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LATINO COLLEGE STUDENTS' DECISIONS REGARDING ACADEMIC SUPPORT SERVICES: A CASE STUDY

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LATINO COLLEGE STUDENTS' DECISIONS REGARDING ACADEMIC SUPPORT SERVICES: A CASE STUDY

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Dedication

First and foremost, I am grateful to God for allowing me to complete this chapter in life. I know His continued guidance will send me where I need to be in my next journey. I dedicate this work to Him. I also would like to dedicate this study to my whole family, especially my Parents, Victorio Rodriguez Flores and Olga Morales Flores for providing me with endless support and for being the driving force that started this journey. I also dedicate this work to my lovely Sister, Cristina Flores, for your endless support and believing in me wholeheartedly as I went through this process. To my Husband, Froylán González, I share this work with you because you were there alongside me from the start of the pilot study and until the end. You were present every step of the way without complaint, motivating and supporting me until the end. Our Daughter Victoria also deserves to share in this honor since she gave me a burst of motivation to finish while I carried her as we trekked all over campus our last semester. Froy, you made sure we were safe every step of the way. I love you and thank you! I also dedicate this work to my brilliant Uncle, Moisés Morales Dominguez, for always being there to listen to me as I vented about my grad experiences. You always found a way to give me strength with your love and pep talks while reminiscing about our family experiences. I also dedicate this work to my loving Grandparents, Bonifacio Flores Hernández and Carmen Rodriguez Flores, and Jose Morales Rodriguez and Maria Idolina Dominguez. You all left me so much more than any college experience could give me. From you, I learned how to strive and not give up no matter what; that I can do whatever I set out to do. I miss you dearly. To my In-Laws, Antonio and Octavia Gonzalez, thank you for your support and prayers through this process. May God continue to bless all of my family.

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LATINO COLLEGE STUDENTS' DECISIONS REGARDING ACADEMIC SUPPORT RESOURCES IN SCIENCE: A CASE STUDY

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This study focused on Latino undergraduate students majoring in science, and their decisions to access academic support programs. The purposes were to understand (1) factors that influence Latino students' career-related choices; choosing a science major and accessing resources in support of their academic careers; and (2) what role socializers play in those decisions. The informants were four Latino college students who chose science majors when admitted to a research university. Using a case-study interview approach, they were interviewed longitudinally over two years to understand the influences on their decisions. Data codes and themes were generated through interpretive analysis of interview transcripts, and results were evaluated against the Eccles' et al. (1983) expectancy-value model of career choices. Three categories were identified: decisions made prior to matriculation, decisions made in adjusting to the university environment, and continuing decisions to persist in the sciences. First, initial decisions as high school students were made within a web environment, through self-dialogue. Participants relied on web information in a non-interactive way to make decisions on their own. Parents, teachers, and peers merely validated decisions. Second,

the process by which these students adjusted in their first year of college revealed differences among the participating students. Unlike the two male computer science majors, two female biology majors had a more difficult time participating in classes, being active about seeking help and contacting socializers, and managing their personal lives. This contrast continued on to their second year. Finally, the study yielded an iterative notion of decision-making about persistence in science. The two female biology majors having a hard time in their classes constantly revisited their initial choice of a science major. They accessed the web to get information necessary to find a solution and relay that to new socializers, such as advisers, mentoring program staff, and peers in college. Drawing from these findings, this study yielded a framework for discussing Latino science students' academic decision making. The importance of the web in initial decisions has digital equity implications, and indicates the importance of Internet outreach. Further, differences in the decision process imply a need for personalized support structures.

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Chapter 1: Introduction

Each year, high school seniors in the United States face challenging decisions impacting the rest of their lives. They are faced with a string of choices about whether or not to attend college, and if they do, which college they will attend. Once they choose a college, students are also faced with the pressures involved with applying and choosing a college major. Some factors demonstrated to influence students' decisions about choosing a major include financial issues, family preferences, career aspirations, quality of the institution, campus life, and academic programs (Cabrera and La Nasa, 2000). Upon deciding to go to college and applying, during the application process, students make the primary choice or decision of choosing college major. For this study, I am focusing on that choice, as well as other decisions or choices (ancillary decisions) they make about what they perceive as helpful to their primary decision of choosing a STEM academic major. Students first make a primary decision to choose a science major, and then they make supporting decisions or ancillary decisions to enroll in a particular school, take particular classes, seek help in some form, participate in optional science related support and professional development programs and organizations to further persist in their science major or career.

Once accepted and in college, students must decide whether to stay once they are accepted and enrolled. While studies of college choice investigate whether or not a student goes to college, and which colleges (s)he chooses to attend (see Paulsen and John, 1997; Zemsky and Oedel, 1983), studies of persistence investigate whether or not a student continues to re-enroll and finish his or her studies (see Astin, 1975; Bean, 1980; Pascarella and Terenzini, 1980; Tinto, 1987). When we consider traditionally underrepresented students, such as women and ethnic minority, with a college major in

Science, Technology, Engineering, and Math (STEM), persistence literature makes clear the need to increase the number of underrepresented groups and understanding the factors at play in their persistence.

The definition of "persistence" according to Arnold's (1999) definition of persistence is "a student's postsecondary education continuation behavior that leads to graduation" (p. 5). For the purposes of this study, "persistence" will be the students' postsecondary continuation behavior during their first two years in college from semester to semester and with the same major. Although graduating can be difficult for any student, low-income, first-generation, and minority students have lower persistence rates than traditional students (Arnold, 1999).

Administrators at a Research University have long recognized the importance of attracting students of different economic and cultural backgrounds. Since 1997, financial aid administrators have made the Research University more accessible to economically and culturally disadvantaged students by offering two major support programs in the Natural Sciences College (NSC); Mentoring Program (MP) and Research Program (RP) are two support programs at Research University set in place to support underrepresented groups in NSC. Please note that pseudonyms are used throughout this study when referencing Research University programs and colleges within. Although administrators at Research University do not recruit students based on income levels or race, many students in MP or RP are first-generation, low-income, and/or underrepresented students (Mentor Program Director, personal communication, August, 2011).

The Mentoring Program is a collection of selective academic programs that has operated jointly out of the Natural Science College and the Liberal Arts College since 2002. The Mentoring Program's mission is to transform the learning experience for its students by creating small academic communities that first promotes academic excellence

and then encourages intellectual investment. The Mentoring Program houses three programs, one of which is the Mentoring Scholars Program (MP), the focus of this study. The MP provides a small-college experience to approximately 325 freshmen each year through linked classes, a critical thinking course, tutoring, dedicated advising and peer mentoring and support continues into their second year. MP targets students who have excelled in high school even in the face of adversity. Students must apply and be selected to the program (Research University website: NSC homepage, 2012, personal communication, November, 2011).

The Research Program (RP) offers about 500 first year students the opportunity to initiate and engage in authentic research experiences with faculty and graduate students in areas such as chemistry, biochemistry, nanotechnology, molecular biology and computer sciences. RP spans three semesters of integrated coursework and laboratory research in newly renovated, dedicated research labs. Students move through the program in cohorts of about 30. Students emerging from RP have experience with experimental techniques and lab work, possible publications and a deep understanding of the scientific process (Research University website: NSC homepage, 2012; personal communication, November 2011). About 40% of first year participants are from underrepresented groups. Since 2005, Research Program has involved about 2000 first year students in faculty research. In 2009, twenty-five percent of RP participants were first-generation students (Research University website: NSC homepage, February 2012). According to a teacher brochure used to promote the program amongst high school science teachers, RP students significantly outperform matched comparison groups (SAT, High School GPA). This gap continues through all 4 years and holds true across groups at risk in the sciences (first generation, low socio-economic background). It also states that students in RP have a

26% higher support rate and a three-fold increase in graduates pursuing PhDs, MDPhDs, and MPhs (Research University website: NSC homepage, February 2012).

Although the Mentoring Program and the Research Program are similar in that they target first year students with the purpose of increasing persistence at Research University, the two programs have different functions and have different selection criteria. Although both programs recruit and target different students, no student can be invited to apply to both programs. The selection begins early in the year (January-February) when student applications for admission have begun to come into the university. The program directors for both programs meet in the beginning of the year with admissions staff at Research University to get briefed on the status of the applicants falling within the Natural Science College (NSC). In that preliminary meeting in mid-January, directors get information (average SAT, GPA etc. and demographics about race, gender etc.) about the overall population of applicants in review for acceptance. Program directors are able to request a list of students based on the program criteria they may need, outlined below. In a follow-up meeting in mid-late February with Admissions staff, program directors meet once again to get briefed on any new pertinent information in regards to the newly admitted students (Mentor Program Director, personal communication and observations, January, 2012).

When analyzing applicants, the Research Program specifically requests admitted students with an SAT equivalent of less than or equal to 1250, with a first choice of major in the Natural Sciences College (NSC) (Mentor Program Director, personal communication, February 2012). For the Research Program, when analyzing applicants, the director requests students that have not been claimed to any other support program, as the SAT equivalent scores for students in RP are more competitive with an average SAT greater than 1250 (Observation meeting communication, February 2012).

It is important to detail that the process by which support program directors prevent student overlap for more than one program requires constant communication within all programs and weekly updates from the registrar's office staff or as needed.

STATEMENT OF THE PROBLEM

Although students choose to attend an institution of higher education and have chosen a major in STEM, the choice-making process is constantly at work. For some students, predominantly underrepresented groups like women and ethnic minorities, making other choices about applying to institutional support programs adds on to the, at times, difficult choice-making process. The students are targeted in high school and recruited by support programs in hopes of increasing the underrepresented groups applying to Research University, as well as to provide them support once accepted to increase their chances of persisting in their major within a college.

Unfortunately, in many cases a student may choose a college without even considering how various factors affect his or her persistence. For example, a student might choose a college because a peer with great ability in science chose the Natural Sciences College, but (s)he might not have taken enough math classes in high school to succeed at that college. Therefore, university administrators may need to be prepared to assist students in persisting at their colleges of choice once they are enrolled.

In the case of predominantly underrepresented students invited to apply to a Mentoring Program and Research Program, pre-college expectations of Research University might be negative because of their high schools' lack of representation at the university. The offer to apply to institutional support programs may give a student a good reason to choose the Research University. However, offering students these academic resources alone does not guarantee that these students will succeed. Students from academically and economically disadvantaged backgrounds may not realize the difficulty

in persisting at an academically challenging university such as Research University. By offering academic and social support, as well as mentorship and research opportunities through the Mentoring Program (MP) and Research Program (RP), respectively at the Research University, it increases the likelihood of persistence for these students from the time they matriculate. If the MP and the RP programs help more low-income, first-generation, and/or underrepresented students graduate from Research University, then other universities may want to consider programmatic adjustments based on the Research University experience.

PURPOSE OF THE STUDY

Mentoring Program and Research Program participants with a Science, Technology, Engineering, and Math (STEM) major were intentionally invited to apply to these programs for this study, because they tend to be academically, economically or culturally disadvantaged students who normally face more barriers in graduating from college than traditional students. Utilizing qualitative methodology, I seek to understand what factors influence Latino science student when making career-related choices, specifically choosing a science major, decisions about accessing resources in support of a science career, and what role socializers play in Latino science students' decisions about those choices.

Mentoring Program and Research Program students actually in the program made the choice to apply to either program and were accepted. These students made a conscious or unconscious decision to apply for many reasons and with possible assistance from a family member, a high school teacher or counselor, a peer or other. Understanding the reasons and value they placed in that decision are very important and provide insight into the students' motivation for that choice. Their reasons for choosing to apply to either of these programs at Research University are important for persisting in their STEM

major and hold special significance for the support programs as universities can learn more about how they can increase the number of underrepresented students that are to benefit from them. However, just as there are students that valued the invitation to apply to these programs for specific reasons, there are students that did not apply and did not take advantage of these resources. These students are equally important to understand, but beyond the scope of this study. Since the students targeted for these programs are underrepresented groups, largely ethnic minorities and women, understanding their reasons for not applying and any possible influence by someone would be important for the improvement efforts of these support programs reaching more underrepresented groups. Unfortunately, this study is limited to only science majors and to students invited to apply to the Mentoring Program only and cannot therefore be generalized to technology, engineering, or mathematics major students or to those participants in the Research Program. The focus of this study is to understand what factors influence Latino science students when making career-related choices, specifically choosing a science major, decisions about accessing resources in support of a science career, and what role socializers play in Latino science students decisions' about those choices.

The link between choice of college major and career choice is important when we think about this study because most of the research on decision making focuses on these. There is research that supports that career choice is the strongest predictor of major choice (Hambourger, 2004), yet not much is known about other ancillary choices to choosing a major or career, such as other choices about how they access resources in support of a science major or science career. The literature devoted to academic major choice is much more limited than the literature on career choice. Strong predictors of undergraduate STEM major choice is self-efficacy in math (Betz and Hackett, 1983; 1986), years of high school mathematics, math anxiety, gender (Hackett, 1985),

specifically, women are less likely to choose a STEM major and students who are good at mathematics and science are significantly more likely to choose STEM majors (Staniec, 2004). Numerous research articles support the positive correlation between career choice and academic major choice (see Bandura, 1997; Hackett & Betz, 1989; Lent, Brown, & Hackett, 1994; Hambourger, 2004).

Considering the strong support for the academic major choice and career choice, interventions offered by the Mentoring Program and the Research Program, mentorship and research experiences, respectively, can help prevent failure for these students who are underrepresented in science majors. Having these components for students is proven by research to help in their persistence by addressing academic and social barriers (such as the lack of preparation in high school) that might affect their persistence.

In order to address the purpose of the study, the following research questions were examined:

1) What factors influence Latino science students when making career-related choices, specifically choosing a science major, and decisions about accessing resources in support of a science career?

2) What role do socializers play in Latino science students' decisions about those choices?

According to the Research University Statistical Handbook 2012-2013, the Office of Information Management and Analysis at Research University, the general profile of first-time freshmen 2012 fall entrants only by number and percent distribution are as follows. Total entrants are 8,092 students of which 45.2 % are male and 54.5% are female, the majority. In terms of ethnicity/race, White student make up the majority (44.5%), Hispanics (any combination) (23.6%), Asians (18.4%), Black (5.2%), American Indian/Hawaiian/ Pacific Islander and any 2 or more ethnic categories (3.3%), and the

rest are foreign and unknown (4.1 %) (OIMA, 2013). Average Research University SAT total scores are 1855, which is 355 more points than the national average (1500). The five largest colleges by undergraduate level are the Natural Sciences, Liberal Arts, Engineering, Communication, and Business Administration, respectively from greatest number of students to least. The focus of this study is on students with a major in science. I will include data about students in the College of Natural Sciences (CONS) only.

ORGANIZATION OF THE STUDY

This study is organized into six sections. Chapter I introduces the study by explaining the significance of defining the relationship between choice of a STEM major and making career-related choices, like choosing a science major, and accessing resources in support of a science major or career, such as participating in a support program, as it relates to MP or RP students at Research University. Chapter II presents the literature that explains persistence for underrepresented students in science, literature on support program efforts like mentorship experiences and undergraduate research experiences, career choice making process for underrepresented groups, literature on the framework, and gaps in the literature. Chapter III describes the research methodology of interviews. Chapter IV presents findings of the study. Chapter V presents a discussion of findings along with a framework for discussion for looking at the choice-making for Latino science students in college. Chapter VI presents implications, a conclusion, and the limitations of the study.

LIMITATIONS OF THE STUDY

Because this study will be conducted at only one institution (Research University), the results might not be transferred to institutions with different historical

and cultural backgrounds. Moreover, this is not a longitudinal study up to graduation. In an ideal situation, entering freshmen would have been interviewed as to how they make decisions about making career-related choices and how they access resources in support of their science major or career, such as why they chose to apply to MP or RP at Research University while still in high school and throughout college up to graduation to determine the factors that affected their persistence. Due to time limitations, however, interviews were set up, composed of Latino students and interviewed throughout their first two years in college. Since the participants were all invited to apply to the Mentoring Program, the results of this study cannot be generalized to other programs, such as research programs; although one participant is accepted to the Research Program later in the first year as well. The intention was to reach out to STEM majors, yet only science majors participated and, therefore, limited the breadth of the study. Also since all participants are high achieving high school students who graduated in the top 10% of their class, it limits the transferability of results to other non-high achieving students.

DEFINITION OF TERMS

Terms defined for this study define general terms used throughout the text.

1) Caucasians: Members of an ethnic group who originated from Europe; White

2) Hispanics: A diverse population that shares a common language heritage (Spanish) but otherwise has many significant differences (Schaefer, 2000).

3) Latinos: See Hispanics.

4) Academic support program: A university based program meant to support the success of first year students as they start their college career; same as support program or retention program;

5) Mentoring Program (MP): A Research University program designed to enhance the undergraduate experience at Research University by providing mentorship opportunities for students (Research University website: Natural Sciences College home page, 2011).

6) Research Program (RP): A Research University program that is designed to provide undergraduate research experiences with faculty in various science related fields (Research University website: Natural Sciences College home page, 2011).

7) Ethnic Group: A group set apart from others because of their national origin or culture (Schaffer, 2000).

8) First-generation college students: are defined as students whose parents have no postsecondary education, or students whose parents have never earned a bachelor's degree but may have some postsecondary experience (Nunez & Cuccaro-Alamin, 1998).

9) Minority Group: A subordinate group whose members have less control or power over their lives than members of a majority or dominant group (Schaefer, 2000).

10) Persistence: For this study, a student's postsecondary education continuation behavior from semester to semester during their first two years in college.

11) Scholastic Aptitude Test (SAT): An examination used by the Research University to assist in determining admissibility of undergraduate students. Information may be obtained by writing the College Board ATP, Box 592, Princeton, New Jersey, U.S.A. 08541 (online Research University website, 2014); A test taken by college-bound juniors or seniors in high school, and universities often use test scores in admissions decisions.

12) Traditional Students: Students who are characterized as being 18-24 years old, single, dependent, attending school full-time, and working less than a few hours per week (Arnold, 1999).

13) International students-Any registered student or applicant at Research University who is not a citizen or permanent resident alien of the United States of America (online Research University website, 2014).

14) High achieving students: for this study, are those students who graduated in the top 10% of their high-school graduating class.

15) Socializers: people that influence in the decision-making of students.

