a community of support both emotionally and academically. As Rebeca confirmed the students shared the same ideas, goals, and struggles as she did. She was able to work together and bond with the other engineering students that lived in the freshman-engineering dorm. The freshman-engineering dorm provided social capital to two of the participants, but it also contributed to new navigational capital. The

dorm Resident Assistant (RA's) provided immediate navigational capital to the undergraduate Latina women for gaining knowledge of upcoming engineering events, and tutoring opportunities. The undergraduate Latina students in the freshman-engineering dorm enrolled in the same courses, which allowed them to form instant study groups. This created a network of academic and peer support.

Two of the undergraduate Latina participants began their engineering program in a cohort format. The formal cohort format network was instrumental to their persistence. They accredited the cohesiveness of the cohort as a major contributor that helped them through difficult courses. This supports the theme of the power of community and collective engagement. They were able to navigate the institution by working together and creating a network amongst their cohort. Miranda stated they were able to ask each other questions for example, "how would you ask a professor this question? Both participants felt their cohort provided them a tremendous support system. They suggested it was not a competitive atmosphere. The students worked together as a team.

For the other participants, they felt the institution's academic community also contributed to their persistence in the engineering program. Faculty provided academic support and navigational support to the undergraduate Latina engineering students. This study challenges the deficit thinking of Vogt, Hocevar, and Hagedorn, (2007) that suggested while many faculty members deny that they are discouraging their women students, very subtle, often undetectable, biases seem to have had a negative effect on young women in engineering. This study found developing a purposeful connection with faculty contributed to the persistence of the participants. Julia felt faculty members were supportive and committed to her and other student's success. She highlighted Dr. Steel always encouraged me and other students to talk

with him outside of class. He had office hours, but she attested he was there almost all the time during the day. His door was always open to assist students. This acknowledgment continues to strengthen the theme of the power of community and collective engagement.

Julia also gathered additional navigational capital through the help of another professor. Julia's professor suggested she apply for a particular research scholarship. With the help of her professor guidance, Julia applied for the scholarship. Julia smiled as she shared that she was awarded the scholarship. She was now living her dream of conducting academic research. With a gleam in her eye, she explained she would be researching native Texas grasses and biofuels. The opportunity contributed to her love for research and the development of new aspirations for her future. She acknowledged that it would help her persist beyond my degree and is now thinking about a master's program. Once again, the social capital she gained from her professor has provided her an opportunity that will help her persist beyond graduation.

Isabella credited her professor's approachability and his knowledge of campus resources as a contributing factor to her persistence within the engineering program. She took the time to speak with her male professor when she was having difficulty in his class. He was a confidant and offered her support. Isabella stated: Dr. Alliede influenced me. He said, "I know it's a very difficult course, but in the end, it will be very rewarding." He encouraged me to go to tutoring and I did." What is important to acknowledge is that Isabella used the navigational capital provided by her professor and went to tutoring. Helping her persist attributes to the guidance her professor provided. However, she also needed to be motivated and committed to succeeding in the course in order to persist in the engineering program. Miranda and Rebeca found that a teaching assistant (TA) and attending study groups with their peers were contributing factors to their persistence.

All of the participants gained their own social capital in the form of academic knowledge through professors, staff, and peers that enhanced their lived experiences. The participants emphasized in the interviews that in order to persist in the engineering programs they needed to put in more study time outside of class. This statement highlights the theme of preparation for and commitment to persistence. In the engineering program, they highlighted, you will need to do more research on your own when it comes to studying. In the interview, Isabella was adamant, that it is all about taking the initiative. She stated: "If you do not understand a word or concept, you need to take the initiative and look it up." She was determined to get her point across and was articulate in doing so. As Isabella spoke, I could hear confidence in her voice. She has built her own social capital in regards to persisting in college. She noted: "A key factor to understanding is you should be able to teach what you have learned. If a student can explain it to someone else, they understand it and then they can develop new knowledge from that understanding."

In addition, the participants in this study had experienced opposition and inequality while persisting in their engineering program. Their ability to challenge the opposition contributed to their persistence. Miranda used her familial capital guidance and support of family when she felt intimidated by the engineering major and especially being a minority in the program. Her parents were there right away to support their daughter to believe in herself and her abilities. Her parents were not naïve to the climate and demographics of the engineering program. They embraced it as a positive challenge and encouraged their daughter to persist in the face of opposition. Rebeca's opposition came in the form of her male classmates. She felt there was a gender bias, but she did not agree with the opposition to her abilities. She used her previous social capital as a softball pitcher to challenge her adversaries. She would not let them get her flustered. She claimed she

knew her academic abilities, she would stay strong and with that mindset would persevere. Julia's opposition was also gender related. As a group leader, there were times certain males would make derogatory comments towards her. She was able to incorporate her guidance and support from past teachers. She has been able to use her social capital that goes all the way back to middle school to give her confidence in her abilities and block the opposition from stalling her progress. She knows she has always been good in math and that she prepared her whole life to persist in engineering. Yosso (2005) asserts that resistance capital includes the various forms of cultural wealth that can be passed and transform oppressive structures.

The participants stressed that part of the fabric of commitment is the sacrifice, Isabella mentioned when you watch successful engineering students, you see how they study in advance, or they make many sacrifices. Rebeca's sacrifice was between collegiate softball and engineering. She was acknowledging the theme of preparation for and commitment to persistence. She said, "There was not enough time for both." Miranda stated lack of time prevents her from playing music. The participants were trying to acknowledge that time management was an important piece in persisting in the engineering program.

The participants have successfully navigated the institution and have developed their own social capital that they can now share with incoming engineering students and family members. The theme of commitment to helping others continued to strengthen during the interviews. Julia is now committed to helping others. She mentors elementary girls to inspire them to consider engineering as a profession. Rebeca was a college camp counselor for Engineering. She was able to help inspire high school students to think about engineering and STEM. Miranda also gave back to the university community and became a peer mentor to other students. Miranda and Isabella are both now both officers in their BME professional societies.

The undergraduate Latina engineering students have created their own social capital and they are sharing their newly formed capital with other girls by becoming engineering camp counselors or mentors and officers of BME professional societies. They are engaging their social capital on the next generation and paving a new path for women wanting to follow their aspirations of majoring in an engineering program. They are now paying it forward.

The study sought to answer two research questions about the undergraduate Latina persistence in an undergraduate engineering program. The results showed through Yosso's (2005) aspirational capital, familial capital, social capital, navigational capital, and resistant capital the Latina student persisted in their engineering programs. Their lived experiences guided by parents, teachers, educational communities, included themes of discovery, sacrifice, encouragement, preparation, and support. Contributing factors that contributed to the Latina engineering students' persistence included living communities, cohort, professors, family, peers, and mentors. These contributing factors brought to light five themes, the discovery of academic passions, guidance and support of family and teachers, preparation for and commitment to persistence, the power of community and collective engagement, and commitment to helping others.

From this study, I heard a voice that did not tie directly into the framework of Yosso's (2005) community cultural wealth. Their words spoke of adversity and the need for strength and courage and determination and self-awareness. After extensive synthesis and analysis of the remaining data, I was determined to find a measure for the missing piece of the undergraduate Latina engineering student's voices. Their voices accentuated with such strength it needed to resonate on paper With the help of their dynamic stories, I have incorporated and developed a new capital entitled fortitude capital.

New Concept for Community Cultural Wealth Capital, Fortitude Capital

The study has helped me expand on Yosso's (2005) community cultural wealth concept. The findings in this study helped in developing a new theme that has not appeared in the literature. From the analysis and synthesis of the data, I have developed an additional capital called fortitude capital. Fortitude capital refers to individual strength in the face of adversity or difficulty. They have emotional power or reserve and the ability to withstand adversity. Fortitude comes from the Latin word *fortitudo*, meaning strength. Each one of the participants had fortitude capital. Julia acknowledges you have to set goals for yourself and believe in your own abilities." She stated: "Keep your goal in mind and don't ever think you are not capable because of your background." The participants developed persistent strength by setting goals and creating new ones. This helped them develop an emotional mindset to persist. Miranda pointed out: "Every semester I would set new goals for myself. I set new goals that I want to accomplish." Isabella explained her process when forming a goal. "You have to envision what you're going to do before you start doing it. But you must also be fully committed to your goal if you intend to persist."