SIGNIFICANCE OF THE STUDY

Eccles, Adler, and Kaczala (1982) demonstrated that socializers play a major role in the decision making process of students choosing a college major as well as in their persistence in college. Because Mentoring Program (MP) and Research Program (RP) are support programs with components research demonstrates help underrepresented groups with persistence in a STEM degree, I hypothesized that the students participating in those programs (especially because of their mentorship and research experiences, respectively) would be helpful and play a major role in contributing their insight in making career-related choices and how they access resources in support of a science major or career. They would also shed light on the role of socializers about those choices.

As first year students, they have fresh in their minds the circumstances they were in during their senior year in high school as they were making the decision to apply to these support programs. Recalling the circumstances in which they were in during the time they were in the process of choosing a major and making a choice to apply to a support program would be easier for them than for a student further on in their academic career (i.e. sophomore, junior, or senior). Understanding the circumstances of where they were when they first heard about the invitation, how they heard, and whom they told or knew of this invitation is important to get a clearer picture. Also, learning about who had input in the decision to choose a major and to apply to support resources is important to

understand how students are influenced and who influences them, and this information is crucial for this study.

In terms of persistence, students underrepresented in science majors that choose not to apply are missing out on the benefits demonstrated to promote persistence. For example, plenty of research demonstrates that the social interactions these programs create, not only with peers, but program staff and faculty, allow students to network and navigate the school system more easily as they get support for their major. Peer mentoring and counseling provided by the program decreases the likely apprehension that underrepresented students, who are often under prepared for attending Research University, might otherwise experience. Other resources available to them such as networking with their peers and professors, and interacting with program staff and others limits the resources that help them persist in their major.

This study addresses the following research questions: (1) What factors influence Latino science student when making career-related choices, specifically, choosing a science major, and access resources in support of a science major or career? (2) What role do socializers play in Latino science students' decisions about those choices? Although several factors potentially affect choice and persistence, this study seeks to define the process by which students made their decisions to choose a major, apply to a support program, access resources in support of that science major, and the socializers predominantly influencing students in the process of their decision making up to the end of their second year in college. A framework for discussion detailing this process of decision making for Latino college science students will be presented. This will help clarify how programs can better recruit students that apply so as to gain support to persist in their science major. Next, in Chapter II, the literature will cover persistence in STEM areas of higher education for underrepresented groups. The support programs' call to help

in the persistence of these underrepresented groups using mentorship and research experiences is detailed, along with the STEM career choice literature highlighting the factors involved, specifically, the classroom experiences and the socializers influencing in that decision. Since literature is limited in terms of other decision making outside of choosing a major or career, such as factors about making a choice to apply to support programs as a helpful resource to persist in their STEM major, I address how Eccles, Futterman, Goff, Kaczala, Meece, and Midgley's expectancy value model (1983) will frame my study, while making some adjustments for this study's needs.

Chapter 2: Review of Literature

Paying more attention to equity in K-16 mathematics and science education is important if we hope to prepare future students and successfully graduate them for a competitive global market. Identifying causes of underrepresentation in science and math in higher education and remedying those under representations have proven difficult. Recent research by Adelman (2006) and Russell, Hancock, McCullough (2007) has helped us better understand the educational "pipeline" through which all scientific personnel flow, and it has described the participation and achievement of women and minorities at critical junctures in that pipeline. Other studies (Espinosa, 2011) have examined how women and minorities differ from White males in ways thought to be linked with attainment in scientific fields. This attainment requires choice making on the part of the student beginning an academic career.

This review will specifically address undergraduate students' academic decision-making within science, technology, engineering, and mathematics (STEM) majors, focusing on the social influences relevant in those decisions. Addressing this decision-making process in college is of great importance to institutions of higher education that implement support programs with components meant to increase persistence of underrepresented groups in STEM majors. It is well known that within the first year of a student's undergraduate academic career, attrition rates are highest (Schutz and Malo 2003). Addressing attrition by providing students with resources in the form of undergraduate research experiences and mentorship experiences, demonstrated by research to increase persistence (see Astin & Astin, 1992; Tsui, 2007; Russell et al, 2007), becomes very relevant. These institutional academic support programs recruit first year students with STEM majors to participate in these programs in order to help them

navigate through their first year within their STEM major. The recruitment process is an effort by these college support programs to reach out to potential invitees into the programs during their senior year of high school to help increase persistence for underrepresented groups in STEM major/careers. Understanding the factors Latino students in science choose to accept these invitations by support programs is a very important piece of the puzzle of understanding science-related choice making and how these students access resources in support of their science career or major. Equally important, but outside of the scope of this study, are reasons students choose not to participate in mentoring and research programs. The focus will be on those students that applied to the programs regardless of whether they were admitted.

In thinking about these students during their first year, it is important to not lose sight of the social and individual influences students in their pre-college or high school years are experiencing. In the process of choosing to apply to a university, students go on about their every day school activities; going to class, talking to close friends, doing homework, possibly working, being involved in school organizations or activities, and going home. This is by no means a uniform experience for every student in high school. What is important is that students get influenced socially in the school system, whether by peers, teachers, counselors, and family. Understanding to what degree these socializers play a role in a student's decision-making process is yet another important piece to persistence.

If they play a role, the degree to which socializers influence students, whether consciously or unconsciously, is important to characterize if institutions want to more adequately identify and target students to participate in these programs. Also important is how institutions can improve the process of recruitment by targeting socializers in an

appropriate way to improve the number of underrepresented students accepting an invitation to participate in these programs.

The purpose of this literature review is five-fold: (1) to understand literature about persistence in STEM majors/careers; (2) to review recommendations of support program literature as helpful strategies that assist underrepresented students to persist in their STEM majors/careers, focusing on two strategies specifically, mentorship experiences, the main focus of this study, and research experiences; (3) to look at literature about the role of socializers in student major/career choice making; (4) to describe Eccles' Expectancy-Value Model on which I build my framework for this study, specifically focusing on the role of parents, high school teachers, and student peers as socializers in the decision making process; and finally, (5) to identify research gaps in the current literature above.

For this study, I focused on the primary choice of choosing a major, supporting decisions or choices to access resources in support of a science career or major, and what role socializers play in those decisions for Latino science students. The decisions they make over the course of the first two years in college can affect whether they will persist in their science major. Students first make a primary decision to choose a science major, and then they make supporting or ancillary decisions to enroll in a particular school, take particular classes, seek help in some form, participate in optional science related support and professional development programs and organizations (or not). To set the stage, next I will look to review literature about decisions related to major and career choice to understand what factors are involved for students making these decisions prior to applying for college.

MAJOR AND CAREER CHOICES

Understanding equity STEM issues for underrepresented groups is complicated by the complex environmental and individual factors that affect each individual's college major and future career choice. A career decision is a culmination of experiences and the internalization of those experiences, specifically how the desired career matches with one's identity and skills (Eccles, 1994). This review will describe some of the college factors that affect the career choice making process as it relates to underrepresented groups in STEM.

In an early study of the choice of college major of African American students studied by Thomas (1984), various theories about choice of major were evaluated. The study group consisted of 2,090 college juniors and seniors attending eight four-year colleges that were primarily located in the South Atlantic region. Five of the institutions were predominantly African American and three were predominantly White. In the study, students completed a questionnaire that covered their early childhood, family, elementary and secondary school experiences, educational and occupational values and expectations, and major field choice and changes in major while 13 majors were selected by the study tabulated as either (1) biological, natural, and technical sciences or (2) business and economics, or (3) education, social work, nursing, social sciences, and other. The findings of this 1982 study suggest choosing a college major is a process, for most African American students, that happens long before the point of college entry. African American students' choice of a college major was primarily influenced by subjective factors, but one's family background and more objective factors were also taken into consideration. The study found that sex status, occupational or career expectations, and career interests were the most important influences for selection of a major (Thomas, 1984). Although this study did not find any form of socializers' influence in African

American students' college major choice, it demonstrates that not all groups of students by ethnicity/race can be approached in the same way.

Furthermore, some of the strongest predictors of undergraduate STEM major choice are measures of self-efficacy, or an individual's judgments on his or her capabilities to perform given actions (Schunk, 1991), and educational attainment in STEM fields, especially for women and students of color (see Leslie, McClure, and Oaxaca, 1998; Colbeck, Cabrera, and Terenzini, 2001; Lent et al. 2005). Although the relevance of the findings to today's students is unclear as the data are more than 30 years old, Betz and Hackett (1983) reported that students with stronger mathematics self-efficacy expectations were more likely to select STEM-related college majors. Hackett (1985) later reported that STEM college major choice is predicted directly by gender, years of high school mathematics, mathematics self-efficacy, and mathematics anxiety. Furthermore, years later, Leslie et al. (1998) found that measures of self-efficacy and self-concept are important positive predictors of the likelihood of choosing a STEM major field and that White men have higher levels of self-efficacy than other students. These findings were later supported by research about the important factors influential in shaping career aspirations by Mau et al. (1995). In their study, Mau et al compared eighth grade female students who aspired to science and engineering careers with those who aspired to homemaking careers. Their results showed that students who aspired to nontraditional careers had higher academic achievement, self-esteem, internal locus of control, parental expectations, and socioeconomic status.

A more recent study by Crisp, Nora, and Taggart (2009) in which they examined the demographic, pre-college, environmental, and college factors that impact students' interests in and decisions to earn a science, technology, engineering, or mathematics (STEM) degree among students attending a Hispanic Serving Institution (HSI) indicated

that Hispanic students' decisions to declare a STEM major and earn a STEM degree were uniquely influenced by students' gender, ethnicity, SAT math score, and high school percentile. Earning a STEM degree was related to students' first-semester GPA and enrollment in mathematics and science ''gatekeeper'' courses. Furthermore, according to Crisp et al (2009), other factors shown to influence Hispanic students' interest in STEM fields, include pre-college preparation (Tyson, Lee, Borman, & Hansen, 2007), test scores (Barton, 2003), academic experiences in mathematics and science prior to high school (Eamon, 2004; U.S. Government Accountability Office, 2005), and prior achievement in mathematics (Astin & Astin, 1992; Moreno & Muller, 1999; Simpson, 2001).

According to Eccles (1994), career choices are influenced by a number of cultural concepts such as socializers' (teachers, family, and peers) influence. For example, a quantitative study by Dick and Rallis (1991) highlighted the impact of socializers on students. The authors surveyed 2,213 high school seniors in nine Rhode Island high schools regarding academic and career choices. They compared survey responses from female and male students with similar backgrounds in advanced science and math classes. The authors found that even when high school students took the same level of science and math courses, males chose more science and math majors than the two female biology majors, crediting parents and teachers for this choice. The two female biology majors who chose science reported having a more positive influence from teachers than those who did not choose science. This finding for the two female biology majors related to the influence from teachers supported an earlier study by Ware and Lee (1988) in which women attending a 4-year college reported having been influenced by high school teachers, as well as guidance counselors in making plans for college.

Furthermore, Carlone (2004) conducted an ethnographic study of an active physics high school course that stressed real-world themes and utilized cooperative learning via laboratory activities. This particular class was taught by an experienced male teacher and composed of 28 students: 14 boys and 14 girls; 26 Whites and two Asians. Carlone focused on the cultural practices that shape girls' identities and science perceptions. The author found that the female students were motivated to take the class because it would improve college acceptance, not because of an actual interest in the subject. None of the girls in the class wanted to pursue science in college. Carlone reported that both the teacher and the students held a perception that males were naturally better at science and consequently would be more successful in science fields and classes. This perception became evident through student and teacher comments. In the class, three girls were receiving the highest grades; however, the teacher reported that this was due to their work ethic and not necessarily to their abilities. Both the teacher and the students explained that the boys who were receiving lower grades had natural science ability and were more successful at science. The teacher reinforced this belief by reaffirming it verbally in class. This idea of natural science abilities promoted the stereotype that the girls would have to work harder than the boys who naturally understood science better. Carlone concluded that in this class, the belief in male natural science abilities negatively affected the girls' interest in science.

As in Carlone's (2004) study, many researchers have raised the concept of male teachers and female teachers treating students differently based on gender. Sabbe and Aelterman (2007) conducted a literature review of studies that focused on the effects of teacher's sex on students' interest and achievement in science and came to similar conclusions as Elstad and Turmo (2009). Sabbe and Aelterman reviewed over 35 studies that focused on the effect of teacher gender or sex on their teaching strategies and on

students' interest and achievement in science (2007). The authors argued that studies that focus on sex differences often oversimplify the term gender by using the terms sex and gender interchangeably. These studies also tend to disregard the diversity among individuals within each gender. The authors concluded that the theoretical framework through which each set of authors views sex and gender affects their studies. Those researchers, who saw sex as a determining factor in how individuals behave and subsequently teach, tended to find differences in how male and female teachers interacted with students. Those researchers who used a constructivist lens found that sex of the teacher had little effect on students' interest and achievement in science. Sabbe and Aelterman (2007) found that the research they reviewed did not support essentialist views (i.e., the concept that men and women teach differently because of their gender). The authors concluded that researchers should be more explicit in their definition of gender and describe the complexity that gender entails. These studies indicated that there is little evidence to support the idea that a science teacher's gender can affect students' achievement and interest in science. However, the studies did indicate that teachers can play an important role in students' interest in science, achievement, and decisions to pursue science. The support (or lack) of socializers is just one of the many possible factors that affect students' persistence in science.

While focusing on the role of socializers like teachers, parents, and peers, there is research that has shown race differences in regards to career role models and mentors. For example, Karunanayake and Nauta (2004) examined college students' (n=220) career role models and found that most students (all but two) identified some type of role model that they admired and would like to imitate. A large majority of these role models were of the same race/ethnicity as the participant, even if they were not a family member. Researchers have suggested that minorities may intentionally identify with a role model

of similar race/ethnicity in hopes of learning how to successfully maneuver their chosen career field (see Greene, 1990; Hackett & Byras, 1996; Assibey-Mensah, 1997). This study sheds a positive light on socialization in that, unlike the previous study by Carlone (2004) in which teacher had a negative impact on students based on their stereotypes of abilities, teachers can also be considered role models simply by reflecting themselves in their students based on ethnicity, especially for underrepresented groups. The problem still points to the lack of role models in STEM fields, in which socialization needs to occur in a more active form, other than ethnicity.

Similarly in another study, informed by social cognitive career theory (Lent, Brown, & Hackett, 1996), Mau and Bikos (2000) identified four clusters of variables—personal/psychological characteristics, family variables, school experiences, and race and sex—that significantly predicted the occupational aspirations of racial minority and female students. These studies shed light on important social aspects that are involved in the family and school experiences, supporting the need to understand how socializers influence students in their choice making. A previous study by Leslie, McClure, and Oaxaca (1998) analyzed data from the Cooperative Institutional Research Program (CIRP) and the National Longitudinal Survey of Youth using ordered statistical modeling to estimate the empirical probability of a student with a specific race/ethnicity graduating with a bachelor degree in science or engineering. The critical variables correlated with obtaining a STEM degree included the student's self-concept, self-confidence in STEM capability, commitment to the goal, and the influence of high school peers. Based on these two studies, it is not clear whether peers or family play a stronger role in influencing career choice making and if one is more influential than the other, although the above presented research demonstrates the link between family, peers, self-concept, and teachers, and choosing a career. A common theme that is particularly important to

this study is the research for underrepresented groups in which the focus is on the academic experiences in math and science. Based on the literature review, it is unclear the type of experiences most influential in career choice making. For this study, the quality of those experiences and what it means persisting in a science major is important in helping how Latino science students make science career-related choices.

Who leads those experiences in the classroom tends to be a teacher or peer. Indirectly, family plays a role by imparting ideas, experiences and thoughts to their children, who in turn may or may not contribute those thoughts in a classroom. When it comes to underrepresented groups and career decision-making, socializers are a very important piece as well. As research demonstrates, socializers are foremost in the primary decision making process of choosing a STEM major. Understanding the role of these socializers beyond choosing a major and in further ancillary decision-making is also the focus of this study. Specifically, this study aims to understand the role of socializers in choosing a science major and in the ancillary decision of choosing to apply to academic support programs focused in either mentorship experiences or undergraduate research experiences. Also, important to this study are decisions in support of persisting in their science major.

To further understand the decision-making when it comes to choices related to choosing a STEM major or career, I will next detail literature related to the importance of socializers in the decision-making process of these students.

SOCIALIZERS ROLE IN DECISION MAKING

According to Seymour (2006), socialization is a "lifelong interactive process in which people learn the values, attitudes, behavioral norms, and roles that are seen as appropriate for particular groups of people (including those for men and women) in any culture." Seymour further adds:

"Children growing up in a particular social world do not just learn what is modeled for them and expected of them. They also internalize these expectations and role models very deeply so that they become an enduring part of identity. Socialization also shapes what people see as appropriate choices for themselves and others. The most intense periods of socialization are in childhood and adolescence, but reinforcement and adjustment of patterned expectations bearing upon the "self" continue throughout life (2006)."

The process of socialization is ongoing and I will next describe the socializers that are important for this study, such as parents, teachers, and peers. Understanding how these socializers influence the decision-making process of students is very important prior to choosing a college major or career and throughout their college career.

Eccles-Parsons, Adler, and Kaczala (1982), suggest that the messages parents provide to their children include information about the values and importance that the parents attach to activities (for example, math and science). According to the authors, these messages are likely to be related to a child's motivation to pursue particular activities in the short run. The authors assessed the impact of parents on children's achievement self-concept and related beliefs. They used extensive questionnaires measuring attitudes and beliefs regarding mathematics achievement administered to children in grades 5-11 and their parents. They investigated the potential influence of parents, both as role models and as expectancy socializers. In this study, they found that attitudes were influenced more by their parents' attitudes about their abilities than by their own past performances in math. According to Eccles et al. (1982) a student may be doing well in math, yet if the parents do not perceive it as such, then the parents' may influence the student away from feeling they can do well in math and the related activities associated with it, as are STEM fields.

In addition, over time, children are expected to develop their own self-perceptions and interests, based on their parents' messages and behaviors as well as on their own

experiences, and these self-perceptions will ultimately affect their future task choices (Jacobs & Eccles, 2000). For example, if a parent values science and they believe that their child excels at it then the parent may demonstrate this belief to the child by verbal communication or by engaging the child in activities related to science. The message the parent would be sending to the child is that of science abilities. Jacobs and Bleeker (2004) make an important point to acknowledge that parents' and children's beliefs are likely to influence each other reciprocally (Jacobs and Bleeker, 2004). Furthermore, Jacobs and Bleeker (2004), find that there are several ways in which parents communicate their beliefs and values about a specific achievement domain to their children according to Eccles model: as interpreters of reality; by their provision of particular opportunities; by their involvement in activities with their children; and as role models of valued activities. Eccles have tested and found support for each of the components of parent influence (for example, Eccles-Parsons, Adler, & Kaczala, 1982; Eccles & Jacobs, 1986; Jacobs, 1991; Jacobs & Eccles, 1992).

This focus on the parents as influencing their children and the effects of their influence is well documented in a more recent study by Jacobs, Chhin, and Bleeker (2006). In the large, longitudinal study using Michigan Study of Adolescent Life Transitions (MSALT), designed to examine children's and parents' achievement attitudes during adolescence and young adulthood , the authors examined participants from diverse social classes (1) the relation between parents' gender-typed occupational expectations for their children at age 15 and their children's own reports of occupational expectations at age 17; (2) the long-term relations between parents' gender-typed occupational expectations for their children at age 17 and their children's actual occupation at age 28; and (3) the relation between job satisfaction and having a gender-traditional or nontraditional job. The results indicated that parents' gender-typed occupational

expectations were significantly related to children's own expectations and to their actual career choices, and job satisfaction was significantly related to having a gender-typed career. These findings suggest that parents' early gender-typed expectations for their children's occupational achievements were highly related to the actual occupational decisions made by the adult children.

In addition, these findings support the Eccles et al. (1982) findings by providing longitudinal evidence of the relations between parents' beliefs and the later motivation of their children to pursue particular fields. Although the focus of the study by Jacobs et al. (2006) is primarily White, middle- and working-class suburbs outside of a large Midwestern city, attention to ethnicity/race is less prominent. On the other hand, a study by Zarrett, Malanchuk, Davis-Kean, and Eccles (2006) examined gender and race differences in young adults' decisions to pursue careers in information technology (IT). They examined how earlier psychological and sociocultural factors, measured when participants' were in the eight and eleventh grades as well as three years after high school, relate to adolescents' aspirations to pursue an IT career three years after high school, both directly and indirectly, through their relation to youths' expectancies and values of computer occupations. The main focus was to understand the gender and race gap in the computer industry, paying close attention to how these different factors may differentially affect adolescents' occupational pursuits dependent on their race and gender. Participants (n=1,482, 49% female, and 61% African American and broad SES) were from the Maryland Adolescent Development in Context Study (MADICS), a community based longitudinal study of adolescents and their families aimed at examining the influences of social context on the psychological determinants of behavioral choices and developmental trajectories during adolescence. The authors' findings suggested three major points concerning the differences found for IT occupational choices by gender and

race. They found early psychological, social, and academic experiences help shape/guide youths' later career decisions. Noting the importance of socializers such as peers, teachers, and parents as important factors for all the groups examined, stating that they should be a focal point for promoting youths to pursue IT. They suggest that the interventions should focus on stressing the importance of early encouragement of children's interest and confidence in math and technical/physical sciences. In another finding they show that there appear to be some real-world limitations that keep some youths out of the IT pipeline, such as SES especially for African American youths from families with slightly lower education and income. The authors cite that in terms of academic achievement, African American males have not reached the levels necessary to go to college and successfully pursue a career. This notion speaks to the quality of education and the quality of educators minority students with low SES see in their school; not all experiences are equal.

Similarly, in a study by Adya and Kaiser (2005), the authors developed a testable model for girls' career choices in technology fields based on past research and hypotheses about the future of the information technology (IT) workforce. The authors identified factors that could potentially influence a girl's choice towards or against IT careers. Their model indicated that parents, particularly fathers, were the key influencers of girls' choice of IT careers; supporting previous work already discussed up to now.

When considering gender in career choice making, according to Seymour (2006), the strongest difference between male and female students was found to lie in their reasons for entering science, math, or engineering (S.M.E.) majors. Women differed very sharply from men in that the personal influence of family, high school teachers, and other significant adults was a much more important factor in their choice of an S.M.E. major

than was the case with men. Also, women were about twice as likely as men to have chosen an S.M.E. major through the active influence of someone significant to them.

The literature discussion up to now has demonstrated the extensive the role of parents as the socializers for the career choices of students, as well as the role of teachers and peers. I will further expand the literature on the role of teachers and peers in career choices of students. For example, in an early study by Eccles (1994), the details of women's educational or occupational choices are discussed in depth, along with the focus on the role of parents and teachers on those choices. Most of the author's findings along with some colleagues clearly indicate that parents and teachers distort their perception of the competencies of particular girls and boys in various domains in a gender role stereotypic fashion. According to Eccles, when parents or teachers who endorse the traditional gender role stereotypes regarding the distribution of talent and interests among girls and boys are asked to rate the child's competencies in a male-typed activity like athletics or physics, they underestimate the female talent and overestimate the male's talent (Eccles et al., 1990; Jacobs, 1991; Jacobs & Eccles, 1992). The authors present descriptive data on 464 first and second year high school girls' and boys' perceptions of various factors that might influence their current career expectations based on data from a larger survey of career development variables. Their results suggested that high school adolescents were aware of a variety of internal and external influences on their current career expectations. Girls endorsed more types of influence for mothers, female friends, and female teachers than did boys. Results of this study suggest that adolescents do perceive their career expectations to be influenced by personal, background, and environmental factors in a manner that is consistent with previous empirical findings.

To further support these findings, Lent and Brown (1996) noted that differential reinforcement by parents, teachers, and peers can influence the formation of career

interests and eventually career choices. Burns, Gerace, Mestre, and Robinson (1982) found that Hispanic and European American high school students made career decisions based on family, relative, or friend role models, and Hackett and Byras (1996) suggested the strong role these groups play with African American women.

Together, these socializers of parents, teachers and peers are a very important part of decision-making as it relates to choosing a career. Choosing a major or career for enrollment in college is necessary and the socializers are an important part of this decision making process. Furthermore for this study, other decisions related to academic support resources, such as choosing to apply to a support program are very important to this study. I will further detail literature that demonstrates the usefulness of taking part in these support programs for persistence in a science-related major or career chosen by a student. It is important to understand literature that addresses how institutions are working to increase the persistence of underrepresented student in STEM majors once they reach college.

ACADEMIC SUPPORT PROGRAMS

Entering undergraduate students have many choices to make that include college life adjustment, integration into the STEM fields, feelings of competence and self-worth, being a member of a minority group, faculty and peer relationships, academic guidance, cultural issues, etc. (see Braxton, 2000; Taylor & Miller, 2002). There is research arguing that a lack of commitment to the institution, involvement, social integration, and self-motivation are the main reasons for the lower retention rates for women and minorities. Within this research we find the interactionist-psychological theories such as Astin's (1984) Involvement Theory, which argues that the extent to which an individual invests psychological and physical energy in the institution (i.e., the extent to which they become

"involved") is the essential element in persistence. Other studies based with this psychological perspective include Bean and Eaton's (2000) psychological model of college student retention and Milem and Berger's (1997) involvement with peers and social activities. Similarly, Tinto (1986) suggests that minority students must assimilate into the cultural mainstream to succeed on predominantly White campuses, with the sole responsibility on the student to adjust to institutional norms, a fixed entity. According to studies of student persistence (Tinto, 1993), the focus is on psychological models which look at a student's attributes, attitudes, motivations, academic aptitude, personality traits, and abilities, among other traits, as they affect persistence or departure. A weakness of this perspective is its focus entirely on the individual assuming that the departure decision is based on some "shortcoming and/or weakness in the individual" (p. 84). Understanding the reasons underlying the implementation of programs for retention purposes is important and complements this current study.

For over 40 years, the implementation of educational intervention/training programs in schools and colleges has been one of the most common methods employed to help close a gap in educational achievement (Maton & Hrabowski, 2004). The high attrition rate among STEM majors has generated an abundance of research which has led to the development of numerous intervention programs. In 2004, $2.8 billion was spent by the federal government to increase the number of students in STEM fields. This money was spent on more than 200 different programs implemented in all 50 of the U.S. states (U.S. General Accounting Office, 2005).

Characterizing what happens in support programs is neither simple nor easy. A study by White, Altschuld, and Lee (2008) evaluated university retention programs, in partnership with the National Science Foundation, formed to address the disparity in retention rates for African-Americans, Hispanics, and Native-Americans in science,

technology, engineering, and mathematics (STEM). The authors looked at the experiences and deliberations between the partnerships. Upcraft and Gardner (1989) report that two main categories of epistemology guide most retention studies. One epistemology views retention from a developmental standpoint, in which students adjust to change and make progress toward their educational goals. The second perspective, in which success comes from being able to assimilate into different aspects, not only socially, but institutionally, looks at the integration into and involvement in campus life. White et al. (2008) go on to state that students who were better at forming new relationships and social networks while making academic progress were more likely to persist. The social component of support programs calls for looking at the socialization that takes place in such program and how socializers play a role in their lives; a focus of this current study. Despite the foundation retention programs are built on, and whether or not they are aligned with what research on persistence of underrepresented groups in STEM mentions as pertinent, the components within those programs are meant to support students academically for persistence purposes.

Literature on retention programs demonstrates evidence that supports intervention components adopted by these programs in an effort to increase diversity and address gender and race/ethnic equity issues in science, technology, engineering, and mathematics (STEM) fields. Some effective components to increase diversity and address these inequities in STEM fields, according to a review by Tsui (2007), include components such as summer bridge programs, mentoring programs, research experience, tutoring, career counseling and awareness, creating a learning center, workshops and seminars, academic advising, financial support, and curriculum & instructional reform. The author also observed that of the ten strategies reviewed, research experience and mentoring have received more attention in the literature than summer bridge programs,

learning centers, workshops & seminars, and academic advising. According to Tsui, while the latter have not received attention via empirical studies, implementers of such strategies believe in their effectiveness, which is most likely judged through informal study, anecdotal evidence, and observations. Additionally, the needs of underrepresented students in the STEM fields tend to overlap with the needs of women, students of color, and low-income students regardless of their major (Tsui, 2007). This implies that programs offering tutoring, internships, research, mentoring opportunities, and advising are also important for determining students' interest, satisfaction, and retention in higher education and specifically in STEM.

A study that speaks to these programmatic efforts for underrepresented student persistence is described by Maton, Hrabowski, and Schmitt (2000). The authors described and assessed the effectiveness of the Meyerhoff Scholars Program at the University of Maryland, Baltimore County (UMBC). The Program is designed to increase the number of underrepresented minorities who pursue graduate and professional degrees in science and engineering. Until 1996 the program admitted African American students exclusively, and the authors focused only on students from that group. According to their study, the Meyerhoff students achieved higher grade point averages, graduated in science and engineering at higher rates, and gained admittance to graduate schools at higher rates than multiple current and historical comparison samples. Student survey and interview data revealed that a number of program components were viewed as being especially important contributors to students' academic success: Program Community, Study Groups, Summer Bridge Program, Financial Support, Program Staff, and Research Internships and Mentors. These results speak to what Tsui (2007) finds as beneficial to students' persistence.

Specifically focusing on the social aspect for this present study, students who are involved in cohorts are able to build a community, with program staff and faculty, along with other student peers that may form a social system that allows for a better environment. Determining to what degree these socializers, along with family, play a role in this process of choosing to be a part of such programmatic efforts is a goal of this present study. The social aspect of interactions within mentoring experiences are most important for this study since all participants involved in this study were a part of a mentoring-focused program in college; which will be discussed next. Literature on undergraduate research opportunities for the persistence of underrepresented groups in STEM will also be discussed briefly after mentoring literature for this study since one of the participants in the study was also able to take part in such a program. This review is intended to build more support for the benefits of these support programs, especially for underrepresented groups in STEM majors.

Mentorship Experiences

Mentorship experience been a component of undergraduate support programs held to increase the probability of students persisting in science majors. Mentorship has been cited as a factor that contributes to the success of students pursuing these degrees.

According to Wilson, Holmes, Sylvain, Batiste, Johnson, McGuire, and Warner (2012), studies show that undergraduate students who are mentored tend to have higher GPAs, higher retention rates, and more units completed per semester as compared to their un-mentored colleagues (Campbell and Campbell, 1997). Wilson et. al. (2011) go on to mention that mentoring addresses key facets of student identity and social integration into scholarship and the academic community (see Redmond 1990; Jacobi 1991; Freeman 1999; Good et al. 2000; DuBois et al. 2002 in Wilson et al, 2011), and the authors go on to add that mentoring provides a core support system for students traditionally

underrepresented in STEM fields (see Good et al. 2000; Gurin et al. 2002; Summers and Hrabowski 2006).

Mentoring is said to address several causes of college attrition and delayed graduation by facilitating aspects of students' academic and social integration (Redmond, 1990). According to Tsui (2007) there is a distinction between formal and informal mentoring. The first involves planned mentoring, while the second is more natural and is supported by research which demonstrates that those relationships are more likely to be successful and result in superior outcomes (Gandara, 1999). In another study, Packard (2004) found that mentoring provides STEM students with the social capital necessary to succeed while helping them to develop their science identity. Beyond mentoring, Perna et al. (2009) found that faculty encouragement was extremely important for African American women's success in STEM majors. According to Perna et al, women in the study felt as though faculty members believed in their abilities and transformed the curriculum and pedagogical practices in order to ensure their success. Maton and Hrabowski (2004) also reported that for students in the Meyerhoff Scholars Program, a support program for minority students in STEM majors, faculty support, motivation, and advising were crucial to their success. For Latina/o STEM students, Cole and Espinoza (2008) found similar results and concluded that faculty support and encouragement are significantly related to average GPA. This notion of informal mentoring is important in building a social group of students and staff that, like research experiences, create a positive environment beneficial for all students, especially for underrepresented groups in STEM.

Another important factor related to persistence in STEM majors is participation in supplemental academic support opportunities. Perna at al. (2009) concluded that academic and career support, early warning systems, and peer tutoring helped African

American women in STEM succeed. Bonsangue and Drew (2006) also claimed that out-of-class support programs, such as supplemental instruction, increase the persistence of underrepresented minorities in math and science courses. Other studies on minority students have reported on the critical role that mentors play in their adjustment to college (Freeman, 1999), and progress toward graduate studies and a career (Lee, 1999). According to a longitudinal study involving minority high school valedictorians and salutatorians, indicated how without proper role models and supporters to guide them through college, promising students could easily fail to live up to their potential (Arnold, 1993). The critical role that mentoring plays in the educational progress of underrepresented minority students is clearly supported in a study by Solorzano (1993) in which he interviewed 66 Chicano/a Ford Foundation Minority Fellowship recipients about their educational experiences. The single-most important factor identified in students' degree attainment was a positive mentoring experience.

Furthermore, in a study of non-persistence decisions among Native American undergraduates, Gloria and Kurpius (2001) found that having a socially supportive network is central to academic persistence; particularly strong is the effect of having a faculty/staff mentor. In a review of literature of effective strategies to increase diversity in STEM fields, Tsui (2007) suggests that because of a very limited availability of Latino faculty role models and mentors on college campuses, students more frequently reported receiving mentoring from peers. Similarly, in a study on the mentoring experiences of Mexican American undergraduates at one institution, Romero (1996) found that these students were most likely to be mentored by a family member (54.4%), followed by a peer/roommate (16.3%), and university personnel (13.6%).

Overall there is plenty of research in support of mentorship as a component important in underrepresented students' STEM persistence. Although this social notion of

mentorship is common for students in STEM, not all interactions are necessarily positive and helpful. Even though within programs are many socializers, such as peers, program staff and faculty, and program colleagues, some students are still influenced by family to some extent. For this study, it is important to understand what socializers play a role in students' decisions, from choosing a science major to applying to support programs with mentoring or undergraduate research experiences, and to other supporting decisions relevant to persisting in their science major. I will next address literature that supports the involvement of research-focused support programs for assisting underrepresented student persistence in their science-related major in college.

Research Experiences

Research participation as an undergraduate experience has long been held to increase the probability of students persisting in science majors. Studies evaluating the benefits of undergraduate research in science career pathways have increased recently due to rising funding opportunities targeted towards improving retention in the sciences (Jones, Barlow, & Villarejo, 2010). Schultz et al. (2011) demonstrated that participating in research exerts a direct impact on student intentions and that this effect is durable across time. Furthermore, their results clearly show that continued engagement in research activities has a persistent and additive effect on student intentions over time (i.e., more is better). This study supports research by Jones, Barlow, and Villarejo (2010) that thoroughly examined the association between timing and duration of undergraduate research participation and college retention and performance in the biological sciences using longitudinal data of biology majors at UC Davis. Jones et al (2010) controlled for main variables previously shown to influence college outcomes (see Bowen & Bok, 1998; Cole & Barber, 2003), their demographic characteristics and pre-college academic performance levels, which include race/ethnicity, gender, socioeconomic status, high

school grades, and SAT scores. Jones et al. (2010) found undergraduate research is positively associated with odds of obtaining a baccalaureate degree, persisting in biology, and performing well in biology. Hispanic and African American students also had the largest gap between those that did research and those that did not in their probability of obtaining a biology degree. This study's findings further support research involvement to help underrepresented groups such as Hispanics and African American students persist in their science major, which is relevant to this study.

Furthermore, when considering the timing and duration of research and graduation in any major, participation in research during or after the third year or for one or more terms was strongly associated with college retention (Jones et al, 2010). In models predicting retention and performance in biology, participation in research during the first two years is almost as strong or slightly stronger in magnitude compared to participation in research during later stages in college (Jones et al, 2010). This could indicate that students that are later in their science academic career have solidified their choice and confidence in that science career track. Although the authors did not find statistical differences by race/ethnicity, initiating undergraduate research early on may be particularly beneficial for underrepresented minorities by helping them to academically and socially integrate, find support systems, and secure a sense of belonging when students take "weeding out" courses in the sciences and face the harsh transition to college as supported by Hurtado, Han, Saenz, Espinosa, Cabrero, and Cerna (2007) and Seymour & Hewitt (1997). Although timing of the research does not affect underrepresented groups, this notion of social integration comes up, supporting the kind of environment that well implemented retention programs can create for students of underrepresented groups and necessary for their persistence. The social interactions with peers, program staff, and professors directing the undergraduate research experience is

crucial in contributing opportunities for socialization that can and do contribute to the successful persistence of science majors.