Miranda further engaged in the notion of fortitude capital when it comes to failures. You have to gain strength during times of adversity and difficulty. Miranda shared her approach using Fortitude Capital:

> "Learn that you may fail once or twice, but that does not mean that you cannot succeed. If you go through a struggle, just know it is only one class, it does not determine your whole life, and you can get past it."

Isabella also gave advice in regards to failures. She shares her philosophy when it comes to times of difficulty. She stated: "People need to learn from failures. Lessons are built on failures as

much as successes. It definitely builds character. Grow from it."

Rebeca explained how she persists. Her words encompass the notion of fortitude capital. She commented: "I keep looking forward and use my motivation from previous classes that I found were really difficult but I succeeded in. This motivates me through the next one." With confidence in her voice, she went on to explain: "You know what? After I get through this, I am going to think it was so easy afterward and it really was not that bad. This motivates me to move forward to persist."

Within the interview, the participants also shared, some advice they would you give to the incoming woman, especially a woman of color when it comes to persistence within the engineering program. Their answers provided support for the newly developed theme of fortitude capital. Julia was open about the difficulty they would experience throughout the program. She stated:

> "It is going to be tough. People will see the end outcome and they will gloss over everything you had to go through to achieve that. People do not see the internal struggle. I think the realization that other people are struggling, just as much as you are, I think that is empowering. As long as you tell yourself, you are going to keep going, you are going to keep going. You are going to make progress."

Miranda commitment to helping others uses fortitude capital to provide advice to incoming freshman. She stated: "I would tell them to not give up, and not let others dictate their future, and to really take their future into their own hands, ask questions, get involved, and do not be afraid."

With rich measure, the participants in my study have helped me understand the importance of fortitude capital. According to the National Science Foundation (2009) Latinas earn only 2.0% of all engineering baccalaureate degrees. The undergraduate Latina students in

this study have emotional power and reserve. They instill academic intelligence that promotes knowledge is power. Regardless of the adversity and difficulties, that they encounter their fortitude capital blended together with discovery of academic passion, guidance, and support of family and teachers, preparation for and commitment to persist, the power of community and collective engagement, and commitment to helping others are all part of the lived experience of the four Latina women in this study. The life stories of each of the participants are unique. Collectively, they each share one goal. They all were determined to persist in their engineering programs.

Chapter 5 will present a summary of the study and present the key finding that emerged from the data. The chapter will also highlight the limitations of this study, and offer recommendations for future studies. I will share my journey and reflection on the dissertation process and conclude with closing thoughts.

CHAPTER FIVE: KEY FINDINGS, AND CONCLUSIONS

Summary of the Study

This study focused on the stories of four undergraduate Latina students that persevered in their engineering programs. Through qualitative methodologies using a narrative approach, the participants shared their lived experiences. The researcher engaged with each participant to record their experiences, and carefully translate those experiences into written form for further study.

This final chapter provides an interpretation of the information that emerged from participant interviews, denotes recurring themes that emerged from the data, and discusses how those themes relate to the perspectives of community cultural wealth and their relationship to the research question:

1. What are the lived experiences of undergraduate Latina engineering students?
2. What are the contributing factors that influence undergraduate Latina students to persist in an undergraduate engineering program?

The purpose of this qualitative narrative study was to report the stories of Latinas students' experiences that persist in their engineering programs. The four Latina students spoke to five major themes that contributed to their persistence in their engineering programs. All of these themes supported facets of Yosso's (2005) Community Cultural Wealth and touched on Bandura's (1997) Self-Efficacy. However, based on participants' narratives, linguistic capital did not emerge as a contributing factor to the students' persistence in engineering. The five themes that emerged included 1) discovery of academic passions, 2) guidance and support of family and teachers, 3) preparation for and commitment to persistence, 4) power of community and collective engagement, 5) commitment to helping others. Each theme was interwoven throughout

the participants lived experiences.

Key Findings

Four major findings emerged from the data that supported the Latina student's persistence in their engineering programs. The analysis of the data showed that family, middle school and high school experiences, faculty and peer mentoring, and their university experiences were key factors that influenced their persistence.

The first major finding that emerged was the importance of family. The women in my study acknowledged that having guidance and support from family was a key factor to their persistence. The findings about family connects with Zeldin and Pajares (2000) study, they found women consistently recalled experiences that involved an influential person, often during a critical time, who helped them, develop their beliefs about their capabilities while also developing their competencies. However, my study focuses exclusively on the influences of Latino families.

Three of the participant's fathers were instrumental in providing encouragement and a belief in their daughters' abilities to succeed. Julia expressed how her father encouraged her. She stated: "growing up she loved building science kits with her dad." She felt empowered from an early age because her dad always supported her interests.

Miranda acknowledged there was one difficult semester where she questioned if college and engineering was really worth it. She offered a prime example of the support her father provided her. Miranda said, "I got a text from my dad, and he said, "I just want you to know you've accomplished so much more than I could ever imagine. You just make us so very proud." She felt her father's encouragement had helped her persist. His words on that day continue to have a positive effect during any times of difficulty.

Rebeca also had a father that could guide her to persist and move forward through her education. When she was having difficulties with an engineering course, her father was her confidant. Rebeca stated: "My dad told me, do not stress out over it. You can just retake it and its fine. You just have to get through it and everything is going to be okay. He told me he was proud of me." Rebeca's always felt she had the support of her father. She believed that his encouragement was a contributing factor to her persistence.

Each one of the women persisted with the support of their mothers. Isabella's claimed her mom's financial help contributed to her persistence in engineering. She stated: "My mom helped me financially to live in the engineering dorm. She made many sacrifices so I could attend. Julia's mom was a tremendous support. She encouraged me throughout the program because she knew I would stand on my own two feet with a degree in engineering." Miranda's mom would go out of her way asking her colleagues' questions on how to navigate the admission process. The key finding of family support and encouragement was a strong indicator of persistence for each of the women in the study.

The second major finding that emerged was the importance of their middle school and high school experiences. The experience included participation in innovative STEM curriculum, dual programs between high schools and the local university, summer math and engineering programs, and Advanced Placement courses. All of the women aspired to pursue engineering early in their life. Their academic passion highlighted the beginning of their persistence.

A key finding was the importance of participating in a national STEM engineering club that encouraging their abilities. The opportunity to work and learn with students that are at different levels increases their development. One of the programs that was highlighted included a 6th-grade robotics club BEST. BEST stood for Boosting Engineering, Science, and Technology.

It was a national program with fifty local competition sites in eighteen states. The middle school and high school students that participated in the robotics club BEST were required to provide an engineering notebook, give an oral marketing presentation, construct an educational exhibit, and show excellent team spirit and sportsmanship. This experience provided Rebeca the tools to learn how to persist through a challenge. Rebeca's team made it to the finals.

Their discoveries of academic passion were nurtured through an innovative STEM curriculum developed in their K-12 education. Isabella said she was fascinated with science. She learned about the component of cells and the human body beginning in the 7th grade. Isabella passion for engineering grew after taking a new innovative computer science course her sophomore year in high school. Miranda passion for engineering began her sophomore year in high school when she took an engineering design class. By her senior year, she became aware she wanted to be a biomedical engineer. These innovative programs were essential to developing the skills needed to prevail in engineering programs.

A key finding was the importance of dual programs with the local universities. They believed these programs contributed to developing their passion for engineering. Julia's interest in engineering was sparked by participating in a dual design program. Their K-12 education communities were influential in developing their passions for engineering. Middle schools and high school communities established the foundation for their persistence.

A key finding was the importance of participating in a summer engineering program at the local university while attending high school. The persistent women took advantage of opportunities to gain additional knowledge outside the classroom beyond the school year. A summer math program assisted Julia advancing her math skills. The summer math program provided a math foundation that would be needed to take advanced math courses. The women

confirmed the value of attending high school engineering summer programs offered at the local universities. They stated it provided them with the knowledge and the academic tools that were needed to persist in an engineering program.