In a recent quantitative study, Espinosa (2011) examined the effect of precollege characteristics, college experiences, and institutional setting on the persistence of undergraduate women of color in STEM majors and also investigated how this pathway might differ for women of color in comparison to their White peers. Using hierarchical generalized linear modeling (HGLM) Espinosa examined the experiences of women (1,250 women of color; 891 White) attending 135 institutions nationwide. Results revealed the important role of women's college experiences. Women of color who persisted in STEM frequently engaged with peers to discuss course content, joined STEM-related student organizations, participated in undergraduate research programs, had altruistic ambitions, attended private colleges, and attended institutions with a robust community of STEM students. Based on this literature, it is possible that a student that is not enrolled in such experiences just described could potentially not do as well as other students involved in academic support programs or in other such experiences.

These findings support earlier studies on the impact of research participation on persistence in science majors. For example, Astin and Astin (1992), found a consistent association between participating in a professor's research project and persistence in, or recruitment into, a science major. Studies focusing on undergraduate research experiences attempt to understand how participation in research experiences influences academic and career outcomes. In another example, Nagda, Gregerman, Jonides, von Hippel, and Lerner (1998) carried out an empirical study reporting on the impact of participation in undergraduate research on student retention and academic performance targeting underrepresented minority students and women with an interest in the sciences. They evaluated the Undergraduate Research Opportunity Program (UROP) at the

University of Michigan which focused on building "intellectual relationships between faculty and first year and sophomore undergraduates through research partnerships." The program included seven components: student recruitment, peer advising, peer research interest groups, faculty recruitment, faculty-student matching, research presentations, and academic credit and assessment. Using retention data on the students, the authors found that when comparing participants in UROP with non-participants, each race/ethnic group demonstrated a significant positive effect on participation and on retention. Attrition rates for African American and White students differed significantly (13.4% vs. 5.0% respectively) as did attrition rates for Hispanic and White students varied significantly (11.4% vs. 5.0%). This study is a good example of how retention programs may positively impact retention of underrepresented minority students and women with interests in science fields. The social interaction found in this study further demonstrates the presence of socializers in the lives of students and the importance of these interactions when making decisions in support of persisting in a STEM major.

In a study by Russell, Hancock, McCullough (2007), the authors attempted to understand how participation in research experiences, as an undergraduate influences academic and career outcomes for underrepresented groups by using web-based surveys conducted between 2003 and 2005. Respondents (n=15,000) participated in NSF programs with a substantial undergraduate research component and the authors found that undergraduate research opportunities increase understanding, confidence, and awareness, supporting other research by Seymour, Hunter, Laursen, and Deantoni (2004), and Lopatto (2004). Specifically, respondents reported an increase in understanding in conducting research projects (88%), more confidence in their research skills (83%), and heightened awareness of the graduate school environment (73%). The finding on increased confidence is also consistent with Mabrouk and Peters (2000) findings based on

surveys of students engaged in undergraduate research, which also found that a high percentage of students would recommend the experience to others, and that students perceived the most valued skills derived from the experience to be technical skills, problem-solving skills, and the development of professional self-confidence (Mabrouk & Peters, 2000). Interestingly, the study did not directly indicate the importance of the role of social interaction within those research experiences and instead, focused on the fact that students are undertaking undergraduate research to learn on their own and because they want to help others. Likewise, Russel et al (2007) also noted that 68% of responders' interest in a STEM career increased at least somewhat as a result of their undergraduate research opportunity. The authors also found that among racial/ethnic groups, effects of undergraduate research experiences tended to be strongest among Hispanics/Latinos and weakest among non-Hispanic whites. The authors also mention that surveys found almost no differences between men and women on any of the study variables, supporting observations by Hyde and Linn (2006) of gender similarities in mathematics and science (Russell et al., 2007). The studies by Russell et al (2007) and Nagda et al (1998) demonstrate some commonalities when it comes to undergraduate research experiences for underrepresented groups almost 10 years apart. Both look to find differences in academic outcomes or career choices and if there are differences by demographic groups. Both studies found that undergraduate research targeted to underrepresented minority participants in their early years of college is associated with retention in science majors and to graduation. These findings also support other studies that address participation in these research experiences earlier in an undergraduate career such as in Nagda et al. (1998) and in Villarejo and Barlow (2007).

Another approach by research that is related to undergraduate experiences is descriptive and ethnographic in nature. The focus of these studies is mostly on how

undergraduate research experience increases skills and may lead to other gains, whether cognitive or personal. For example, some of the gains participants report are an improvement in basic science inquiry skills, including data collection and analysis and oral presentations based on studies by Kardash (2000) and Lopatto (2004). Lopatto (2004) also found that students had an increased general understanding of what scientists do and how they do it. Furthermore, in another study, undergraduate research experience has been found to influence the selection of a STEM career (Zydney et al. 2002).

Other studies by Seymour et al (2004) found an increased sense of professional identity and confidence in being able to do the work of a scientist, which in turn is supported by a later study by Hunter, Laursen, and Seymour (2006). Specifically, these two ethnographic studies found that undergraduate research can help counter students' negative perceptions of the sciences by facilitating opportunities for students to network with and obtain support from faculty, peers, and science professionals. In these ethnographic studies, students and faculty reported that undergraduate research provided a form of "cognitive apprenticeship" in the sciences, where students gained academic, practical, and professional skills necessary to develop a positive identity as a scientist and continue in a science career (see Hunter et al., 2007; Seymour et al., 2004). Undergraduate research also encouraged intellectual and personal development in the sciences, increased interest in the sciences, helped to refine career and graduate school paths, and improved scientific competence and skill sets, such as problem-solving, critical thinking, and understanding theory and concepts in the sciences (see Hunter et al. 2007; Seymour et al., 2004).

Most of these ethnographic studies describe the changes experienced by undergraduate research experience participants over time. Not as clear is the outcome after college in terms of persistence, but a recent study found that alumni who

participated in their university's long-established Undergraduate Research Program reported significantly greater overall satisfaction with their undergraduate education and were more likely to attend graduate school and complete it, than comparable alumni who had no research experience (Bauer & Bennett, 2003).

Although some studies have identified differences between men and women in the influence of undergraduate research experiences, few have addressed variations by participant ethnicity/race (Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998). In a study addressing ethnicity/race on undergraduate student-faculty research partnership at the University of Michigan, which targeted underrepresented minority and female students interested in science, produced positive effects on retention. Using an experimental design in which student applicants to the program were randomly assigned to either the control or experimental group, the researchers found that program participation positively affected retention for each of the race/ethnic groups examined (Hispanic, African American, and White). Particularly strong effects were found for the lower-achieving African American group (Nagda, Gregerman, Jonides, von Hippel, & Lerner, 1998).

After detailing the extensive research in support of undergraduate mentoring and research-focused support programs as beneficial for underrepresented STEM persistence, a common theme regarding undergraduate mentoring or research experiences is the social factor. This social factor, as it relates to the people students interact with, is critical to understand for this present study. I will next focus on the literature focused around the persistence of underrepresented groups in STEM careers or majors.

PERSISTENCE OF UNDERREPRESENTED GROUPS IN STEM

Historically, STEM pipeline studies have investigated the notions of attrition (i.e., leaving) and persistence (i.e., entering or staying). For example in a study by Hilton and

Lee (1988), using data from both the National Longitudinal Study of the High School Class of 1972 (NLS:72), and High School and Beyond (HS&B:82), student degree attainment in the sciences was studied. The authors concluded from their analysis that the greatest overall attrition from STEM came between high school graduation and undergraduate matriculation, generally declining thereafter. More recently, using NELS:88, Tai et al. (2006) indicated that the majority (80%) of students who graduate with STEM degrees enter the pipeline in high school or college. These studies set the stage in terms of timing for higher education institutions as critical for addressing attrition of prospective students in future STEM majors and career paths. From the time students are preparing to graduate from high school, as they make choices about what career path to focus on and what schools to apply to, and in the time they are in college as undergraduates, there are many social and individual factors that complicate persistence of students in STEM paths.

Graduation statistics reveal that in 2006 the relative percentages of students earning degrees in nearly all STEM fields were at, or below, previous levels (National Science Foundation, 2010c), supporting what research has described over the last 20 years, a decline in the number of freshmen students in Science, Technology, Engineering, and Mathematics (STEM) majors (National Science Board, 2008). From an early longitudinal study from national samples collected through the Higher Education Research Institute (HERI), Astin & Astin (1993) demonstrated a 40% and 50% decline in the number of students interested in STEM majors between high school and freshman year and between the freshman and senior year of college, respectively. They also showed a 57.5% decline in the number of biology majors between freshman and senior years of college, with the majority switching to non-STEM disciplines (Astin & Astin, 1993). Similarly, in a more recent study on agricultural/biological science majors, the

National Science Board (2008) showed a 51.1% decline among the 115,300 majors who began college in 1995. With a substantial part of students leaving STEM majors during or after college and an insignificant number of students filling those vacant spots resulting in a net leakage from the STEM pipeline (Seymour & Hewitt, 1997). Although, other studies have indicated that this is not significant for some fields like physical science and engineering (Riegle-Crumb and King, 2010).

Even though the national demand for motivated students to enter postsecondary STEM fields is at its highest, high school seniors' interest in and readiness for pursuing these majors have been sluggish (ACT, 2006). With more students leaving than are taking on STEM majors in college, looking more closely at underrepresented groups becomes important. According to Crisp, Nora, Taggart (2009), despite the increasing number of Hispanic students entering postsecondary education, Hispanic students are currently underrepresented in terms of the percentage of students both pursuing and attaining STEM degrees (Oakes, 1990; Young, 2005).

Of particular concern in the discussion on broadening STEM participation is the underrepresentation of racial minorities, women, and students of low socioeconomic status (SES; e.g., Anderson & Kim, 2006; Herrera & Hurtado, 2011; National Science Foundation, 2006, 2010a, 2010b; Schultz et al., 2011). An overwhelming body of research has also suggested that underrepresented racial minorities, women, and students of low SES persist at lower rates in STEM fields of study than their White, male, and more socioeconomically advantaged counterparts (see Kulis & Sicotte, 2002; Bailyn, 2003; Blickenstaff, 2005). The NSF (2009) reported that underrepresented racial minorities (URM) make up 22.7% of the 18-to 24-year-old age group (traditional college-going age) in the U.S. but earned only 13.7% of all bachelor's degrees in science, technology, engineering, and mathematics (STEM) fields. In comparison, White students

make up 61.4% of the same age group and earned 65% of STEM degrees. This discrepancy in degree attainment may not necessarily be due to the perceived lack of motivation and interest of URM students in science. Furthermore, it appears that an equal percentage (44%) of African American and White college-bound high school students intend to major in STEM fields; however, retaining these students in STEM is a major challenge, as only 27% of URMs, compared to 46% of White students, who intend to complete a science or engineering major actually do (Huang, Taddese, & Walter, 2000). These numbers demonstrate a further decline for ethnic groups in terms of college persistence in STEM degrees. To further understand persistence of underrepresented students, it is important to understand how gender plays a role in persistence.

PERSISTENCE IN STEM BY GENDER

More recent data from the National Science Foundation (2010b) indicate that since 2005 more baccalaureate degrees in STEM go to women than to men. At first glance, this seems to be a positive move towards increasing persistence in terms of gender, but these degrees are not equally distributed. The NSF (2010c) study also found that in 2009, females completed 72% of the degrees in the life sciences (majority since 1976), whereas males completed more degrees in the physical sciences (58%), geosciences (61%), mathematics and computer science (74%), and engineering (82%). Even though women are graduating with more STEM degrees, women are not graduating with degrees that are predominantly male-dominated as in math, engineering, and computer science. When considering race, Espinosa (2011) makes clear that women of color—African American, Asian American, Latina, Native American, and Pacific Islander—represented 20% of the nation's populace aged 15–24 years in 2010 (U.S. Census Bureau, 2009). She notes that this figure encompasses a large proportion of the precollege and college-going population and yet it stands in stark contrast to the 12% of

total STEM bachelor of science degrees conferred to women of color in 2006 (NSF, 2009). In contrast, the percentage for White women who received degrees was twice this number, with 25 percent in 2006. This illustrates the relationship between gender and race/ethnicity in STEM fields. Women of color are even further underrepresented in select scientific fields, earning less than 4% of undergraduate physics degrees, 7% of engineering degrees, and less than 10% of BS degrees in computer science (Espinosa, 2011).

This notion of apparent closing of the gap in persistence rates was also observed in an earlier study (Tan, 2002) using reports on the status of STEM majors in higher education released by the National Center for Education Statistics (NCES) (Huang et al., 2000) and the Center for Institutional Data Exchange and Analysis (C-IDEA) located at the University of Oklahoma (Smith, 2001). Tan (2002) found that first-time freshman enrollment in STEM disciplines increased by 25% from 1993 to 1999, this is in contrast to an increase of 20% from 1992 to 1998 (Tan, 2002). However, the report found that women and ethnic minorities (with the exception of Asian Americans) were still underrepresented in the STEM disciplines during that same time period. Specifically, women represented 38% of all first-time STEM freshmen compared to 62% who were men. By minority status, 9% of all first-time STEM freshmen were African-Americans, 7% were Hispanics, and 1% were Native Americans (in contrast to 83% of Whites and Asian-Americans). In addition, Tan (2002) reported that more women and minorities in STEM disciplines were enrolled in less selective institutions (categorized by average standardized test scores): 43% of all STEM minority students and 43% of women were enrolled in these institutions (Smith, 2001). Furthermore, by racial-ethnic groups, the proportion of minority students who continued in their STEM majors during the second year was lower than of non-minority students (65% compared to 69%). The general

persistence rates (regardless of whether they switched majors or remained in their STEM disciplines) were 76% for minorities and 82% for non-minorities. By gender, the general persistence rate among women was 80% compared to 82% for men. The difference in discipline-based persistence (that is, those who continued in their STEM majors) was slightly higher for males (69%) than for females (66%) (Smith, 2001).

These two studies by Tan (2002) and Espinosa (2011) demonstrate well that not much has changed in terms of persistence for underrepresented students in STEM career paths. It is clear from the literature on STEM persistence that women and ethnic minorities are underrepresented in STEM careers/majors despite small gains for both when compared to their White and Asian counterparts. Identifying factors at play for this underrepresentation in STEM persistence is very important so that appropriate measures are set in place to improve it. The educational system is a social endeavor that compounds individual student factors with institutional and social factors also set in place in which all students must navigate. These social and institutional factors are what come into play when understanding persistence in STEM fields.

Similarly, general college persistence research argues that the rigor of high school preparation (see Schneider et al, 1998; Adelman, 2006) and, more importantly, student intentions play a large role in student retention (Tinto, 1993). When addressing the intersection of gender and ethnicity/race, using new national data from Adolescent Health and Academic Achievement (AHAA), Riegle-Crumb (2006) examined students' high school math patterns. Compared with White males, African American and Latino males received lower returns from taking Algebra I during their freshman year, reaching lower levels of the math course sequence when they began in the same position. According to the author, this pattern was not explained by academic performance, and, furthermore, African American males received less benefit from high math grades. This finding speaks

to the notion of unequal math experiences, as well as to the quality of the experience teachers may provide for students. In terms of gender, Riegle-Crumb (2006) did not observe lower returns for minority female students, suggesting that more attention to racial-ethnic inequality in math among male students is needed. The analyses in this work clearly revealed that race-ethnicity does not shape math course-taking in identical ways based on gender. This study also supported literature that addresses the closing in the gender gap in math achievement by demonstrating no statistically significant difference in the percentage of students taking Pre-Calculus or higher (38% for boys and 36% for girls). Despite this closing of the gender gap in math course-taking, this study also demonstrates that women remain underrepresented not only in math fields, but also science, technology, and engineering. Similarly, according to Huang et al., although females, relative to their male counterparts, are less likely to enter science and engineering majors, female students who do apply to these majors are well prepared with regard to academics. These findings support Riegle-Crumb's (2006) finding that there is no ethnic-racial inequality within minority females who took high level math courses, suggesting that minority female math coursework preparation may not significantly affect STEM persistence when compared to males in general, and other factors are more likely at play, such as classroom experiences and interests.

While the research discussed above shows the impact of high-school coursework and performance on persistence, students have different experiences within each of these classes. Reviews of previous research (see Osborne, Simon, & Collins, 2003) are clear that while most students have positive attitudes about science as an endeavor, they do not hold positive views about the science they experience in the classroom. According to Maltese and Tai (2011), the type of experiences students have in their STEM classes may play a large role in who decides to remain and who leaves STEM. To further look at

students' high school experiences in their STEM classes as a factor in STEM persistence, it is important to review a qualitative study by Seymour and Hewitt (1997) that addresses attrition of students in STEM fields based on their high-school experiences. Seymour and Hewitt (1997) explained that many of the students reported entering college with plans to major in STEM because of their positive experiences in high school science; however, once matriculated, many students reported leaving the sciences because they lost interest or had negative experiences in their college courses. Similarly in college, in a longitudinal study by Brainard & Carlin (1997), the authors examined factors affecting retention of females in science and engineering. They detailed a consistent pattern describing the academic experiences influencing the decisions of women to persist, or switch out of, degree programs in engineering and science.

Similarly, Maltese and Tai (2011), using data from 4,700 students in U.S. schools who participated in the National Education Longitudinal Study of 1988 (NELS:88), a nationally representative sample containing information concerning students' school experiences and outcomes in mathematics and science between eighth grade and college completion, completed a two-part analysis to assess the school-based factors related to students choosing to complete a major in STEM. The results indicated that the majority of students who concentrated in STEM make that choice during high school, and that choice is related to a growing interest in mathematics and science rather than enrollment or achievement. This study focuses the attention on the student and the particular interests each student brings to the classroom. Important to note is that the classroom is composed of direct social interactions among peers and teachers. When considering the University classroom setting, the social interaction continues to be that of students interacting with peers and a professor, yet the peers are, for the most part, grouped around a similar major course of study. The students' own perceptions of other social interaction with family are

also present in the classroom indirectly, as a student is influenced at home predominantly by family. At the University setting, family may play a lesser role in social interaction since most students leave home to go to college; the case in this study.

Two of the consistent factors addressed by literature in STEM persistence speak to the underrepresentation of women and ethnic minorities in STEM fields. Despite demonstrating a close in the gap in math achievement, women continue to be underrepresented in fields like math, engineering, computer science, and physics. The literature does highlight that the predominant factors for underrepresented groups in STEM relate to student interests and social factors related classroom experiences. The academic experience involves social factors and interactions that involve peers, teachers, and parents or family. The environment also becomes important and ways to improve students' experiences in STEM classrooms also come into play. Also, according to Wang (2013), most research concentrates on persistence and attainment among students who have already entered STEM fields. Yet few academic studies using nationally representative samples have dealt with the very first step of STEM participation: why students enter STEM majors; unlike this study. According to Wang, the primary focus of existing studies based on national samples revolves around students who have already chosen a STEM major; just like this study. Furthermore, while abundant data exist to indicate the low enrollment and high attrition rates in STEM fields of racial minorities, women, and students of low SES, little is known in regard to how factors influencing STEM entrance work differently or similarly across these subgroups of students (Wang, 2013).

After brining attention to persistence of underrepresented groups in STEM careers and considering the gender differences in persistence, I now turn to the literature that

discusses the foundation for Eccles et al. (1983) expectancy-value model of achievement related choices.

ECCLES EXPECTANCY-VALUE MODEL AND CAREER CHOICE MAKING

The nature of educational decision-making is complex and many approaches have been taken to understand student choices. In psychology, theorists have, for example, linked educational choices to individuals' personality types (Costa, McCrae, & Holland, 1984; Head & Ramsden, 1990). In sociology, educational and vocational behaviors have been understood as products of socio-economic factors such as social class (Ball, Davies, David, & Reay, 2002; Bourdieu & Passeron, 1990). When it comes to academic motivation there is self-efficacy theory (Bandura, 1997), intrinsic and extrinsic motivation (Ryan & Deci, 2000), interest development (Hidi & Renninger, 2006), attribution theory (Weiner, 1985) and expectancy-value theory (Eccles et al., 1983), the framework described for this study.

The Eccles et al. (1983) expectancy-value model of achievement-related choices (see Figure 3.1) is comprehensive and based on empirical evidence. It is grounded in social psychology and incorporates social, psychological and cultural aspects that have been shown to affect young people's motivational behavior. Important components of the model are the expectations and values of individuals concerning their choices about participating in an activity. Eccles and her colleagues have developed and tested this model over many years and in many studies over the years (see Eccles, 2009; Eccles et al., 1983; Eccles, Barber, & Jozefowicz, 1999; Meece, Wigfield, & Eccles, 1990; Nagy et al., 2008).

The model has, for example, contributed to the understanding of how achievement is linked to interests and self-concepts in mathematics, language and science (Denissen, Zarrett, & Eccles, 2007), of college enrollment in mathematics and English

(Eccles, Vida, & Barber, 2004), high-school course enrollment in mathematics and science (Simpkins, Davis-Kean, & Eccles, 2006) and of links between interest and competence in sports (Fredricks & Eccles, 2002). A specific focus on gender is often seen, for example, in studies of women's educational and occupational choices in relation to physical sciences, engineering and applied mathematics (Eccles, 1994; Eccles et al., 1999). The model is inclusive in the sense that many of its constructs overlap with concepts from other motivational theories. These include Bandura's (1997) self-efficacy, Ryan and Deci's (2000) intrinsic and extrinsic motivation and the concept of interest (Krapp, 2002, 2005). The link between these concepts and the Eccles et al. model is described by Eccles and Wigfield (2002).

According to Eccles (1994), career choices are influenced by a number of cultural and individual concepts. The cultural concepts include the influence of gender role and cultural stereotypes, socializers' (parents, peers, and teachers) influence, and achievement and abilities in science and math. This cultural concept of socializers' influence in career choices fits well with the present study in which the focus is the role of socializers in the primary decision of choosing a science-related major and also ancillary decision making related to accessing support resources by Latino science students.

Also pertinent to this study is to understand the students' interpretation of the socializers' influence. For example, a parents' lack of support for his or her STEM interest may be interpreted as an indication of poor abilities by the child or as a reason to withhold pursuing the field if the child is trying to gain the parents' approval. Therefore, these interpretations can help to shape an individual's goals and decisions according to Eccles (1994). Understanding how a student interprets socializers' influence on decisions for this study may resemble a scenario in which an undergraduate student chooses to accept an invitation to participate in a retention program with a component focused in

mentorship or undergraduate research. Although seemingly straightforward, accepting to apply (or not) involves many pieces of information a student gathered from several experiences or lack thereof. Assuming the student is solely making this decision, what experiences informed him or her of what academic support programs are for, who informed the student and whether or not it was a positive one or negative experience, the outcome could play out differently. A student may see retention programs as a crutch for a weakness in the students' abilities and therefore requiring assistance or a student may have had the experiences and the right people assisting him or her to develop an understanding of what can help him or her do well their first year of school as they are trying to adjust to college life.

Furthermore, Eccles (1994) makes clear that as children develop, they witness and often internalize the stereotypes around them and begin to measure and evaluate their own achievement and abilities based on others around them. These factors influence an individual's perception of gender and cultural stereotypes (Eccles, 1994). So by the time students are in high school they will have been through many classroom experiences with different peer-teacher interactions that will have influenced them in some form or fashion. Experiences outside of school, at home with family, will be a part of their lives. Understanding how a student perceives those experiences with socializers and how much those interactions influence in their ancillary decision making process is important to this study.

These social influences, combined with the individual's perceptions and experiences, culminate in the final two parts of the expectancy-value model: expectation of success and the value a person attaches to this success (Eccles, 1994, 2007). According to Eccles, one's expectation of success is influenced by one's confidence in his or her abilities. This confidence level is also affected by the estimated difficulty of the tasks

required for a STEM career. For example, a study by Burtner (2005) identified post-enrollment attitudes and perceptions that influence students' decisions to remain in an engineering curriculum. They used discriminant analysis functions to distinguish among students who remained in the engineering school, those who remained at the university in a different school, and those who left the university altogether. According to the study, significant predictors of both short-term and long-term persistence in engineering were linked to self-reported confidence in college-level math/science ability and the belief that an engineering degree enhances career security at a respectable salary (Burtner, 2005). When looking at the Eccles model, individuals' beliefs regarding his or her abilities are influenced by that individual's performance in science and math courses and by the support he or she receives from socializers. Even if a person expects to be successful in a career, that person might not choose that career because of the low value he or she places on this success.

When it pertains to value, Eccles (2005) accounts that aspects of subjective task value are grouped into four broad categories: interest value (the enjoyment from engaging in the task or activity), utility value (the instrumental value of the task or activity for helping to fulfill another short- or long-range goal), attainment value (the link between the task and one's sense of self and identity), and cost (defined in terms of either what may be given up by making a specific choice or the negative experiences associated with a particular choice).

The expectation of success and the value one places on a particular career are unique to that individual and depend on the individual's experiences and the individual's own interpretation of those experiences (Eccles, 2007). This uniqueness factor almost calls for a qualitative-based study in which more personal information from participants is required to gather insights into the experiences and the socializers impacting student

when making decisions. Not all students fill a mold perfectly, whether considered underrepresented in STEM major or not, students have unique backgrounds and experiences that do not traditionally fit the culture of STEM fields, which is predominantly White and male dominated. Next I will address important literature gaps addressed by this dissertation study.

LITERATURE GAPS

After reviewing the literature on STEM persistence, on retention program components, specifically mentorship and research experiences, as interventions for underrepresented students in STEM, the Eccles' model of expectancy-value, and the role of socializers in students' academic career choice making, I will present gaps in the literature important for this study to address.

When college career choice-making is factored in, it is evident that there is a lack of research that addresses ancillary choice making at the college level. By 'ancillary' I refer to decisions that are connected to supporting or supplementing students' initial choice to choose a science major or choice. The literature demonstrates that women and ethnic/race minorities already come in with a need for more science-related experiences, issues related to identity, and the influence of socializers and still manage to choose a science-related career. Understanding the experiences and social factors in terms of influence in their ancillary choices related to their science career choice is also important. This gap in addressing ancillary career choice making would allow us to understand if the factors at play for initial major or career choice making are the same factors at play in ancillary decisions such as the type of classroom experiences in math and science and the people involved in those experiences, such as parents, peers, teachers, and community role models. Even though the review demonstrates that there are certain classroom experiences and socializers that play a role in underrepresented groups in STEM fields,

there is not much out there that addresses socializers' role in ancillary decisions such as choosing to apply to academic support programs intended to help students persist in a STEM major and about other decisions necessary to persist in their science major. Specifically, there is a need to understand if the socializers governing a student's initial science career choice, predominantly parents, teachers, and peers, as the literature demonstrate, continue to dominate in ancillary decision-making. There is no present literature that looks at these ancillary choices, much less at how Latino science majors make these choices. In this way, my present study would allow us to understand ancillary decision-making.

Also an important gap relates to the use of the Eccles framework as a guide for ancillary decision-making. Understanding whether the concepts in Eccles model apply similarly when considering ancillary choices, is novel and exploratory in nature. The only way to understand the utility of this model for this study is putting it into practice. The use of a qualitative approach by using a case study approach has not been widely used. I think delving into how socializers play a role in ancillary decision making with respect to using academic resources with a qualitative approach lends itself to getting rich information. This rich information addresses the uniqueness factor Jacobs (2005) describes when understanding the experiences students encounter throughout their academic career and in turn influence their careers choice.

The literature gaps presented allow us to ask many questions that need addressing in terms of decision making for underrepresented groups in science majors. Underrepresented students' interest in science fields often depends on the experiences in the classroom and the support or, lack thereof, from socializers. Even if these experiences have been positive for students, the quality of the experience and the quality of teachers plays a role, especially for minority and economically disadvantaged students. This study

hopes to address these questions to add to the literature of research about student ancillary choice making and to literature that speaks about understanding how to help address STEM issues related to underrepresented students' persistence in the general scheme. Increasing the persistence for underrepresented groups in STEM is important for institutions vested in addressing the lack of underrepresented groups in the STEM global market. The support programs within institutions would benefit from this study in that it would allow them to restructure the process by which they target and recruit students for their programs and in the same way raise the likelihood of more underrepresented groups in STEM persisting toward graduation.

Chapter 3: Methodology

The purpose of this study is to explore the views, beliefs, and experiences of Latina/o science majors from a Research University. As the previous chapters demonstrated, students make decisions that affect their retention in their major and those decisions are complex. Their academic decisions involve the influence of other people such as peers, family, and teachers. These sources of influence affect what major they choose to take part in, what academic programs they seek out, and ancillary decisions indirectly connected to these that affect their persistence in their science major.

This chapter, therefore, addresses the research design used to explore the following research questions:

(1) What factors influence Latino science students when making career-related choices, specifically choosing a science major, and accessing resources in support of a science career?

(2) What role do socializers play in Latino science students decisions' about those decisions?

I identified answers to these questions by connecting with a small group of Latina/o students with a science-related major in a pilot study using focus groups. This pilot study allowed me to rethink the methods used for the remainder of the study due to the difficulty of recruiting enough participants for a small group of at least three per focus group. For the focus groups scheduled, a single participant took part, allowing me to rethink the methodology most useful for this present study to in-depth interviews.

Given the nature of these research questions and the complexity of studying student decision making in regard to who influences their decisions, the Eccle's et al. (1983) model will be used as a framework. The model was developed by Eccles and

colleagues at the University of Michigan and tested a model to explain how social forces act on young women's decisions to study science and mathematics. This model includes the psychological and social factors that influence long- and short-range achievement goals and behaviors such as career aspirations, course selections, persistence on difficult tasks, and how hard a student works on achievement-related activities. Eccles and her colleagues drew on the theoretical and empirical work associated with decision making, achievement theory, and attribution theory (see Atkinson, 1964; Crandall, 1969; Weiner, 1974) and created a model for achievement-related choices. This model links choices to two sets of beliefs: the individuals expectations of success and the importance, or subjective task value, that the individual attaches to the various options perceived to be available, leading to achievement related choices, (Lynch, 2000, p. 248).

RESEARCH PARADIGM

Research, including its purposes, question, data analysis, findings, conclusions, and implications, is not only a reflection of a study's results but also a reflection of the researcher herself. Furthermore, a researcher's overarching research paradigm influences every aspect of her work. According to Crotty (1998):

"At every point in our research—in our observing, our interpreting, our reporting, and everything else we do as a researcher—we inject a host of assumptions. These assumptions shape for us the meaning of the research questions, the purposiveness of research methodologies, and the interpretability of research findings. Without unpacking these assumptions and clarifying them, no one (including ourselves) can really divine what our research has been or what it is now saying" (p.17). Thus, the importance of one's research paradigm in shaping research requires a discussion about my own paradigmatic view, specifically the interpretivist paradigm.

As Merriam suggests in an interpretive qualitative study, "the researcher is interested in understanding how participants make meaning of a situation or phenomenon, this research is mediated through the researcher as instrument, the strategy is inductive, and the outcome is description" (2002, p.6). Interpretivism is also built upon an ontology of realism and is rooted in a constructionist epistemology. Constructionism " is the view that all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (Crotty, 1998, p.42). In the constructionist view, meaning is not something that is objectively discovered, but it is something that is constructed as we engage and work to interpret our world. Thus research guided by this paradigm does not focus on finding the one "correct" answer, but, on developing a deeper understanding of the topic of study.

RESEARCH METHODOLOGY

In line with this study's interpretivist paradigm, this study is grounded in qualitative research methods. Denzin and Lincoln (2005) characterize qualitative research as:

"a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of presentations, including field notes, interviews, conversations, photographs, recordings, and memos to self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them (p.3)."

In exploring student decision-making regarding academics, it is imperative to study students in their natural school settings of their school as students' daily decision making about what and how to go about their daily activities in school are a function of these specific contexts. Thus qualitative research provides several important features necessary for studying the questions at hand.

This naturalistic approach to research provides an opportunity to explore the complexities and nuances associated with each participant's interaction with and understandings of the phenomenon being studied. For example, Patton (1990) notes that qualitative research methods are most useful for questions that focus on the process and the development of a participant, stress individual outcomes, call for in-depth information, and account for unique qualities exhibited by participants. "It is not necessarily to map and conquer the world but to sophisticate the beholding of it" (p.43). This is the purpose of this research; to better understand what factors influence Latino science students when making career-related choices and accessing resources in support of a science career, and what role socializers play in Latino science students' decisions about those choices.

Qualitative research allows for participants to provide a voice to their experiences, in essence, for a dialogue to happen between researcher and informant. Crotty (1998) describes it as "telling our very own story, it is…the voice of our culture—its many voices, in fact---that is heard in what we say" (p.64). By following this research method that supports rich descriptions of lived experiences and interactions within the social world, qualitative research gives voice to the struggles, triumphs, and the push-and-pull of the process of understanding Latina/o students as they make academic decisions in social contexts.

The research questions outlined in the beginning of this chapter therefore align with the goals of qualitative research methodology. Thus, the decision to use qualitative research methods—which allowed the researcher to jump deeply into how students make academic decision with the influence of others in social contexts before, during, and after their first year of college and through to the end of their second year—in order to provide a rich and thick description of student decision making is one with purpose.

CONCEPTUAL FRAMEWORK

Some major educational theories or constructs make up the framework for this study. Eccles and her colleagues drew on the theoretical and empirical work associated with decision making, achievement theory, and attribution theory (see Atkinson, 1964; Crandall, 1969; Weiner, 1974) and created a model for achievement-related choices. This model links choices to two sets of beliefs: the individual's expectations of success and the importance, or subjective task value, that the individual attaches to the various options perceived to be available, leading to achievement related choices, p.248 (Lynch, 2000). In order to understand what factors influence Latino science student when making career-related choices, specifically a science major, and accessing resources in support of a science career, this framework will act to support this research question. This research started addressing this knowledge gap using Eccles et al. (1983) expectancy-value model to qualitatively and longitudinally examine undergraduate students' choices to enroll in academic support programs in while enrolled in a science major. Specifically, this study focused on who influences students to make these decisions, focusing on the role of socializers in the decision to apply to academic support programs.

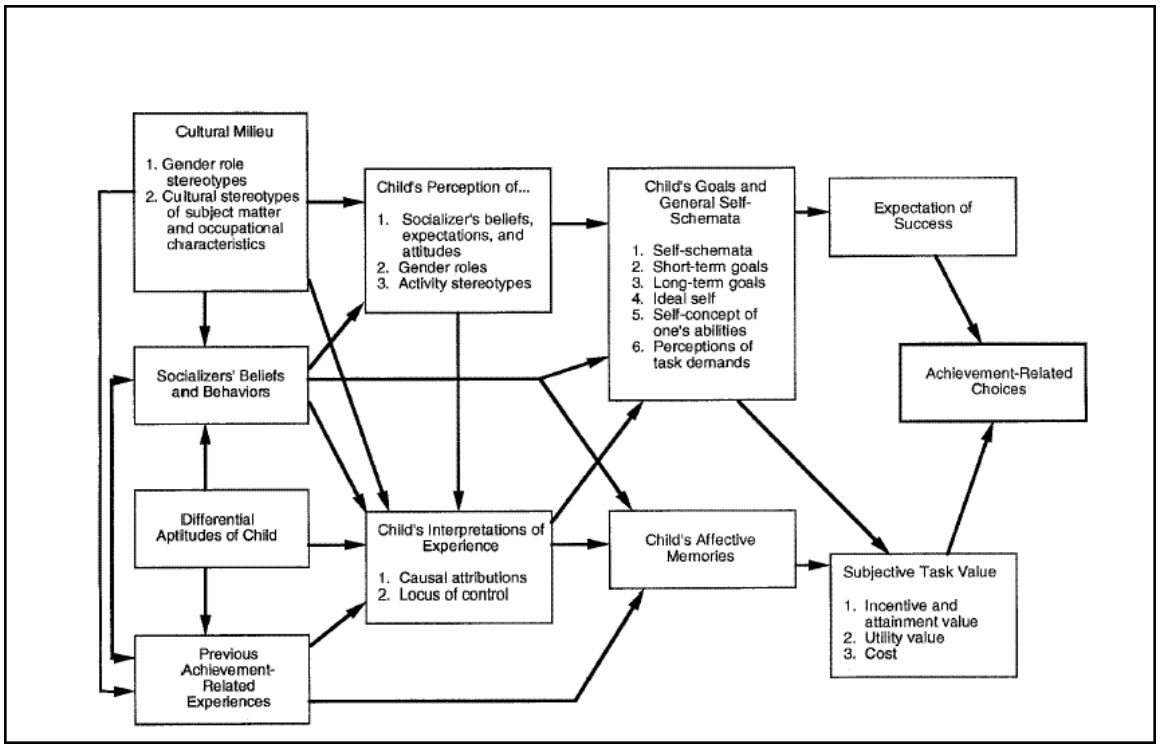

Figure 3.1 Eccles et al. (1983) Expectancy-value Model of Achievement-related Choices.