A key finding was having a strong foundation in math and science. My study connects to Veenstra, Dey and Herrin (2009) study that suggests students who enter an engineering college with more quantitative knowledge in areas such as algebra, geometry, trigonometry, pre-calculus, calculus, and physical sciences are most likely to succeed in engineering. The women in my study highlighted the importance of taking Advanced Placement (AP) calculus and Advanced Placement (AP) physics Advance Placement (AP) chemistry and Advance Placement (AP) biology. My findings also suggest that students should be ready to enroll in calculus I their first-semester in college. They stated calculus I provided the foundation needed to persist in all the engineering programs.

The third major finding that emerged was the contribution of faculty and peer mentoring. Berk *et al.* (2005) described a mentoring relationship as one that may vary along a continuum from informal/short-term to formal/long-term. The faculty offers advice, information, guidance, support, and provides opportunities to a student. Developing a purposeful connection with faculty contributed to their persistence. The faculty provided additional opportunities outside the classroom, developing the strengths of each of the women creating an environment for academic persistence. They benefitted greatly from knowing key faculty and professional staff. Professor's approachability and knowledge of campus resources were a contributing factor to their persistence within the engineering program. My study correlated with Kim *et al.* (2009) study that found faculty can help women students by bolstering their confidence and encouraging them to see themselves as successful in STEM majors and careers in the future. Isabella stated

her professor was instrumental in encouraging her to seek tutoring for a difficult course. She felt the professor believed she could be successful in the class with the help of tutoring. With the mentoring of Dr. Green, Julia gained valuable information about scholarships and internships that were available. She accredits part of her persistence to the fiscal and academic rewards that she earned. Julia stated: "This will help me persist beyond my degree. I can include my experience on my resume." She felt that Dr. Green was an advocate for her success. Miranda and Isabella believe that the faculty sponsors for their (BMES) Biomedical Engineering Society are true mentors. We enjoyed working with the faculty they were able to help us with making connections outside of our university." My findings support Miller (2002) and Nora and Crisp (2007) studies that determined that mentoring could have a positive effect on students. They suggested that listening, identification of problems, providing encouragement, and providing moral support are all parts of the mentoring experience. The faculty in my study served as a resource offering the women opportunities such as tutoring, funding, and internships. The faculties were influential in the academic development of each of the women.

Another significant finding suggested having an engineering upperclassman peer mentor formal or informal was contributing factor to their persistence. Miranda stated: "It helped me persist early on in the engineering program. I had a biomedical engineering (BME) peer mentor. A key finding emerged stating having a mentor that shares the same major contributed to their persistence. Miranda pointed out it is easier because we share some of the same experiences." Rebeca found an upperclassman engineering mentor student that helped her group with the difficult classes." These mentoring experiences were essential in their development.

A fourth major finding was the importance of their university experiences. The engineering dorm provided a community that supported the persistence of the three of the

women in the study. Contrary to Seymour (1995), findings that suggested women entering college felt isolated, intimidated, and insecure, questioning whether they were in the right place. A key finding in my study found that the creation of an engineering dorm has changed the engineering climate for these women. By living in an engineering community, they were reassured that they were not alone in the process of pursuing an engineering degree. They lived with students that had the same ideas, goals, and struggles and were able to develop lifelong friendships. The engineering dorm offered tutoring, study groups, intellectual and social bonding. They were empowered to persist in their programs with the community network that they engaged in. An important key finding is having engineering student RA's. They felt an engineering RA provided them with an additional resource. Miranda met Isabella, who lived on the engineering floor, so she would spend a lot of time there doing projects, and studying for engineering classes. Miranda felt the dorm provided her the academic and social resources she needed to persist.

In addition, my study provides additional support to Hyde and Gess (2000) and Kahveci *et al.* (2008) study that found interactions with peers could provide women with an avenue to exchange information, find study partners, and create informal peer role models. My study found that being involved in a cohesive engineering cohort contributed to their persistence in engineering. The cohort structure offered additional social and academic support for two of the women in the study. The cohorts formed study groups providing academic support throughout the program. The cohort provided a space for collaboration that promoted and supported their interests. Miranda was convinced the cohort was a key factor to her persistence in the engineering program. She stated: "We went through everything together. We asked each other questions. It is a big support system." Isabella also identified her cohort as a reason why she

persisted in the engineering program. She acknowledged the cohesiveness of the cohort as a major contributor that helped her through difficult courses.

Latina student's persistence in their engineering programs was the result of their family support, middle school, high school experiences, faculty and peer mentoring and their university experiences.

Limitations

There were several limitations in this study. First, the study did not include non-traditional students. Second, the experiences of the women were unique to their circumstances and, thus, the results are not generalizable to all undergraduate Latina students that persist in their engineering programs. A third limitation was the sample size and the focus on one institution. Despite the limitations, the participants' thick descriptions and rich narratives provided a valuable insight, understanding these Latina students' persistence in their engineering programs.

Recommendations

This qualitative narrative inquiry case study provided insight into future research that could explore Latina students' persistence in the graduate engineering program. It is extremely important that future studies contribute to non-deficit perspectives of Latina students. This study focused on five forms of community cultural wealth (Yosso's, 2005) aspirational, familial, social, navigational, and resistant capital. Additional research could focus on the linguistic capital. Another aspect worth exploring is the life stories of Latino fathers' contributions to their daughters' academic persistence.

Future studies could consider examining the effective STEM programs that K-12 incorporates into their curriculum to inspire girls into pursuing engineering degrees. In addition,

future research could include a longitudinal study examining Latinas who enrolled in K-12 STEM outreach programs and their connection to their college persistence. In light of the limitation of this study, it is important to extend this research to other STEM fields beyond the engineering programs.

Researcher's Reflection on the Study

Looking back on this journey, I felt honored to be able to hear the life stories of the four participants. Their stories were empowering. When I first reached out to them through email, they responded with such enthusiasm. I was looking forward to the journey that we had in front of us. I felt fortunate that they were willing to share their personal life stories with me and with the people that might read this dissertation. From personal experience, it is not easy to share your struggles and successes with the world. As a society, we can be too quick in judging others. I admire their courage for being open to sharing their lived experiences. Most importantly, I valued their commitment and trust throughout the dissertation process.

I must first acknowledge that I learned much from Yosso's (2005) community cultural wealth. I realize this theoretical framework helped shape my own personal journey. Throughout the dissertation process, I also connected with the theoretical framework. Community cultural wealth was not just a connection with the participants, but it has also shaped my development throughout the years. I would not have entered into the doctoral program if it were not for the people that have influenced my life.

Conclusion

Our society will only benefit when we ensure that all women are provided the same opportunities and guidance needed to acquire the knowledge and skill needed to persist in undergraduate engineering programs. Latina students' early academic foundation in math and

science is crucial. It is the responsibility of elementary, middle school, high school, and college educators to create opportunities that contribute to women's persistence in engineering.

Professional educators have the knowledge to become advocates for future women engineers. It is imperative that students acquire a strong foundation in math and science, while they are in high school. A strong foundation in math and science can develop through Advanced Placement and Dual Credit math and science courses. School districts working together with their local colleges and universities can develop summer engineering programs. By strengthening our connections, we are creating an environment that encourages and supports Latina engineering aspirations early in their education.

As I conclude this study, I continue to reflect on the journey each of the participants openly shared with me. Their powerful stories illuminate the impact of the human spirit and the importance of the people that encompass their lives. People that were committed to student success nurtured their persistence in the engineering programs. Supporters inspired the participants' by providing opportunities that developed their passion for learning. Their persistence involved many people that created life-changing opportunities. Guidance from parents, teachers, faculty, and peers offered support creating spaces that promoted persistence. With this support, the Latina students were able to develop for themselves preparation for and the commitment to persist. They developed self-empowerment, motivation, commitment and a vision for their future. Moreover, they are now committed to helping others to persist through mentoring. They continue to want to assist others as they navigate the educational system becoming leaders for the community and promoting collective engagement. Their hope is to increase the persistence of other Latina women in engineering programs. The journey for each participant continues. Persistence for them does not have a conclusion. They are constantly

setting new goals for themselves. For each of the persisting Latina engineering students in the study, this is only the beginning of their story.