There are two shortcomings of Eccles et al. (1983) expectancy-value model of achievement related choices model in the context of this study. First, Eccles model has been used mainly in quantitative research (typically surveys). Surveys often do not

provide the full picture of a phenomenon (Farmer, 1997). For example, the interviews in Farmer's study provided information that was not apparent in the surveys and in some cases contradicted the surveys. Farmer concluded that the interviews provided a fuller picture of the participants' career decisions. The another shortcoming with Eccles et al. (1983) model is that it has been developed by research of mostly boys and girls up to their secondary education. Using this model to explore how the links of expectancies and values to performance and choice change across ages (see Eccles et al. 1993, Wigfield 1994), beyond into college-aged men and women, could provide insight into a deeper understanding of the unique experiences each participant undergoes as they make decisions as college students. Focusing on Latino students would also provide important knowledge about their choice-making process.

This dissertation study does not intend to fit this framework in every aspect, it is intended to direct this study and contribute new knowledge where necessary regarding Latina/o students with majors in science when it pertains to the socializers that influence in their decision to apply to academic support programs to help them persist in their major their first year, and to decisions about what resources they access to support their science major beyond their first year.

STUDY RESEARCH DESIGN

According to Miles and Huberman (1994), qualitative methods call for purposeful sampling of participants in which participants are selected because they have direct experience with the phenomenon under investigation. Merriam (1998) recommended that participants selected for a case study are able to supply "information-rich" data for the researchers. However, Hancock and Algozzine (2006) reminded beginning researchers of the importance of obtaining access to the case under consideration for investigation. The

current interpretive case study will purposefully select highly informative participants to which the researcher has immediate and easy access.

Participants (Cases)

For this dissertation study, I recruited four first year Latina(o) students with a major in science. These students were chosen from a cohort of students that applied to an academic support program focused on mentoring, referred to as Mentoring Program (MP) throughout. None of the students applied to the Research Program (RP), which provides the students an opportunity to do undergraduate research within their first year in college, except for one student who applied in their second semester of their first year. These academic support programs are located at a large, research university in the southwest portion of the United States, which will be known as Research University. The participants started their first semester at Research University in the fall of 2012 and completed their first year in the spring of 2013. The participants were enrolled through the fall of 2013 and into the spring of 2014. All participants were Latino(a); two male and two female. Participant background will be given in more detail in the Participant Biographies section below.

University Requirements

During their first year of college, participants in this study were enrolled with a major in science as their first choice and have applied to Mentoring Program, regardless of acceptance into the support program. They continued to be enrolled in the same science major as they entered their second year at Research University and up to the second semester of their second year.

DATA COLLECTION

Data collection occurred twice in the fall of 2012, twice in the spring of 2013, and continued in the fall of 2013 and onto the spring of 2014 with a single interview for each semester their second year. All data gathered from participant resources was collected with permission from the participants and in full compliance with the Institutional Review Board (IRB) guidelines. Data gathered from participants began only after explicit permission was granted, and the researcher offered a detailed explanation of the project's aim and processes to informants.

Qualitative research requires that multiple data sources be used to provide a holistic and well-rounded understanding of the phenomenon under study (see Denzin & Lincoln, 2005; Erlandson et al., 1993; Guba & Lincoln, 2005; Merriam, 1988). This dissertation research pulled from three sources: 1) semi-structured interview data, which comprised approximately of six one-hour digitally recorded audios; 2) surveys, one 20-minute survey during the first and last interview each; and 3) artifacts such as student acceptance letters/emails to the mentoring support program, MP, the participant applied to.

Interviews

The use of interviews is common in qualitative research and has been well-documented in scholarly literature (see Denzin & Lincoln, 2005; Erlandson, Harris, Skipper, & Allen, 1993; Guba & Lincoln, 2005; Merriam, 1988). Interviews are conversations that have the sole purpose of finding out a special kind of information that is "in and on someone else's mind" (Patton, 1990, p.278). As Merriam suggests, "interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them. It is also necessary to interview when there interest in past events that are impossible to replicate" (Merriam, 1998, p.72).

For this study, students' decision making in regards to applying to college and choosing a science major and choosing to apply to the MP program were crucial for this study. Also important were understanding their decisions related to other supporting decisions necessary to persist in their science major. Using interviews allowed the researcher to delve into those events while participants were in high school and to those in college. For this dissertation study, interviews served as significant source of data as the researcher explored how students make decisions about how they made the decision to come to Research University and chose a science major and applied to MP. Also understanding what socializers played a role while they were in high school and in college would necessitate a meeting with participants to find out those details. Furthermore, in investigating the factors that influence this decision-making process, as well as the socializers that play a role, it is often necessary to explore the participants' past experiences, including events that are impossible to replicate and is necessary to interview them about those past experiences.

Interviews with the participants followed a semi-structured interview format. Merriam (1998) suggests that interviews range from unstructured to highly structured formats. In the unstructured interview, the researcher engages in an informal conversation with the participant usually without a set of predetermined questions. This is to capture information on a recent incident and focuses on investigating the what, when, where, and why of the situation. On the other hand, structured interviews strive to ask participants the same set of questions related to specific information and can include both closed and open-ended questions. The semi-structured interview offers a balance between the spontaneity and conversational flow of the unstructured interview and the directedness of the structured interview.

Semi-structured interviews provide for consistent investigation of particular topics with the participant on basic introductory questions but also afford flexibility to engage in natural conversation that provides deeper insight. This makes the interview more honest, morally sound, and reliable because respondents are treated as equals, allowing them to express personal feelings and therefore present a more "realistic" picture than can be uncovered using more structured interview methods (Fontana & Frey, 1994, p. 371). This semi-structured interview format offers the researcher a multiple opportunities for exploring the realities of participants and for participants to work as participating agents in the discovery and discussion process.

For this dissertation research, approximately 6 one-hour interviews, conducted on six separate occasions per participant (for a total of 24 hours of interview data), were audiotaped and transcribed using digital media and provided to the participant for review and member checking. Since most of the data is from interviews, these were purposefully chosen to take place early and late in each semester to get participants' expectations for each semester and to allow them to contribute as much information especially in the early fall 2012 since that is where students had to recall events when they were in high school. Also, focusing on the end of the semester after their final exams for another interview allowed students to reflect on what may have surprised them about the semester and allow a greater opportunity for them to be fully immersed in their academics. This also allowed me to ask them about what expectations they had for the next semester. Once they began their second year, I focused on a single interview after their final exams to capture their reactions about how they ended the semester and to learn about how their expectations were met, if they were met and how they could have improved it. By using semi-structured interview protocol, I asked open-ended questions that focused on key concepts. This allowed me to ask more probing questions that dug deeper into the

interpretations held by participants or clarifying questions to gain a fuller understanding of their point of view. During their early interviews, participants were asked to describe the timeline by which they chose a university and science major and how they went about applying to the Mentoring Program or Research Program, and what socializers they talked to about those decisions. During their second year in college, the focus of the interviews was to capture the experiences they encountered and how they went about persisting in their major in science.

Interviews were audio-taped and transcribed verbatim and offered to participants for member checking and review. Member checking is very important to the construction of a trustworthy research design, but more than that, it allows for clarification and validation of information transcribed by the researcher (Creswell, 1998; Merriam, 1998; Stake, 1995). Member checking also serves as a form of triangulation; by asking participants to look over "interview transcripts, analytical thoughts, and/or drafts of the final report" (Creswell, 1998, p.203) the researcher ensures that the participants' ideas and thoughts are represented appropriately. During the course of the interviews, typewritten notes were taken to further elucidate the interview setting, context, and participant's mood (if noteworthy). These notes provide the opportunity to jot down extending questions or make connections between and among interviews with other participants. Each research participant was given the opportunity to review data materials and provide further response to the research questions. Interviews took place at the participant's choice of setting on each occasion. The interviews took place predominantly within the Research University proximity, making accommodations for participants' schedules. At every moment after an interview, participants were treated to lunch or dinner.

Surveys

Survey data collection is a method of collecting data and providing details and evidence of the biographical data of participants. This allows us to get a clearer picture of each participant and supports the interviews, as well as triangulates the data when artifacts are considered. The information collected related to demographic information and GPA, SES, Family income, education level of parents, high school organization involvement, and college organization involvement (see Appendix A).

Artifacts

Artifact collection is a less intrusive method of collecting data and provides detail and evidence of corroboration or contradiction when compared to other collected data (Merriam, 1998), but Yin (2009) has cautioned that while gleaning material from artifacts, researchers must recall that these artifacts were designed for purposes other than research and, therefore, these sources should be used judiciously.

The semi-structured interview protocols (see Appendix B), surveys (see Appendix A), and artifact collection were designed to investigate further the central research questions as well as issues raised by the literature review, and further facilitated data analysis.

METHODS OF VERIFICATION

A qualitative study requires verification in order to establish quality and integrity. Creswell (1998) viewed verification as "a process that occurs throughout the data collection, analysis, and report writing of a study and standards as criteria imposed by the researcher and others after a study is completed"(p.l94). Since qualitative research is based upon naturalistic inquiry rather than an empirical approach used in quantitative studies, Lincoln and Guba (1985) proposed using alternative terms for the constructs of internal validity, external validity, reliability, and objectivity (p.300). The alternate term

used in the study is trustworthiness. Components that constitute trustworthiness are credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985, p.300). There are various verification procedures available that researchers can use to establish trustworthiness in a study. The following methods of verification were used in this study: 1) referential adequacy, 2) triangulation of data, and 3) use of a peer debriefer/auditor.

Referential adequacy

According to Erlandson et al. in order to create credibility (1993), "all data must be interpreted in terms of their context, p.31. He suggests that all materials be collected "to give holistic views of the context." For this study the interview audios and the support program web information provide the "slice of life" from the context being studied that Erlandson et al. speaks of. It is this "slice of life" that provides a supportive background that communicates to the reader a richer contextual understanding of the researcher's analyses and interpretations (Erlandson et al., 1993, p.31).

The use of recording devices ensures that the interview accurately represents the interview proceedings, thus increasing credibility (Wolcott, 1994). Audio taping also provides the interviewer the opportunity of repeated access to the data. Further, transcripts can be provided to participants for verification if clarification is needed and to an auditor to establish credibility. A reflective process journal was also used in order to record the process of the study, as well as reflections of the interviewees (Bogdan & Taylor, 1975). The transcripts were compared to the journal notes during the development of themes.

Triangulation of data

Triangulation of data indicates the use of more than one site or source of documentation, also intended to establish trustworthiness (Creswell, 1998). Although the selected sites were similar in that they were within the school context and located within close proximity to Research University in the United States, the use of multiple sites provided variation in participation and increased corroboration of themes found in the data (Creswell, 1998).

Peer debriefer/auditor

Peer debriefers/auditors, specifically two faculty researchers, who were familiar with the qualitative research process and topic were used to review all procedures in the study (Merriam, 1988; Miles & Huberman, 1994). Coded transcript review, audiotape review, and the researcher's journal of events and contacts were provided to the peer debriefers/auditors for evaluation at several points in the process. This external check of the data collection and analysis procedures aided in the interpretation of the data collected (Creswell, 1998). The review of procedures and thematic interpretations by an individual who has recently completed a qualitative study added insight, as well as confirmability and credibility (Lincoln & Guba, 1985; Wolcott, 1984) to the study.

DATA ANALYSIS

Qualitative case study research amasses volumes of raw data; therefore, it was essential to maintain the data in an organized and timely fashion (see Denzin & Lincoln, 2005; Humerman & Miles, 1983; Merriam, 1998; Stake, 1995; Yin, 2003). Even more important, preliminary data analysis must be conducted immediately post-collection or better yet, "the right way to analyze data in qualitative study is to do it simultaneously with data collection" (Merriam, 1998, p.162). Stake has emphasized that data is continuously interpreted since qualitative research is inherently reflective, "in being ever

reflective, the researcher is committed to pondering the impressions, deliberating recollections and records…data [is] sometimes pre coded but continuously interpreted, on first sighting and again and again" (Stake, p.242).

Huberman and Miles (1983) have outlined a detailed procedure for data gathering and analysis—aiding the simultaneous nature of the work: Coding (organizing and theming data); Policing (detecting bias and preventing tangents); Dictating field notes (as opposed to verbatim written recordings); Connoisseurship (researcher knowledge of issues and context of the site); Progressive focusing and funneling (winnowing data and investigative technique as study progresses); Interim site summaries (narrative reviews of research progress); Memoing (formal noting and sharing of emerging issues); and, Outlining (standardized writing formats).

While these procedures were used in a large, multi-site study by Huberman and Miles, research for this dissertation utilized a similar format, making necessary changes to accomplish a similar task or a smaller study with a single researcher. This particular data collection/analysis focused on the verbatim data (either typed on a laptop computer or handwritten in a notebook and used an excel file). These procedures attempted to organize the data as it was collected; such procedures highlighted a fine line between data collection and analysis, thus easing the task of simultaneous collection and analysis.

After all data from all sources was reviewed, the materials (interview transcripts, surveys, and artifacts) were manually coded and preliminary meaning generated from the interviews, surveys, and artifacts. As outlined by Miles and Huberman (1984), the data analysis proceeded from noting patterns and themes to arriving at comparisons and contrasts to determining conceptual explanations of the case study.

Triangulation of the multiple data sources was built into data collection and analysis for the purpose of achieving trustworthiness. This process "has been generally

considered a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or interpretation…triangulation serves also to clarify meaning by identifying different ways the phenomenon is being seen" (Stake, 1994, p.241). The following points of high quality analysis have been described by Yin (2003). The analysis must attend to all the evidence, address all major rival interpretations, address the most significant aspect of the case study, and utilize the researcher's prior expert knowledge (p.137).

These four elements were considered and built into the research study design and were used to guide the data analysis and ensure its quality. As the researcher, I too was a Latina student entering college with a science major. My experiences prior to matriculating in college and those after give me the expert knowledge that allow me to delve into those experiences that allow me to get rich information from the participants and insight into analysis of that information at a more personal level, catching those subtleties that only a student in a similar experience can.

CONTEXT OF STUDY

This study was situated at a large research university in the Southwest portion of the United States. The participants started as first-year students at Research University with a major in science. To participate, they must have applied to an academic support program for first-year students of which they did not have to be accepted to take part in this study. All participants applied to the Mentoring Program at Research University and were enrolled in a required course in critical thinking in their first semester in college as participants of the Mentoring Program. Only one male, second generation student applied to the Research Program in their second semester of their first year.

Biographical Participant Description

Four participants, all enrolled as first-year students, voluntarily agreed to participate. Each of these four students did not participate in the previously conducted pilot study (described below) and indicated interest in participating for this dissertation study.

The students, all identified by pseudonyms in this study, were purposefully selected based on their application to a first year academic support program, regardless of acceptance into the program. Purposeful sampling in case study research provided the researcher with the opportunity to select and learn from the most promising participants, "purposeful sampling is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (Merriam, 1998, p. 61). For the purpose of this dissertation, the term first-year student describes those students that are starting their first year of college, regardless of credit hours they may have earned prior to starting college. The term science major refers to a major in biology, computer science, chemistry, physics or neuroscience.

The first participant, was Martin, Latino and 19-years-old, and attended a school south of San Antonio, Texas. He started with a computer science major in the fall of 2012. He is the oldest child of two kids (younger sister). He receives financial aid and is a first generation college student. Both parents are educated in Mexico with some hours of college, but did not complete their degrees. Neither parent completed a high school education in the United States. He was actively involved in high-school UIL (University Interscholastic League) competitions and visited his current university at least 3 times before enrolling at the university. The student applied to the Mentoring Program as a high school senior and was accepted into the program upon starting his first year of college.

The second participant, Karen , an 18-year-old Latina Biology major, attended a school on a small border town in Texas. She is the older of two kids (younger sister). She receives financial aid and is a first generation college student. Both parents are educated in Mexico. Her mother completed a GED and her father completed some course work in college, but did not graduate. She visited the school only once before enrolling at the university. The participant applied to the Mentoring Program during her senior year in high school and was accepted to the program upon starting her first year of college.

The third participant, Anita, was an 18-year-old Latina with a major in Biology, and attended a high school in a small border town in Texas. She is the youngest of two (older sister). She receives financial aid and is a first generation college student. Both parents are educated in Mexico. Both parents work in Mexico, and speak Spanish. Her mother did complete high school in the United States but her father did not. This student was very open and fluent at giving details of her experiences leading up to college. Although she applied to the Mentoring Program in her senior year of high school, she was not admitted into the program.

The fourth and final participant, Jaime, was an 18-year-old Latino computer science major, and attended a high school in south Texas. He is the middle child of 3 children. He is not a first generation student. Both parents are educated in the United States. His father completed a college degree in Engineering. He was the quietest participant. He applied to the Mentoring Program as a high school student and was admitted upon starting his first year in college. At the end of his first semester in college, he was able to apply to the Research Program and was accepted to start the program in his second semester in college. He is the only participant who was involved with both programs.

Pilot Study

The pilot study leading up to the dissertation study was conducted in the spring of 2012 with a completely different design in mind. I focused on first year students from two different pools, those of the Mentoring Program and the Research Program. The pilot study did not take into consideration whether they were first- or second-generation college students, their ethnicity, or whether they were international students. I originally set up four focus groups; one group a day for four days. However, only one participant attended on each day. As a result, for the final dissertation study I selected a more traditional qualitative case study design. Furthermore, two participants were from MP and two from RP; half of all participants were international students. As a result and in conversation with the program directors, for final dissertation study, the decision was made to limit recruitment to Latina(o) students within the programs who provided a science-related major as their first choice major upon applying to Research University.

Each program director sent out a mass recruitment email to their students that declared a science major as their first choice when enrolled at Research University. Despite this, only participants with a major in computer science or biology took part in the study.

RESEARCHER POSITIONALITY

"All researchers have great privilege and obligation: the privilege to pay attention and the obligation to make conclusions drawn from those choices meaningful to colleagues and clients" (Stake, 1995, p. 49). Beyond Stake's assertion of paying attention and drawing conclusions, such privilege and obligation extends to the researcher disclosing positionality and conducting the research in an ethical manner.

I approached this dissertation study with previous experience as a Latina student from a border town in Texas. Both of my parents speak only Spanish and pushed me to

go to college. As a first-generation student, my first year in college with a science major helped in making it an interest of mine to understand more of what factors go into making decisions concerning academics. My interest in conducting this dissertation was instigated by my own struggles as a first year student persisting in a science major. It also serves the purpose of partly fulfilling the requirements for a doctorate in philosophy and making my parents proud.

In contemplating my role as researcher, Stake's (1995) conception of case researcher as interpreter is most fitting. According to Stake, "the case researcher recognizes and substantiates new meanings. Whoever is a researcher has recognized a problem, puzzlement, and studies it, hoping to connect it better with known things. Finding new connections, the researcher finds ways to make them comprehensible to others (p. 97)."

It is my hope that I was able to conceive new connections between Latino students in college with science majors and their decision-making pertinent to academic decisions. If successful, more students will better be able to apply decision-making theory and to extend that theory beyond a single application. Given the interdependent nature of the work conducted by the researcher and participants, indeed, both the researcher and the students represented the Research University and the community; ethical research was a necessity on professional and moral grounds. Therefore, it was critical that I conduct the study with the utmost consideration for research ethics by respecting the participants, the research process, and the outside community involved.

STUDY TIME LINE AND PILOT STUDY

The pilot study began in the spring of 2012, as soon as IRB consent was obtained and there was approval by committee members. The dissertation study started the fall of 2012 and all interviews, surveys, and artifact collection took place between fall 2012 and

through spring 2014, as well as data transcription and analysis. The final oral defense took place in April 18, 2014.

This study originated in a very different form, as a class project in a course entitled Advanced Study Course in Qualitative Research in the Fall of 2010 as an investigation into the resources that first-year biology students use to persist in their major. At the time, I was involved with first year biology students in a small university in South Texas helping them develop their own research. It was thought out to use that pool of students in developing a refined future dissertation study with participants from this small university. A plan was developed and the IRB at the small university was granted. Later, this plan was halted since there was an opportunity to work with students from a particular program with Research University. This allowed the researcher to remain at a closer proximity to the pool of students and get support from the program to fulfill a dissertation study in a slightly new direction, that of understanding students' decisions about choosing a science major and accessing support resources as college students, as well as the socializers that played a role in those decisions. Upon completing the IRB approval and the pilot study, changes were made to the design of the study and thus began the focus on case study research.

Through the use of rigorous qualitative case study research, the purpose of the study was to uncover the underlying influence of the choices Latino students make in their academic career. The processes and features of students' understanding and thinking when they make choices related to their major while in high school and in their first year and further into their second year is important, and who influences in those decisions and to what degree as well. The procedure and operational details of the study are presented and justified in this chapter. Additionally, guidelines for maintaining quality research and analysis were provided. Ultimately, Stake's (1995) assertion that, "The function of

research is not necessarily to map and conquer the world but to sophisticate the beholding of it" (p. 43) was the goal of this dissertation, to illuminate and understand the underlying socializers that play a role in influencing Latino/a students with a science major to apply to academic support programs in their first years of college and how they access support resources to persist in their science major beyond and into their second year.

Chapter 4: Results

Eccle's Model of Socialization (1983), specifically the social influence acting on an individual when it comes to making decisions, is a major concept used to guide this study. According to the model, parents, teachers, and peers have a great influence on an individual when making decisions. In this study, the focus is in fact how participants have made the primary decision to pick a science-related major and how they make ancillary decisions about accessing support resources up to two years in college. The people that influence in those decisions is also important for this dissertation study.

When this study began, the participants were all first-year students recruited to apply to a Mentoring Programs (MP); a single participant also applied to a Research Programs (RP) at the end of their first semester in college, regardless if they were accepted. The following table represents the research progression outline which includes the timeline for the IRB protocol, the pilot study, and the case study interviews carried out for this dissertation study (see Table 4.1 below).

Research Progression Outline

Proposal and IRB Development
(Aug 2010 - Feb 2011)

IRB Approval and Proposal Defense
(Dec 2011- Feb 2012)

Pilot Study Participant Recruitment;
Focus Groups and Survey
(March 2012 - April 2012)

Pilot Data Transcription/Analysis
(May 2012 - July 2012)

Formal Study Participant Recruitment;
First Year Fall Interview #1 and Survey
(Aug 2012 - Sept 2012)

First Year Fall Interview #2
(Nov 2012 - Dec 2012)

First Year Spring Interview #3
(Jan 2013 - Feb 2013)

First Year Spring Interview #4
(April 2013 - May 2013)

Second Year Fall Interview #5
(Nov 2013 - Dec 2013)

Second Year Spring Interview #6
(Jan 2014 - March 2014)

Table 4.1: Research Progression Outline.

The participants were interviewed twice a semester in their first year in college; once early in the semester and a second time at semester's end for a total of four interviews in their first year. On their second year in college, I interviewed them once at semesters end their first semester and early to mid-semester on their second semester for a total of two interviews in their second year, for a total of six interviews each. Each participant's expectations for each semester and the results are discussed along with how they initially decided to apply to RP or MP. The initial two interviews were very important towards understanding the process by which they made the initial decision to apply. The following interviews allowed me to gather more rich data that gave an insight in how they make decisions related to accessing support for their academics. They were asked a series of questions about their expectations for each semester and whether they met or surpassed those expectations. Each participant was allowed to check transcripts upon the next visit for clarification purposes and to give credibility to the data collected. For the last interview, participants were allowed to review a copy of their transcript and confirmed through email.

Each of the four voluntary participants in this study contributed their experiences when choosing a science-related major and very similar experiences in terms of the process by which they applied to the MP program. Other ancillary decisions in support of their persistence in their science-major or career further shed light on the decision-making process for participants in this study. All participants are high-achieving students in high school who graduated within the top 10% of their class. The findings for this study will be presented in this chapter.

DESCRIPTION OF EACH PARTICIPANT

Martin—as a first-year participant, he was 18 years of age with a major in Computer Science. As a first generation college student, his parents only attended school

in Mexico. He was from a small town in South Texas; as a Latino, he was also very interested in Math being his second major, which he later declared in his second semester. As demonstrated in the data included in this chapter, Martin was very well spoken and descriptive in his interviews. He was very involved in MP and very supportive of his mentor, also male. He clearly demonstrates that he has a great relationship with his mentor outside of MP, in a more social environment as well. He clearly demonstrates the value in establishing a great network of people within the MP program, which include his peers in the program, as well as outside of the program, such as with professors in his classes, and colleagues at his workplace on campus. He is the oldest of three siblings; two younger sisters.

Karen---as a first year participant, she was 18 years of age with a major in Biology. As a first generation college student, her parents only attended school in Mexico. She was from a small border town in Southwest Texas; as a Latina, she was the first in her immediate and extended family to leave home to go to college. As demonstrated in the data included in this chapter, Karen progressively felt more comfortable to opening up about her experiences during the interview. She was not very involved in MP outside of the mandatory meetings with her mentor, who was male. She expressed feeling put down by her mentor for being female and expressed a feeling of loneliness and felt Latino's were not represented well in the program. She constantly expressed feeling challenged by professors and motivated by the staff in MP. Although she felt behind in her classes, she never actively asked for help. The need to work part-time during her first and second semester was important to her. Her personal life was front and center with a boyfriend in the picture mid-to-late in her second semester in her first year of college.

Anita--- as a first year participant, she was 18 years of age with a major in Biology. After her first semester in college she expressed her interest in Public Health, but her GPA was too low to be able to switch majors. She worked to get into the pre Public Health degree instead during her first semester during her second year in college. As a first generation college student, her parents attended school in Mexico. She was from a small border town in Southwest Texas; as a Latina, she was the first in her immediate and extended family to leave home to go to college even though she is the younger of two daughters. As demonstrated in the data included in this chapter, Anita applied to MP, but was not accepted into the program. She is the only student not participating in either program. She actively sought out another program for first year students in biology that met in her dorm. As only one of two Latina(os) in a Freshman Program for biology majors, she felt out of place and soon stopped attending the sessions altogether by the end of her first semester. She expressed that most of her time outside of school was dedicated to studying, but that having a boyfriend during her first year of college did require her to make use of her time wisely since they would visit often. She also felt a disconnect with other students in class and felt "stupid" when she studied with one of her classmates that made her feel like she asked "dumb questions." Her best support came from her roommate during her first full year at school. She moved into an apartment with her in the summer after her first year in school. Her boyfriend also moved into another apartment in the same complex at the same time.

Jaime—as a first year participant, he was a Latino, 18 years of age with a major in Computer Science. Since he was not a first generation college student, both his parents completed undergraduate degrees in the United States, as well as his older brother. He is a middle child and has a younger sister. He was from a small town in the valley of South Texas. As demonstrated in the data included in this chapter, Jaime was the quietest and

most soft-spoken of the participants. His answers tended to be very short and concise. He was invited to apply to MP where he immediately started to get involved with undergraduate research during his second semester in college under the other program RP. He consistently demonstrated a confidence in his classes. His concern was time management during his second semester when he took on his normal 15-hour course load and undergraduate research, but that feeling faded. He expressed he did most of his studying on his own.

The research questions for this study, "How do Latino students make career-related decisions, and decisions about the support resources they access, such as choosing to apply to academic support programs?" and "Who mostly influences in the academic decision-making?" With guidance from the previously outlined research questions three primary themes surrounding the decision-making process of these Latino students emerged. These themes and related sub-themes are introduced in the next section and further discussed in the following sections of Chapter Four.

INTEGRATING THE THEMES OF THE STUDY

To make the process of analyzing more efficiently, each semester's data was analyzed and the following integrating themes will be discussed further in the next chapter: To Apply or Not to Apply, Navigating A New System, and Never Ending Decisions. Through the use of qualitative data analysis outlined by Miles and Huberman (1983, 1994), four themes were uncovered and developed. As the multiple data sources (transcribed audio interviews, field notes and journals, and artifacts from the MP website) were read, re-read, and categorized, words, phrases, and ideas were repeated, such as sources of communication. The volumes of data were organized first by participant, then by type, such as interview transcript or field notes such that the themes emerged both within and across the participants. Ultimately, the entire quantity of data was reduced to a

long list of topics commonly found within the whole of the data; these topics were then combined and developed into cohesive themes with appropriate data examples for support and illustration.

These three themes highlight many of the academic and social complexities of the experiences by the participants; both before and after college matriculation. These themes involve: issues of identity, learning about the college system, academic help seeking, family, expectations, developing relationships with peers, professors, and staff, and balancing cultural differences. As these challenges were confronted and resolved by science students they continued to develop and refine their belief systems about how they make decisions and who influences in those decisions.

The first theme, entitled To Apply or Not to Apply, entails the environment in which the students first engage in making decisions related to choosing a science-related major, applying to a university, whether to apply to specific support programs during college, and discusses in detail the socializers that played a role in these very important decisions.

The second theme, Navigating a New System, explores the participants' experiences related to encountering a new system, strategies to be successful in courses, the people that were crucial in helping them make decisions during their first semester,

The third theme Never Ending Decisions, explores the participants' experiences related to continue to navigate a new system by using various strategies, the support they receive, the people that were crucial in helping them make decisions during their second semester and in their near future, and what socializers were important in making decisions that allowed them to persist through it.

THEME ONE: TO APPLY OR NOT TO APPLY?

Students in high school prepare to make decisions about their future early on in high school, and for participants of this study their environment and the people surrounding them were crucial in making those decisions. Because the college attendance decision is influenced by a variety of individual, school, and geographic factors, the literature on college choice is extensive (Baumann and Lucia, 2009). According to Turley (2009) students are in the choice stage when it comes to deciding what school to attend, which typically occurs toward the end of high school, when students receive admissions notices and financial aid offers and select an institution in which to enroll and attend. According to the authors, the focus on the sequence of the college-choice process has by and large taken the spotlight off the geographic context in which college choices are made. In particular, the search stage assumes that students give consideration to all appropriate institutions, regardless of where they are located. However, most students consider only a limited number of colleges, and this small set of institutions is largely determined by location (Turley 2009). The students in this study were involved in countless daily decisions that shaped their interactions with other peers and adults, the high-school environment, and their family; while at the same time they were focusing on the decisions of their future academic careers. One of those decisions, ancillary to their primary decisions of applying to a college of their choice and choosing a major, was how they chose to respond to the offers they received by email to formulate a decision about how to persist in college once there. Over the course of the initial interviews, the data showed that the participants were all very technology savvy and most of their choices were being communicated online; at times without the guidance of human contact. The first four sub-themes of To Apply or Not to Apply, focus on the decision-making process in high school during their final semester before graduation, including the important

people and experiences when Picking a science major, Using technology to make choices about their future academics, the people important in high school in the sub-theme Socializers-Who matters most in high school?, and the Timing of application to an academic support program in college.

Picking a science major

For all participants this decision was straightforward and based on the previous experiences leading up to that choice. All participants expressed a sense of "just knowing" that they would choose the major they chose. For the women, they chose a major in biology, and for the men a computer science major. The difference was in the type of experiences they had with science. For the two women in biology, the participants expressed that they had great experiences with a teacher in their science classes and that they made the classroom material fun. Anita in particular, further expressed a personal connection with science because she frequently encountered the home care of a grandparent by a visiting doctor. "I was always around when the doctor or nurses came by to take care of my grandma and so I found it very interesting to see them work on her. I was always curious about disease since my grandma was very sick. I think that is where I became curious of science." For the two male computer science majors, the focus of why they chose a science major was because they were very good at it all through college and they both enjoyed technology use and video games. They both expressed having an interest for computer science early on. One participant, Jaime went on to further explain that he took online tests that would help him decide what he "was good at." According to the online tests, he always demonstrated high ability to do computer science-related careers. This was very interesting to hear, because this participant demonstrates how much technology use is a part of his life and his future career. Jaime mentions that it was obvious that he should stick to computer science because of a combination of those

online results and his high ability in math and computer science classes in high school. From these findings about choosing a science major, these participants demonstrate different reasons for doing so. For the women with biology majors, the social interaction with a good female teacher in a classroom had a greater impact on their decision to choose a science major, as well as social interaction with doctors and nurses for one participant. The women with biology majors never mentioned that their high ability in their classes helped them to choose that major, unlike the men with computer science majors, where high ability in math and computer science courses in high school and for the over-confident male (Jaime), confirmation through an online test that demonstrated his computer science ability. Also, common for the male participants was the frequent use of online gaming that made them tech savvy and gave it a fun factor. It is important to note that for the two women with biology majors, the social interaction is greater than for the two male computer science majors with computer science majors. Anita's and Karen's interaction with female teachers influenced their decision to apply to a science major, whereas Jaime and Martin acknowledge relying on their own ability in computer science and math, as well as the online interaction with while playing video games, which may or may not be their own peers. This interaction with peers was online and not in person, bringing to light how technology separates them from social interaction. These findings are mostly supported by the literature review presented in the previous chapter two and will further be discussed later. I will now detail the technology sub-theme below.

Using technology

With the greater availability of technology in our high schools and at home, students are expected to navigate various forms of communication. They are expected to integrate technology in their daily lives as well as a way to navigate the real-world. Many students are able to navigate their lives all through technology, the Internet, and social

media. It has become a part of their daily lives and sometimes there is no rest in constantly being connected to the rest of the world. This is true for the participants in this study. Decisions about their future lives were taking place all by the click of a button. The need to request an application for college has long passed since early spring semester is the time for submitting the application. All it takes is a click of a button to send in a college application via the Internet, and along with the click go the decisions that will have a great impact in their future lives, such as which major a student chooses.

The following interview and journal data illustrate excerpts discussing essential technology issues encountered by these high school students during their last semester in high school, and upon receiving notice of their acceptance to college.

Martin was very self-motivated when it came to technology use for the purpose of following up to learn more about the academic support program he was invited to apply to. In his initial interview, he mentioned:

> "I received an email, 'cause you get scholarships from a few programs and I read MP and at first I didn't know what it stood for or nothing and I looked at the information and I Googled it just to see what this is; just 'cause you get a bunch of stuff and like you know which ones are worth your time and which ones are just there…and so I looked it up and I saw some of the things they did and what they stand for and stuff like that and so it seemed like something that was pretty cool and when you see the benefits as well like why should I be in this program you know like what's the purpose of it and so not only is there a mission and a statement and stuff but then there is also a bunch of things to help you transition and so it helped a lot too."

Based on the interview data and journal notes, Martin was indeed a self-motivated student. He demonstrated a proactive approach to his future academic career once he learned he was accepted to his second choice school. He received an email about the program [MP] inviting him to apply to the program focused on mentorship. Like many other students that are invited to apply to support programs, he devoted of his time to

research what the program was about based on an email he received from the program via email. He opted to Google the program where he learned about the benefits for the program for his transition to college. He further adds that upon reading the information on Google, he goes directly to the email to continue with the application process. He adds,

> "I just read over it (the information) and saw and I immediately 'cause it was like, "Do you want to apply to this?" and I just replied yes. In the email it gave you a link to where you go to and do stuff and so from there I just went and filled it out like a regular application." Upon having Googled, he then clicks on the link provided in the email and further went to the official university website to find out more information. "I remember seeing the web page and since I like looking at the design and those things I really liked it. It was easy to access and navigate. The information was well organized and I could clearly see the important information that caught my attention like the reserved seats in classes. I liked that I could also be a mentor and that they would help in that process."

Martin was not the only student to take this proactive approach to finding out more about the Mentoring Program.

Karen also mentioned in the interview that upon receiving a MP email, she too accessed the college website immediately to find out more about the university and the academic support program she hoped to apply for. Karen said, "I believe I got sent an email before graduating high school. I immediately went to check what it was about and followed the link provided to me because we had to do the application." She in particular liked the website for the Mentoring Program and liked how easy it was to navigate. She mentioned,

> "I remember that I liked to see all the information organized in sections and the information was short and to the point. It had all the people in the program in one of them and it was nice to see who would be helping out if I got in because it had pictures of them. I really liked that they had small classes and reserved our place in the classes."