APPENDIX A

Informed Consent

Permission to Take Part in a Human Research Study

Title of research study: Engineering Success: Undergraduate Latina Women's Persistence in an Undergraduate Program

Investigator: Steve Rosbottom

Purpose of the research study and reason for your participation:

The purpose of this qualitative study is to describe and explore the experiences of undergraduate Latina women that persist in their engineering degree.

We invite you to take part in a research study because you are an undergraduate Latina woman that has declared an engineering major at UTSA. You have successfully completed calculus I, calculus II, and physics for scientists and engineers I, physics for scientists and engineers II, and applied engineering analysis I. You also have a 2.5 or higher and you are working towards your first degree.

The conditions surrounding your participation:

- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Contact information:

If you have questions, concerns, complaints, or think the research has harmed you, you may talk to the research team at 210-458-5525 or steven.rosbottom@utsa.edu or 210-458-5403 or Mark.Giles@utsa.edu

This research is being overseen by an Institutional Review Board ("IRB"). You may also talk to them at (210) 458-6473 or IRB@utsa.edu if you have questions regarding your rights as a research participant or other questions, concerns, or complaints.

Participation in the research study:

If you agree to participate in this study you will be:

- Asked to meet with the researcher at a mutually agreed upon locale and take part in two recorded interviews which will last 60 minutes each.
- You will be asked to supply a pseudonym to be used in place of your name.
- You may be contacted two weeks after the second interview in order to clarify some of your earlier responses. The follow-up interview will last, approximately ½ hour.

- The data collected through the interviews will be transcribed using the pseudonym you provided.

Risks and Discomforts:

None

Participant Privacy and Research Record Confidentiality:

Specify any protections you will have in place. For example:

Your data will not contain anything to connect your identity with your information and will be anonymous. Your research records will not be released without your consent, unless required by law or a court order. Your records may be viewed by the Institutional Review Board, but the confidentiality of your records will be protected to the extent permitted by law. The data resulting from your participation may be used in publications and/or presentations, but your identity will not be disclosed.

You may be advised by the IRB to include additional information in the consent form if your study includes prisoners as participants, the study is greater than minimal risk, the study is subject to FDA oversight, or there is additional information that participants should be made aware of.

Signature Block

Your signature documents your permission for the named participant to take part in this research.

Name of participant (Age if minor)	
Signature of Participant (or participant's legally authorized representative)	Date
Signature of person obtaining consent	Date

APPENDIX B

Participant Recruitment Email

Dear, _____,

I am a doctoral student in the College of Education and Human Development at the University of Texas at San Antonio. I am seeking participants to aid my research. My study is exploring the lived experiences of undergraduate Latina women engineering students.
This email is a request to help me identify potential participants for my research study. I am seeking participants who:

1. Identify as Latina
2. Declared engineering as a major of study
3. Full time student
4. Has completed the following courses: calculus I, calculus II, physics I, physics II, and applied engineering analysis
5. 2.5 or higher grade point average

I am asking you to share the attached flyer with students that meet the criteria. You can contact me via email at steven.rosbottom@utsa.edu.

Thank you in advance for your assistance.

Sincerely,
Steven Rosbottom

APPENDIX C

Flyer for Engineering Advisors

Looking for participants for a research study!

Who-

Latina women who have declared engineering as a major and completed Calculus I &II, Physics I &II, and Applied Engineering Analysis I

Why- For a dissertation, research study

When- Spring and summer 2016

What- 2 interviews (approximately 60 minutes each)

Where- Campus locations (e.g., JPL)

If interested, contact Steven Rosbottom via email at steven.rosbotom@utsa.edu

APPENDIX D

Email Letter of Invitation to Potential Participants

Date:
Dear _____,

As a doctoral student at The University of Texas at San Antonio, I will be conducting a dissertation study entitled, "Engineering Success: Latina Women's Persistence in an Undergraduate Engineering Program." This letter is an invitation to you as a potential participant in the study.

Only five persons will be selected to participate in the study. You will be asked to participate in two interviews that will be approximately 60 minutes in duration. The interviews will be audio recorded and transcribed by myself, the researcher. You will be provided with a copy of my interpretations of your interviews in order to allow you to corroborate that your perceptions will be accurately reported. All the materials used for the study will be kept in a secure location and pseudonyms will be used for all the participants to ensure anonymity and confidentiality.

The results of this study will be published in a dissertation format, and will possibly be presented at professional conferences and printed in further publications within professional journals. Furthermore, it is the intent of this study to add to the scholarly literature, inform future research, and to inform leaders and policymakers within the higher education system.

Please state your interest in participating in the study by placing an X in one of the two statements and then forward this email to steven.rosbottom@utsa.edu.

Yes, I would like to participate_____

Time and date available for an interview: Date_____ and Time_____

I do not wish to participate_____

Should you have questions or concerns about this study you can contact me, or my Faculty advisor, Dr. Mark Giles at 210-458-5403 or at mark.giles@utsa.edu.

I thank you in advance for your consideration of supporting my research.

Steve Rosbottom

Ed.D Candidate, The University of Texas at San Antonio

APPENDIX E

Email Letter of Filled Spots to Potential Participants

Date: _____

Dear, _____

I would like to thank you for your interest in participating in my dissertation study entitled, "Engineering Success: Latina Women's Persistence in an Undergraduate Engineering Program."

The five slots that were open filled quickly, which acknowledged the importance of this study. At this time, I will not be able to include you in the study. Thank you though for taking the time to support my research.

Sincerely,

Steven Rosbottom

APPENDIX F

Interview Protocol for the Interviews

Round One Questions

- Introduce myself to the student and thank the participant for taking the time to participate. The purpose of this interview is engineering success and undergraduate Latina women's persistence in an undergraduate engineering program.

- This interview will last approximately one hour. Our conversation will be recorded and I will be taking notes throughout this interview. You may ask questions throughout this interview.

- Provide interviewee with a copy of the consent form for their records.

The following questions will focus precisely on the women in the engineering program.

1. What life experiences guided you to choose this profession? How has these experiences enriched your life?
2. What were your experiences as a student (middle or high school) related to science or math or engineering?
3. Can you recall when you first knew you wanted to be an engineer? Can you explain that experience?
4. What were your expectations of the engineering program?
5. Describe how you adjusted academically and personally to your first year in the engineering program?
    a. Describe any fears you had upon entering the engineering program?
6. Which courses were the most challenging? Why? What strategies did you employ to succeed in those courses?
    b. What support did you seek or receive to help you persist?
7. Did you experience any barriers in your pursuit of an engineering degree? If so, how were you able to overcome such barriers?

8. How would describe your academic and personal growth?
9. Who were the key individuals that provided you with motivation, encouragement, or academic or financial support?
10. What knowledge or skills would you say a Latina student would need to persist in the engineering program?
11. What are your goals after graduation?
12. Where do you see yourself in five years?

Wrap-up questions

Do you have any questions for me?

At the end of the interview

I will thank the participant for her time and insights. I look forward to our follow-up interview.

APPENDIX G

Interview Protocol #2 (Individual)

Round Two Questions

Date of interview:

This second interview will last approximately one hour. Our conversation will be recorded and I will be taking notes throughout this interview. You may ask questions throughout this interview.

1. Thinking back to what you shared with me regarding your experiences, which experiences do you feel had the most impact to your persistence in the engineering program.
2. What influences from family members or from your home community helped you navigate your collegiate experiences?

3. Are there any university programs that you were part of that helped you persist in the engineering program and how did they help you?

4. What motivates you to persist in engineering and what do you contribute to be the most significant influences? What would you say has been your primary motivation?

5. What advice would you give an incoming woman, especially a woman of color, when it comes to persistence in the engineering program?

6. Is there anything else you would like to add that we have not discussed today?

APPENDIX H

Approval		
Document No.:	**Date:**	**Page:**
HRP-522	**11 April 2016**	**Page 1 of 1**

Steven Rosbottom
EHD - ELPS
210-458-5525
Steven.Rosbottom@utsa.edu

Dear Principal Investigator:

On April 11, 2016 the IRB approved the following from April 11, 2016 to April 10, 2017 inclusive.

Type of review:	**Initial**
Title:	**Engineering Success: Undergraduate Latina Women's Persistence in an Undergraduate Engineering Program**
Principal investigator:	**Steven Rosbottom**
IRB number:	**16-180**
Faculty Sponsor:	**Mark Giles, Ph.D.**
Documents reviewed:	**Initial Review Application; Research Personnel; Protocol; Information Sheet; Interview Questions (R1 & R2); NoSpots email; Recruitment email Participant; Recruitment Flyer; Recruitment Request Advisors Identify;**

No later than one month prior to expiration, you are to submit a continuing review to request continuing approval or closure. If the IRB does not grant continuing review, approval of this protocol ends after **April 10, 2017**.

Copies of any approved consent documents, consent scripts, or assent documents are attached.

In conducting this study, you are required to follow the requirements in "INVESTIGATOR GUIDANCE: Investigator Obligations (HRP-800)."

Sincerely,

Marcia Isaacs, M.S., C.I.P.
Senior Research Compliance Coordinator
UTSA Office of Research Integrity - IRB Office

REFERENCES

Andersen, M., & Collins, P. H. (2007). *Race, class, and gender: An anthology*. Belmont, CA: Wadsworth Publishing.

Aronson, E. (1999). Dissonance, hypocrisy, and the self-concept. *Readings about the social animal*, 219-236.

Arriola, E. (1998). March! *Chicano-Latino Law Review, 19,* 1–67.

Astin, H. S., & Sax, L. J. (1996). Developing scientific talent in undergraduate women. *The equity equation: Fostering the advancement of women in the sciences, mathematics, and engineering*, 96-121.

Atkinson, R. D., & Mayo, M. J. (2010). Refueling the US innovation economy: Fresh approaches to science, technology, engineering and mathematics (STEM) education. *The Information Technology & Innovation Foundation, Forthcoming*.

Bandura, A. (1997). Self-efficacy: The exercise of self-control. *Gordonsville, VA: WH Freeman & Co*.

Bandura, A., Barbaranelli, C., Caprara, G.V. & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*, 187-206.

Bell, D. A. (1980). *Brown v. Board of Education* and the interest-convergence dilemma. *Harvard Law Review, 93*(3), 518–533.

Bell, D. A. (1992). *Faces at the bottom of the well: The permanence of racism.* New York: Basic Books.

Bell, D. A. (2004). *Silent covenants: Brown v. Board of Education and the unfulfilled hopes for racial reform*. New York: Oxford University Press.

Bernold, L. E., Spurlin, J. E., & Anson, C. M. (2007). Understanding Our Students: A Longitudinal-Study of Success and Failure in Engineering with Implications for Increased Retention. *Journal of Engineering Education*, *96*(3), 263-274.

Besterfield-Sacre, M., Moreno, M., Shuman, L. J., & Atman, C. J. (2001). Gender and ethnicity differences in freshmen engineering student attitudes: A cross-institutional study. *Journal of Engineering Education*, *90*(4), 477–489.

Black, D. A., & Smith, J. A. (2006). Estimating the returns to college quality with multiple proxies for quality. *Journal of Labor Economics*, *24*(3), 701-728.

Blickenstaff, J. (2005). Women and science careers: leaky pipeline or gender filter?

Bloom, L. R. (2002). From self to society: Reflections on the power of narrative inquiry. *Qualitative research in practice: Examples for discussion and analysis*, 310-313.

Boeije, H. (2002). A purposeful approach to the constant comparative method in the analysis of qualitative interviews. *Quality and quantity*, *36*(4), 391-409.

Bogdan, R., & Biklen, S. (2007). Qualitative research for education: An introduction to theory and practice.

Bong, M. & Skaalvik, E.M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review, 15*, 1-40.

Bruning, M. J., Bystydzienski, J., & Eisenhart, M. (2015). Intersectionality as a framework for understanding diverse young women's commitment to engineering. *Journal of Women and Minorities in Science and Engineering*, *21*(1).

Burge, S. W. (2006). Gendered Pathways in Higher Education: Change and Stability in the Pursuit of a Science Degree.

Burack, C., & Franks, S. (2004). Telling stories about engineering: Group dynamics and resistance to diversity. *NWSA Journal*, *16*(1), 79-95.

Burtner, J. (2004). Critical-to-quality factors associated with engineering student persistence: The influence of freshman attitudes. In *Frontiers in Education, 2004. FIE 2004. 34th Annual* (pp. F2E-1). IEEE.

Byars-Winston, A.M. & Fouad, N.A. (2008). Math and science cognitive variables in college students. *Journal of Career Assessment, 16*(4), 425-440.

Caldwell, P. (1995). A hair piece: Perspectives on the intersection of race and gender. In R. Delgado (Ed.), *Critical race theory: The cutting edge* (pp. 267–277). Philadelphia: Temple University Press.

Canagarajah, A. S. (1996). From critical research practice to critical research reporting. *TESOL Quarterly*, *30*(2), 321-330.

Carbado, D. W., Crenshaw, K. W., Mays, V. M., & Tomlinson, B. (2013). Intersectionality. *Du Bois review: social science research on race*, *10*(02), 303-312.

Carrasco, E. R. (1996). Collective recognition as a communitarian device: Or, of course, we want to be role models. *La Raza LJ*, *9*, 81 Carrasco, E. R. (1996). Collective recognition as a communitarian device: Or, of course we want to be role models. *La Raza LJ*, *9*(1), 81-101.

Cech, E., Rubineau, B., Silbey, S., & Seron, C. (2011). Professional role confidence and gendered persistence in engineering. American Sociological Review, 76(5), 641–666.

Ceci, S. J., & Williams, W. M. (2010). Sex differences in math-intensive fields. *Current Directions in Psychological Science*, 0963721410383241.

Chapa, J., & De La Rosa, B. (2006). The problematic pipeline demographic trends and Latino participation in graduate science, technology, engineering, and mathematics programs. *Journal of Hispanic Higher Education*, *5*(3), 203-221.

Charles, M., & Bradley, K. (2009). Indulging our gendered selves? Sex segregation by field of study in forty-four countries. *American journal of sociology*, *114*(4), 924-976.

Charmaz, K. (2000). Constructivist and objectivist grounded theory. *Handbook of qualitative research*, *2*, 509-535.

Chemers, M.M., Hu, L. & Garcia, B.F. (2001). Academic self-efficacy and first-year college student performance and adjustment. *Journal of Educational Psychology, 93*(1), 55-64.

Clandinin, D. J., & Connelly, F. M. (2000). Narrative inquiry: Experience and story in qualitative research.

Colbeck, C.L., Cabrera, A.F. & Terenzini, P.T. (2001). Learning professional confidence: Linking teaching practices, students' self-perceptions, and gender. *The Review of Higher Education, 24*(2), 173-191.

Cole, E. R. (2009). Intersectionality and research in psychology. *American psychologist*, *64*(3), 170-180.

Collins, P. H. (1999). Moving beyond gender: Intersectionality and scientific knowledge. *Revisioning gender*, 261-284.

Collins, P. H. (2007). Pushing the boundaries or business as usual? Race, class, and gender studies and sociological inquiry. In C. J. Calhoun (Ed.), Sociology in America: A history (pp. 572–604). Chicago, IL: University of Chicago

Commission on Professionals in Science and Technology. (2006). *Professional women and minorities: A total human resource data compendium* (16th ed.). Washington, DC:

Crenshaw, K. W., Gotanda, N., Peller, G., & Thomas, K. (Eds.) (1995).Critical Race Theory: The key writings that formed the movement . New York: The New Press.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into practice*, *39*(3), 124-130.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches.* Thousand Oaks, CA: Sage.

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2008). Educational Research: Planning, conducting, and evaluating quantitative and qualitative research (3 ed.). New Jersey: Pearson Education.

Creswell, J.W. (2009). Research Design: *Qualitative, Quantitative and Mixed Methods Approaches*: London: Sage Publications.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic Serving Institution. *American Educational Research Journal*, *46*(4), 924-942.

Daempfle, P. A. (2003). An analysis of the high attrition rates among first year college science, math, and engineering majors. *Journal of College Student Retention: Research, Theory & Practice*, *5*(1), 37-52.

Delgado, R. (Ed.). (1995). *Critical race theory: The cutting edge.* Philadelphia: Temple University Press.

Delgado, R., & Stefancic, J. (2000). California's racial history and constitutional rationales for race-conscious decision making in higher education. *UCLA Law Review, 47*, 1521– 1614.

Delagado Bernal, D. (2002). Critical race theory, latcrit theory and critical raced gendered epistemologies: Recognizing students of color as holders and creators of knowledge. *Qualitative Inquiry*, *8*(1), 105-126.

Daly, J., Kellehear, A., & Gliksman, M. (1997). The public health researcher: A methodological approach. Melbourne, Australia: Oxford University Press.

DeFreitas, S. C. (2012). Differences between African American and European American first-year college students in the relationship between self-efficacy, outcome expectations, and academic achievement. *Social Psychology of Education*, *15*(1), 109-123.

Denzin, N. K. (1989). *Interpretive biography*. Newbury Park, California Sage.

Denzin N. &Lincoln, Y. (1994). *Handbook of qualitative research*. Thousand Oaks,California: SAGE Publications Inc

Dill, B. T., & Zambrana, R. E. (2009). Critical thinking about inequality: An emerging lens. In B. T. Dill & R. E. Zambrana (Eds.), *Emerging intersections: Race, class, and gender in theory, policy, and practice* (pp. 1–21). New Brunswick, New Jersey: Rutgers University Press

Dixson, G. (2011). Are math readiness and personality predictive of first year retention in engineering? *The Journal of Psychology, 145*(3), 229-245.

Davies, D., & Dodd, J. (2002). Qualitative research and the question of rigor. *Qualitative health research*, *12*(2), 279-289.

Duff, P. A., & Bell, J. S. (2002). Narrative research in TESOL: Narrative inquiry: More than just telling stories. *TESOL Quarterly*, *36*(2), 207-213.

Eccles, J. S. (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly*, *18*(4), 585-609.

Eide, E., Brewer, D. J., & Ehrenberg, R. G. (1998). Does it pay to attend an elite private college? Evidence on the effects of undergraduate college quality on graduate school attendance. *Economics of Education Review*, *17*(4), 371-376.

Elliott, R., Strenta, A. C., Adair, R., Matier, M., & Scott, J. (1996). The role of ethnicity in choosing and leaving science in highly selective institutions. *Research in Higher Education*, *37*(6), 681-709.

Farmer-Hinton, R. L. (2008). Social capital and college planning students of color using school networks for support and guidance. *Education and Urban Society*, *41*(1), 127-157.

Flores, L. Y., Navarro, R. L., Lee, H. S., & Luna, L. L. (2014). Predictors of Engineering-Related Self-Efficacy and Outcome Expectations across Gender and Racial/Ethnic Groups. *Journal of Women and Minorities in Science and Engineering*, *20*(2).

Fouad, N.A. (2007). Work and vocational psychology: Theory, research, and applications. *Annual Review of Psychology, 58*, 543-564.

Freebody, P. (2003). *Qualitative research in education: Interaction and practice*. Thousand Oaks, California: SAGE Publications Inc.

Freire, P. (1973). *Education for critical consciousness* (Vol. 1). Bloomsbury Publishing.

French, B. F., Immekus, J. C., & Oakes, W. C. (2005). An examination of indicators of engineering students' success and persistence. *Journal of Engineering Education*, 94(4), 419–425.

Frome, P. M., Alfeld, C. J., Eccles, J. S., & Barber, B. L. (2006). Why don't they want a male-dominated job? An investigation of young women who changed their occupational aspirations. *Educational Research and Evaluation*, *12*(4), 359-372.

Gay, L. R., & Airasian, P. (2003). Education research. *Competencies for Analysis and Applications, New Jersey*.

George-Jackson, C. E. (2011). STEM switching: Examining departures of undergraduate women in STEM fields. *Journal of Women and Minorities in Science and Engineering*, *17*(2).

Glesne, C. (2011). *Becoming qualitative researchers: An introduction* (4th ed.). Boston, Massachusetts: Allyn & Bacon.

Gonzalez, K. P., Stoner, C., & Jovel, J. E. (2003). Examining the role of social capital in access to college for Latinas: Toward a college opportunity framework. *Journal of Hispanic Higher Education*, *2*(2), 146-170.

Gough, N. (2000, October). Methodologies under the microscope. In *Notes for a presentation to a doctoral research students' conference, DUPA* (Vol. 8).

Haines, V.A., Wallace, J.E. & Cannon, M.E. (2001). Exploring the gender gap in engineering: A re-specification and test of the hypothesis of cumulative advantages and disadvantages. *Journal of Engineering Education,* 90(4), 677-684.

Hall, R. M., & Sandler, B. R. (1982). The classroom climate: A chilly one for women? Washington: Association of American Colleges.

Hancock, A. (2007). Intersectionality as a normative and empirical paradigm. *Politics & Gender, 3*(2), 248-254.

Harper, S. R. (2010). An anti-deficit achievement framework for research on students of color in STEM. *New Directions for Institutional Research*, *2010*(148), 63-74.

Hassinger, M., & Plourde, L. A. (2005). “Beating the odds": How bi-lingual Hispanic youth work through adversity to become high achieving students. *Education*, *126*(2), 316.

Hatch, J. A. (2002). *Doing qualitative research in education settings*. Suny Press.

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

Huang, G., Taddese, N., & Walter, E. (2000). Entry and Persistence of Women and Minorities in College Science and Engineering Education. *Education Statistics Quarterly*, *2*(3), 59-60.

Hurtado, Sylvia, Nolan L. Cabrera, Monica H. Lin, Lucy Arellano, and Lorelle L. Espinosa. "Diversifying science: Underrepresented student experiences in structured research programs." *Research in Higher Education* 50, no. 2 (2009): 189-214.

Hutchison-Green, M. A., Follman, D. K., & Bodner, G. M. (2008). Providing a Voice: Qualitative Investigation of the Impact of a First-Year Engineering Experience on Students' Efficacy Beliefs. *Journal of Engineering Education*, *97*(2), 177-190.

Hyde, M. S., & Gess-Newsome, J. (2000). Factors that increase persistence of female undergraduate science students. *Women succeeding in the sciences: Theories and practices across disciplines*, 115-137.

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., & Williams, C. C. (2008). Gender similarities characterize math performance. *Science*, *321*(5888), 494-495.

Jacobs, J. E. (2005). Twenty-five years of research on gender and ethnic differences in math and science career choices: What have we learned?. *New directions for child and adolescent development*, *2005*(110), 85-94.

Janesick, V. J. (2000). The choreography of qualitative research design. *Handbook of Qualitative Research.*, 379-399.

Johnson, A. C. (2007). Unintended consequences: How science professors discourage women of color. *Science Education*, *91*(5), 805-821.

Johnson, B., & Christensen, L. (2012). *Educational research: Quantitative and qualitative approaches*. Allyn & Bacon.

Jones, S. R., Torres, V., & Arminio, J. (2013). *Negotiating the complexities of qualitative research in higher education: Fundamental elements and issues*. Routledge.

Jones, S. R. (2009). Constructing identities at the intersections: An autoethnographic exploration of multiple dimensions of identity. *Journal of college student development*, *50*(3), 287-304.

Jones, S. R., Torres, V., & Arminio, J. (2006). *Negotiating the complexities of qualitative research in higher education: Fundamental elements and issues*. New York, NY: Routledge.

Kahveci, A., Southerland, S. A., & Gilmer, P. J. (2008). From marginality to legitimate peripherally: Understanding the essential functions of a women's program. *Science Education*, *92*(1), 33.

Kvale, S. (2007). *Doing interviews*. Thousand Oaks, CA: Sage

Kim, K., Fann, A., & Misa-Escalante, K. (2009). Engaging women in computer science and engineering: Insights from a national study of undergraduate research experiences. *Center for Embedded Network Sensing*.

Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *The Journal of*

Higher Education, *79*(5), 540-563.

Ladson-Billings, G., & Tate, W. F. (1995). Toward a critical race theory of education. Teachers College Record ,97(1), 47–68.

Lawrence, C. (2002). Foreword: Who are we? Why are we here? Doing critical race theory in hard times. In Valdes, Culp, Harris (Eds.).Crossroads, directions & a new Critical Race Theory . Philadelphia: Temple University Press.

Leslie, L. L., McClure, G. T., & Oaxaca, R. L. (1998). Women and minorities in science and engineering: A life sequence analysis. *Journal of Higher Education*, 239-276.

Leidens, J. A., Moskal, B. M., & Pavelich, M. J. (2004). Qualitative methods used in the assessment of engineering education. *Journal of Engineering Education*, *93*(1), 65-72.

Lincoln, Y. S. (2002). On the nature of qualitative evidence. Paper presented at the annual meeting of the Association for the Study of Higher Education, Sacramento, CA.

Lieblich, A., & Josselson, R. (1997). *The narrative study of lives*. Sage.

Lincoln, Y.S. & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.

Lord, S. M., Camacho, M. M., Layton, R. A., Long, R. A., Ohland, M. W., & Wasburn, M. H. (2009). Who's persisting in engineering? A comparative analysis of female and male Asian, black, Hispanic, Native American, and white students. *Journal of Women and Minorities in Science and Engineering*, *15*(2).

Lotkoiski, V., Robbins, S., & Noeth, R. (2004). The role of academic and non-academic factors in improving college retention: ACT Policy Report. Retrieved from http://www.act.org/research/ policymakers/pdf/college_retention.pdf.

Luna, N. A., & Martinez Ph D, M. (2013). A qualitative study using community cultural wealth to understand the educational experiences of Latino college students. *Journal of Praxis in*

Multicultural Education, *7*(1), 2.

Lynn, M., & Parker, L. (2006). Critical race studies in education: Examining a decade of research on US schools. *The Urban Review*, *38*(4), 257-290.

MacPhee, D., Farro, S., & Canetto, S. S. (2013). Academic self-efficacy and performance of underrepresented STEM majors: Gender, ethnic, and social class patterns. *Analyses of Social Issues and Public Policy*, *13*(1), 347-369.

Marra, R. M., Rodgers, K. A., Shen, D., & Bogue, B. (2009). Women Engineering Students and Self-Efficacy: A Multi-Year, Multi-Institution Study of Women Engineering Student Self-Efficacy. *Journal of Engineering Education*, *98*(1), 27-38.

Marra, R. M., Rodgers, K. A., Shen, D., & Bogue, B. (2012). Leaving Engineering: A Multi-Year Single Institution Study. *Journal of Engineering Education*, *101*(1), 6-27.

Marshall, C. & Rossman, G.B. (2006). *Designing qualitative research* (4th ed.). Thousand Oaks, CA: Sage.

Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin*, *28*(9), 1183-1193.

Meinholdt, C., & Murray, S. L. (1999). Why aren't there more women engineers? *Journal of Women and Minorities in Science and Engineering*, *5*(3).

Merriam, S. B. (2014). *Qualitative research: A guide to design and implementation*. John Wiley & Sons.

Miller, A. (2002). *Mentoring students & young people: A handbook of effective practices.* London: Kogan Page.

Milner, H. R. (2007). Race, culture, and researcher positionality: Working through dangers seen, unseen, and unforeseen. *Educational Researcher*, *36*(7), 388-400.

Morrow, S. L. (2005). Quality and trustworthiness in qualitative research in counseling psychology. *Journal of counseling psychology*, *52*(2), 250.

Morse, J. M., Barrett, M., Mayan, M., Olson, K., & Spiers, J. (2008). Verification strategies for establishing reliability and validity in qualitative research. *International journal of qualitative methods*, *1*(2), 13-22.

Morris, L. K., & Daniel, L. G. (2008). Perceptions of a chilly climate: Differences in traditional and non-traditional majors for women. *Research in Higher Education*, *49*(3), 256-273.

Moses, L., Hall, C., Wuensch, K., De Urquidi, K., Kauffmann, P., Swart, W., & Dixon, G. (2011). Are math readiness and personality predictive of first-year retention in engineering? *The Journal of psychology*, *145*(3), 229-245.

Moustakas, C. (1994). *Phenomenological research methods*. Sage Publications.

National Science Board. (2006). *Science and engineering indicators* 2006. Washington, DC: National Science Board.

National Science Board. (2007). *A national plan for addressing the critical needs of U.S. science, technology, engineering, and mathematics education system*. Arlington, VA: National Science Foundation.

National Science Foundation (1984). *Women and minorities in science and engineering*. National Science Foundation, Arlington

National Science Foundation (1990). *Women and minorities in science and engineering*. National Science Foundation, Arlington (NSF Publication No. 90-301)

National Science Foundation (2005) *Women, minorities, and persons with disabilities in science*

and engineering. National Science Foundation, Arlington

National Science Foundation (2009). *Women, minorities, and persons with disabilities in science and engineering*. National Science Foundation, Arlington, VA.

National Science Foundation. (2011). *Women, Minorities, and Persons with Disabilities in Science and EngineeringArlington, VA.*

National Science Foundation, Division of Science Resources Statistics. (2012). Women, Minorities, and Persons with Disabilities in Science and Engineering: 2012. Special Report NSF 11-309. from http://www.nsf.gov/statistics/wmpd/

National Science Foundation, National Center for Science and Engineering Statistics. (2015). Women, Minorities, and Persons with Disabilities in Science and Engineering. Arlington, VA

Nauta, M., Epperson, D., & Kahn, J. (1998). A multiple-groups analysis of higher level career aspirations among females in mathematics, science, and engineering majors. *Journal of Counseling Psychology, 45*(4), 483–496.

Nora, A., & Crisp, G. (2007). Mentoring students: Conceptualizing and validating the multi-dimensions of a support system. *Journal of College Student Retention: Research, Theory & Practice*, *9*(3), 337-356.

Park, J. (2011). Why is it so challenging for collegians and student affairs educators to talk about race? The elephant in the room race. In P.M. Magolda, & M.B. Baxter Magolda (Eds.), Contested issues in student affairs (pp.225-243). Sterling, VA: Stylus Publishers

Pascarella, E. T., & Terenzini, P. T. (2005). How college affects students: A third decade of research. *San Francisco: Jossey-Bass*.

Patton, M. Q. (1990). *Qualitative evaluation and research methods*. SAGE Publications, Inc.

Patton, M. Q. (2002). Qualitative research and evaluation methods 3 edition Sage. *Thousand Oaks, CA*.

Rallis, S. F., & Rossman, G. B. (2012). *Research Journey: Introduction to Inquiry*. Guilford Press.

Reinharz, S., & Davidman, L. (1992). *Feminist methods in social research*. Oxford University Press.

Rennie, D. L. (2004). Reflexivity and personcentered counseling. *Journal of Humanistic Psychology*, *44*(2), 182-203.

Rice, P. L., & Ezzy, D. (1999). *Qualitative research methods: A health focus*. Melbourne: Oxford University Press.

Riegle-Crumb, C., Farkas, G., & Muller, C. (2006). The role of gender and friendship in advanced course taking. *Sociology of Education*, *79*(3), 206-228.

Rosenthal, G. (1993). Reconstruction of life stories: Principles of selection in generating stories for narrative biographical interviews.

Rumberger, R. W., & Thomas, S. L. (1993). The economic returns to college major, quality and performance: A multilevel analysis of recent graduates. *Economics of Education Review*, *12*(1), 1-19.

Russell, M. (1992). Entering great America: Reflections on race and the convergence of progressive legal theory and practice. *Hastings Law Journal, 43*(4), 749–767.

Ryen, A. (2003). Cross-cultural interviewing. *Inside interviewing: New lenses, new concerns*, 429-448.

Samuelson, C. C., & Litzler, E. (2016). Community Cultural Wealth: An Assets-Based Approach to Persistence of Engineering Students of Color. *Journal of Engineering Education*, *105*(1), 93-117.

Sandoval-Lucero, E., Maes, J., & Klingsmith, L. (2014). African American and Latina (o) community college students' social capital and student success. *College Student Journal*, *48*(3), 522-533.

Santiago, D. (2006). Inventing Hispanic-Serving Institutions (HSIs): The Basics. *Excelencia in Education (NJ1)*.

Sax, L. J. (2008). *The gender gap in college: Maximizing the developmental potential of women and men*. Jossey-Bass.

Schunk, D.H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*, 207-231

Shields, S. (2008). Gender: An intersectionality perspective. *Sex Roles*, 59, 301–311

Sin, S. (2010). Considerations of quality in phenomenographic research. *International Journal of Qualitative Methods*, *9*(4), 305-319.

Seymour, E., & Hewitt, N. M. (1997). Talking about leaving: Why undergraduates leave the sciences. Boulder: Westview Press.

Seymour, E. (1995). The loss of women from science, mathematics, and engineering undergraduate majors: An explanatory account. *Science Education, 79*(4), 437–473.

Shapiro, C. A., & Sax, L. J. (2011). Major selection and persistence for women in STEM. *New Directions for Institutional Research*, *2011*(152), 5-18.

O'Shea, S. (2015). Avoiding the manufacture of 'sameness': first-in-family students, cultural capital and the higher education environment. *Higher Education*, 1-20.

Shields, S. A. (2008). Gender: An intersectionality perspective. *Sex Roles*, *59*(5-6), 301-311.

Silverman, D. (Ed.). (2010). *Qualitative research*. Sage.

Snyder, T. D., & Dillow, S. A. (2013). Digest of Education Statistics, 2012. NCES 2014-015. *National Center for Education Statistics*.

Solorzano, D. G., & Bernal, D. D. (2001). Examining transformational resistance through a critical race and LatCrit theory framework Chicana and Chicano students in an urban context. *Urban Education*, *36*(3), 308-342.

Solórzano, D. G. (1997). Images and words that wound: Critical race theory, racial stereotyping, and teacher education. *Teacher Education Quarterly, 24*(3), 5–19.

Solorzano, D. G., & Solorzano, R. W. (1995). The Chicano educational experience: A framework for effective schools in Chicano communities. *Educational Policy*, *9*(3), 293-314.

Sonnert, G., & Fox, M. F. (2012). Women, men, and academic performance in science and engineering: the gender difference in undergraduate grade point averages. *The Journal of Higher Education*, *83*(1), 73-101.

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: using in-group experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of personality and social psychology*, *100*(2), 255.

Strauss, A. & Corbin, J (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications.

Subedi, B., & Rhee, J. E. (2008). Negotiating collaboration across differences. *Qualitative Inquiry*, *14*(6), 1070-1092.

Tang, M., Fouad, N. A., & Smith P. L. (1999). Asian American career choices: A path model to examine factors influencing their career choices. *Journal of Vocational Behavior, 54*(1), 142-157.

Tate, W. F. (1997). Critical race theory and education: History, theory, and implications. *Review of research in education*, *22*, 195-247.

Taylor, E. (2000). Critical race theory and interest convergence in the backlash against affirmative action: Washington State and Initiative 200. *Teachers College Record, 102,* 539–561.

Tesch, R. (1990). *Qualitative analysis: Analysis types and software tools*. Falmer Press, London.

Thomas, S. L., & Zhang, L. (2005). Post-baccalaureate wage growth within four years of graduation: The effects of college quality and college major. *Research in Higher Education*, *46*(4), 437-459.

Trenor, J. M., Yu, S. L., Waight, C. L., Zerda, K. S., & Sha, T. L. (2008). The relations of ethnicity to female engineering students' educational experiences and college and career plans in an ethnically diverse learning environment. *Journal of Engineering Education*, *97*(4), 449-465.

U.S. Bureau of Labor Statistics (2004). Women in the labor force: A data book (Report 973). Retrieved from http://www.bls.gov/cps/ wlf-databook.pdf

U.S. Bureau of Labor Statistics (2008). Women in the labor force: A data book (Report 1011).

U. S. Government Printing Office. (2014). Electronic code of federal regulations-Title 34: Education, part 643-Talent search.

Valencia, R. R., & Solórzano, D. G. (1997). Contemporary deficit thinking. *The evolution of*

deficit thinking: Educational thought and practice, 160-210.

Villalpando, O., & Solórzano, D. G. (2005). The role of culture in college preparation programs: A review of the research literature. *Preparing for college: Nine elements of effective outreach*, 13-28.

Veenstra, C. P., Dey, E. L., & Herrin, G. D. (2009). A model for freshman engineering retention. *Advances in Engineering Education*, *1*(3), 1-31.

Vogt, C. (2003). An account of women's progress in engineering: A social cognitive perspective. *Journal of Women and Minorities in Science and Engineering*, *9*(3&4).

Vogt, C. M., Hocevar, D., & Hagedorn, L. S. (2007). A social cognitive construct validation: Determining women's and men's success in engineering programs. *The Journal of Higher Education*, *78*(3), 337-364.

Wang, X. (2013). Why Students Choose STEM Majors Motivation, High School Learning, and Postsecondary Context of Support. *American Educational Research Journal*, *50*(5), 1081-1121.

Ware, N. C., & Lee, V. E. (1988). Sex differences in choice of college science majors. *American Educational Research Journal*, *25*(4), 593-614.

Webster, L., & Mertova, P. (2007). *Using narrative inquiry as a research method: An introduction to using critical event narrative analysis in research on learning and teaching*. Routledge.

Wolniak, G. C., Seifert, T. A., Reed, E. J., & Pascarella, E. T. (2008). College majors and social mobility. *Research in Social Stratification and Mobility*, *26*(2), 123-139.

Williams, M. M., & George-Jackson, C. E. (2014). Using and Doing Science: Gender, Self-Efficacy, and Science Identity of Undergraduate Students in STEM. *Journal of Women*

and Minorities in Science and Engineering, *20*(2).

Wilson, D. M., Bates, R., Scott, E. P., Painter, S. M., & Shaffer, J. (2015). Differences in Self-Efficacy among Women and Minorities in STEM. *Journal of Women and Minorities in Science and Engineering*, *21*(1), 27-45.

Wing, A. K. (Ed.). (1997). *Critical race feminism: A reader.* New York: New York University Press.

Wing, A. K. (Ed.). (2000). *Global critical race feminism: An international reader.* New York: New York University Press. Wing, A. K. (Ed.). (2000). *Global critical race feminism: An international reader.* New York: New York University Press.

Xie, Y., Shauman, K. A., & Shauman, K. A. (2003). *Women in science: Career processes and outcomes* 26,(73.4). Cambridge, MA: Harvard University Press.

Xu, Y. J. (2008). Gender disparity in STEM disciplines: A study of faculty attrition and turnover intentions. *Research in Higher Education*, *49*(7), 607-624.

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race ethnicity and education*, *8*(1), 69-91.

Yosso, T. J. (2006). *Critical race counterstories along the Chicana/Chicano educational pipeline*. Routledge.

Zeldin, A. L., & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research*

Journal, *37*(1), 215-246.

Yosso, T. J., Parker, L., Solorzano, D. G., & Lynn, M. (2004). From Jim Crow to affirmative action and back again: A critical race discussion of racialized rationales and access to higher education. *Review of Research in Education*, *28*, 1-25.

Zeldin, A. L., Britner, S. L., & Pajares, F. (2008). A comparative study of the self-efficacy beliefs of successful men and women in mathematics, science, and technology careers. *Journal of Research in Science Teaching*, *45*(9), 1036-1058.

VITA

Steven R. Rosbottom graduated from Texas State University with a B.A. in speech communications with a minor in media studies. He spent eight years teaching in a title I high school. He earned a master's degree in Education at the University of Texas at San Antonio. He was an academic advisor in the college of engineering at UTSA for eight years. After receiving a doctorate in Educational Leadership and Policy Studies, Steven aspires to become an instructor in a higher education institution.