Jaime too used Google to access more information about the program and clicked on the link provided to him in the email via his telephone. He recalls going to the site and remembers that he liked that he could be a part of a program "that would help [him] get into research later by taking a critical thinking class." On the other hand, Anita let a lot of time go by before she applied to MP despite having received a flyer and an email inviting her to apply early on. She goes on to say, "I think they sent me an email. I just had fliers too and I just had it there on my wall; they sent them through the mail. I had it right there on my wall in front of my computer. One day I was like yeah, I will just apply." All of the participants received the same email to apply and they all decided to apply, the difference with Anita's decision to apply was that she did not tell anyone about her decision to apply. She mentions that even though she is supported by her parents to do anything in benefit of her education, she did not tell her parents. She goes on to say:

> "Well I didn't tell my parents that I was applying to MP—that was just something that I was doing myself; 'cause my parents they weren't those type of parents that you come home and they ask for your report card; I would just tell them oh, I got a 100 on my test or whatever and they are like oh that's good; I would keep them informed for certain things, but not about like what I learned that day; we never really did that."

For her, there seems to be an independence factor in making her own decisions about her academic career. Despite this, she is the only participant that did not get accepted into the program, but has the same approach of using technology, in this case her personal laptop to investigate the details of MP further. She states, "I Googled MP and it eventually took me to the main MP page on the Research University website." Despite the results of her application, this study focused on the actual process by which students take to make decisions about applying, or not, to academic support programs. In this case, she too is focused on the use of technology to get more information allowing

her to make an informed decision herself. Although she did express that she constantly carries her phone, in her application, she used a personal computer. Interestingly, she says about receiving the MP letter denying her acceptance, “I was on my way to school when they sent me the email in the morning, but I didn’t get it.” She clears up that she received the email via her cell phone.

As the participants went about their last semester in high school, the use of the internet to explore the various expectations for each student was common in all of the four participants despite what particular piece of technology they used, a personal computer or cell phone. Each student accessed Google and was then directed to the university website to learn about important dates related to the MP program. The choice of technology to learn about the school or receive knowledge about their acceptance or denial into the academic support program they would like to be a part of was a smartphone or a personal computer. All participants expressed that it was essential to have their cell phones for this purpose. Martin writes, “I always have my cell phone and I can check my email there as soon as it arrives so I did follow up on what MP was and went on to the link to get more information.” Karen goes on to reiterate, “I always have my phone so as soon as I had a chance to check my phone and email in detail I did it.” Anita and Jaime both favored the same technology with ease of access at all times or when allowed while in high school.

Technology was also important for students throughout their first year of college and beyond to their second year in their first semester. More data will be touched upon as each semester in college is discussed further below.

Martin’s comments summarize the students’ experiences, which culminated in an overwhelming feeling of needing to use technology in order to get important information that would prepare them for their first semester in college. This was a universal feeling

throughout the semester with all of the participants and was common given the expectations of starting a new system in college in the near future. They were very interested in accessing as much information to help them stay on task once their first semester in college started. Access to technology also allowed them greater networking.

Socializers-Who matters most in high school?

Furthermore, the process of using technology to gather information to prepare for their future in college also implicates other people. This could be related to the fact that the decision-making they are doing on their own via the internet produces a self-dialogue of sort that can only be affirmed with a person. The use of the internet as a medium allows the student the modalities in a visual and textual form. The information presented to them is passive and non-interactive. The idea that the student gets involved in self-talk or self-dialogue with the information they see via the internet does not allow for feedback. It is after making a decision that students talk to a human socializer as a source of affirmation of their decision. Although the student is able to make a decision based on the information provided by the internet, the need to reflect on that decision with a socializer is constant for all participants in this study, although not necessarily for all decisions. The fact that they used technology to make a decision about applying to an academic support program meant, for this group of students, that they needed to check with other people for this decision. Self-dialogue with the Internet was not enough for them to feel "all in" when applying, they turned to other people that mostly strengthened their decision to apply.

The participants found themselves in charge of their future, and by gathering information via the Internet, they made the decision on their own, finding agency in the choice they made. Rather than making a decision to apply centered on the socializers, the

choice was centered on the individual. Jaime demonstrates this process in the following way:

> "I told my parents when I first got the email, and my teachers and my friends. They all said it sounded pretty cool because I explained to them that it was like a scholars program and all that stuff and that I was going to apply to it. They all were happy that I was going to apply."

Jaime's experience with this validating process was typical for the other participants except Anita, who was not accepted to any academic support program. Through the interview process I learned that participants reached out to family, friends, and teachers from within their local high school. From their conversations, they expressed a sincere need to tell others their intentions to apply to a program. Again, this supports the idea that maybe for these students, there is s till an important need to make a connection with a person about the direction their future academic career is going, especially since they are moving into new territory. Making a decision that will affect their future may be a concern that prompts them to seek that personal interaction with someone, as opposed to a self-dialogue with the Internet information demonstrating that the use of technology to access the Internet is not enough to strengthen their decision. A personal touch is still very important in this decision making process.

When it came to making a decision to apply to academic support programs, participants continuously seemed to want important people in their lives to validate existing choices, as opposed to asking for their advice about what choice to make regarding whether to apply or not. For example, Karen reached out to her mom and teacher regarding her decision to apply to the program, as opposed to asking if she should apply. She states "I actually had another program in mind, but when I Googled MP, I

liked that MP had opportunity for research and I decided to apply and then I told my mom and my really close teachers."

When it came to her mom, Karen described that talking to her mom about her decision to apply to the academic support program was "something I always do; I tell my mom everything I am going to do regarding school because she tells me that I should do whatever I know will be good for my education." Interestingly, I found this notion in the second female participant, Anita, who also expressed this notion of having support to do anything beneficial for her education by her parents. She too mentioned this notion of having support from her parents, but she did not communicate it to anyone, even her parents. Martin touches on the notion of making the decision on his own and then validating through others. In his case, he informed his "favorite" female teacher about his decision to apply to a mentoring program during his first year and likewise, received support for it by his teacher. When it came to informing his friends and family, he mentioned the actual acceptance to the program, not so much validating it. He opted to ask his teacher about his decision to apply only. With these three first generation students, Martin, Karen, and Anita, they all expressed not asking about whether to apply to the program or not because they felt that, much like in many other occasions, their parents would not understand what it would be about since their parents did not attend school in the United States, but in Mexico. Karen states the following about her parents' lack of knowledge about MP as "they are from Mexico so they don't know anything about college here in the United States." This is a consensus amongst these students. Although Jaime is a second generation college student, Jaime seemed to be the most confident in his decision to apply to the support program MP as a means to do research in RP during the second semester, which is geared towards first year undergraduate research. He seemed to have a lot of knowledge about how he could transition into the

RP program while in MP by first taking a critical thinking course that is offered through the MP program; a requirement to be able take part in research the second semester of their first year for the Research Program. He goes on to describe:

> "As a MP scholar, MP people, not all, can go into that research with RP next [second] semester, but they do have to take research methods the first semester, which is our critical thinking class in MP. So because of that, it was a lot easier to just apply to my research class next semester, which I'm going to be doing. I already applied and I already got the application back and I am going to be researching Artificial Intelligence next semester."

During our first interview, he already demonstrated the drive to get his goals accomplished. He was well informed and sought out what he needed to do beforehand. During the interviews, there was always an interesting contrast with the other participants in his confidence. Although the only other male, Martin, was also secure in his ideas and intentions about his education, he seemed still cautious about what steps to take next. He seemed to have to inform himself first and do his own research before taking a decision, whereas Jaime simply already had a notion. The interesting contrast to the three other first generation college students when it comes to validation of their decisions regarding application to such support programs was Jaime told a wider range of people about his decision to apply, including his parents, brother, teachers, and friends.

In describing these experiences, only representative experiences have been recounted in this first theme. These are issues that were commonly recursive during the first and, to some extent, the second interview. These experiences demonstrate the similarities amongst these Latina/o students as they make decisions affecting their college career regarding their use of technology to inform themselves about what steps to take next regarding their college career; how they use this information to make a decision to apply to support programs during their first year AND how most validate through various

socializers. These experiences demonstrate similarities in regard to timing, which is the next theme.

Timing of application

The third sub-theme dealt with the timing of the application to these academic support programs while in their last semester in high school. The importance of applying to these support programs was pressing for each of the participants. This is of course to be expected as there is a process of applying to the programs to determine if they have been admitted or not. The notion of competing for a spot in these programs was present in each participant. Despite this, there was a delay in applying to these programs on a timely basis or prior to "the last minute." This disconnect between the urgency to desire to apply to compete for a spot in a support program and the delay in taking the action needed in a timely manner stood out. Martin was aware that it must be competitive since UT is a very large school, but reading more and seeing how selective it was did not pressure him into applying right away. He goes on to say, "I was hoping that I was a strong candidate and just waited to hear from my other schools first." Similarly, Jaime states that even though he knew that being a scholar would be a great way to start the semester, he was taking his time since he believed that he was a good candidate to get in. "I knew that I could come to UT, but I was also waiting to hear about my other schools." Anita states, "I think I applied on the day it was due. I just decided to do it last minute. I knew I should do it earlier, but I tend to do things on the spur of the moment; when the time feels right." Karen mentions that she went right to work on the application, but did not submit it until close to the deadline just because she "forgot to get to it because of all the things we need to do to prepare to go to college during high school."

Despite the various reasoning behind the tardiness or delay of submitting the applications, all participants expressed the urge to apply, but their actions did not reflect

that. Whether their confidence in themselves, as the two male computer science majors expressed, kept them from it, or issues regarding their own personal situation, such as finding the right time or the stresses of preparing for college, as the two female biology majors expressed, timing was a critical theme. Regardless of the reason, there is a disconnect in the intentions and actions of the students during their last high school semester before college in regard to submitting the application.

Theme One: To Apply or Not to Apply, in the High School environment is an important theme that emerges in this study with Latino science students as the focus. The participants devoted a great deal of time during their last semester in high school to prepare for their first semester in college. From making decisions to choose a science major, to accept award letters to a certain school, to applying to support programs, using technology to learn about benefits to belonging to support programs, and validating those choices with others when necessary.

The four sub-themes of the first theme, Picking a science major, Using technology, Socializers-Who matters most in high school?, and Timing of application were all connected. Each evolved into the next in a way that demonstrates how technology is embedded in the context of exploring interests of each participant further and making decisions regarding their future education. This information is used to make a decision to apply to academic support programs, which they validate, in most cases, with their family, closest teachers, and friends. Upon this validation, most students go on to feel an urgency to apply, yet wait to apply until the last moment possible.

The first theme provided further detail regarding the experiences of the participants in terms of their first semester of college. Theme One: To Apply or Not to Apply?, was indeed a setting for the following themes as they are progressive in nature. Theme Two: Navigating a New System, explores the participants' experiences related to

encountering a new system, strategies to be successful in courses, and the people that were crucial in helping them make decisions during their first semester, Theme Three: Never Ending Decisions, explores the participants' experiences related to continue to navigate a new system by using various strategies, the support they receive, and what socializers were important in making decisions that allowed them to persist through it.

THEME TWO: NAVIGATING A NEW SYSTEM

The fall semester of the first year of college for the participants relates to the experiences during that semester only. The sub-themes within this theme explores the participants' experiences related to navigating a new system, strategies to be successful in courses, and the people or socializers that were crucial in helping them make decisions during their first semester.

Upon entering a new system in their first semester in college, participants are expected to explore a new educational system at the same time that they are making adjustments to the many changes they encounter. Being torn away from their families is a marked adjustment for most. Balancing a new life with new rules and managing time become very daunting for most first year college students. The focus on academics gets sidetracked by this adjustment that needs to happen at the same time. Although some were able to be admitted to academic support programs that are demonstrated to be of tremendous help, some do not receive the adequate attention needed to remain in their major. Some sub-themes overlapped with those of the first theme demonstrating a sense of familiarity in the process by which students are making decisions from high school to college.

Managing Time

This sub-theme was also common in their first semester of college. One of the most important aspects of navigating a new system that was a common factor in the persistence of Latino students during their first year was timing or time management. Most participants expected this factor to be the most important determinant to being successful in their first semester. According to Martin,

> "time management is a concern for me just because I am not used to getting up on my own and getting ready to go to school. Now that my schedule will not be like it used to be in high school, where I was there all day with back to back classes, it is going to take some time."

Jaime also supported this notion of being able to manage time to be successful. He expressed that his Father and brother mentioned that I should focus on making sure I learned to organize my time upon arriving because it was going to take time to get used to it. For the women, they, too, arrived with notions of figuring out their schedule and making sure they could make time to get all of their work completed. The obvious difference within the participants was Jaime's access to personal family support during college. Since his Father and Brother had previously graduated from college, they could help him prepare by putting focus on the importance of timing during the first year of college. Jaime was also not as worried about timing because he could always just call home for help if he needed anything to help him if needed.

Another common sub-theme from Theme One is the validation from people that matter most, the socializers; described next.

Socializers-Who matters most in college?

In order to be successful in navigating the new system, participants had in mind that building a network of people would be important. All of the students, including Anita

who did not get into any academic support program, were aware of the importance of having someone to study with or talk to about general questions about the new system. The need to have a buddy of some sort was in their minds. Anita recalls:

> "It was probably my sophomore year in high school when I came with Future Business Leaders of America; one of our FBLA ex-presidents came to school here and she was in the Business School at Research University. She was telling us, it's such a big school; you need to find your niche in your group. You need to find people to be with and study with to do well."

Anita was in the difficult task of needing to find support and she recalls:

> "I had seen a Freshman Program (FP) before, because my friend told me that she was going to do an FP (when she went to Research University); I wasn't really interested in a FP…well, once I didn't get into MP, I researched it and I was like, if I don't have anything else that is what I will do. When I came here for summer orientation, I was on the lookout for it. I thought it was already too late to apply to be in something, so when I found out it wasn't too late to apply—found out in an info session in orientation; one of the brochures that they gave me—I went online and I double checked and it was there so, I was looking at a 2 page double sided brochure and it had all the different FP's there."

Anita was very concerned that because she was not in any program yet that she would find this network in the form of a freshmen support program for Biology students. The Freshman Program is a program that any student can be a part of and meets once a week to discuss questions related to academics. She adds, "Once I didn't get into MP, I researched it [FP] and I was like, if I don't have anything else that is what I will do…I went online and I double checked…" Unfortunately, feeling out of place and as the only Latina, left her with urge of finding another form of support. According to Anita, "the group was so large that I felt I couldn't ask any questions. She also mentioned, "I was the only Latina in the group. When I went to the first session, there [were] so many students in the group and it just was overwhelming. I didn't feel like comfortable there. I think I

was like the only Latina there, except for one other student; a guy." The urge to find a group to belong to is clear for Anita and the other students agree with this notion of needing a support group.

Martin was very happy and appreciated being a part of the MP group and to have a mentor that he connected with. He felt that his mentor's guidance and reprimands also were a great factor in him building a strong network of people that he felt comfortable with and that made it easy to ask questions about anything. Although meeting on a weekly basis could be tough due to timing, he felt that it allowed him to make connections with other MP students and recognize them within class and on campus. Martin states, "I am glad I was part of the MP program because it really helped my thinking. 'Cause it provided me with lots of information and someone to talk to as a mentor that I probably wouldn't have had if I wasn't a part of MP and so it made me feel like I had someone to go talk to about when things were going wrong and also when things were going well."

For Martin, communication with his high school peers while in college was prominent during his first semester in college and less in his second semester of his first year. Furthermore, the communication was via technology and the Internet. Martin detailed his interaction with friends online via headset while playing video games:

> "…so that happens mostly weekends; or if I am really exhausted and I need a study break, boom! If there is something that I need to stop thinking about, math or like computer science, I just do something fun for a couple of hours…it's a good way to communicate especially cause, I mean, I do text a lot but not as often as I used to and so no, you know, even with close friends, I don't make the time that I should to, "Hey, how are you doing?...at least for me and a couple of friends, we all play that, it's a good way to at least, "Hey we are playing on line, let's talk; let's put on our headsets and talk and I guess it's another way to keep the communication."

For Martin, communication with his peers:

> "can be about anything that comes to our mind. They will range from when we play the game, there is 40 seconds in between matches so they will range from anything from—hey how have you been, how is your mom, brother; how is the family or in school, today this happened or my classes are really getting really hard; anything from academics to personal…"

Martin further goes on to add that he talked to one of his friends about the importance of going to college. He reached out to a friend that was going through a difficult personal situation and was not enrolled in college. Martin goes on to add that his friend,

> "…graduated with me and we [another online peer] told him you have to get into college; don't take a year off; we really wanted to stress that…when we would play on line we were like, 'So did you apply to college yet?' or we would ask, 'Where are you going?', I got accepted here and here and we would ask him, 'Where did you get accepted?'"

This form of communication for Martin demonstrates a way to communicate with people, specifically high school peers aside from his peer mentor. Interestingly enough, Karen was also a part of MP and met with her mentor and group on a weekly basis, but she expresses dissatisfaction with her group and mentor, but sees the intention as a positive one. She felt the male mentor was sexist most times, and the fact that she was the only Latina in her group compounded the situation. She states,

> "My mentor was always on top of me and trying to provide help, even if he wasn't the best it is still some kind of support. Despite having all girls in the group, he made it a point to compare males and females and how he didn't trust the girls in his class groups when he had to do a group lab. He constantly made me feel like we were a lower species. Not to mention that I was the only Hispanic student in the mentor group; I just never felt comfortable saying much."

Karen although she felt the importance of having a network of support, she failed to find it in her program or elsewhere for that matter. Although she was aware of the good intention in having a mentor for support, her experience with the mentor was negative. In a separate occasion, she recalls that while working on a group lab project for her biology class, she felt undermined by a male group member when he took it upon himself to disregard her part of the project data results, choosing his results instead.

Even though she did not find the network within her peers or her MP mentor, she did find comfort in her critical thinking professor who also happens to be a part of the MP program. “She really helped me feel comfortable about asking her questions about class and my future path. Like she would always focus on what we can do, not only a certain path, but that there are many different paths that you can take to get to that same goal. She was a great help.” For Jaime, the network was not crucial for being successful in navigating a new system because he was “used to being alone and independent.” He expressed an initial concern, but later mentions that it was not an issue for him.

Furthermore, another important part of this socialization sub-theme for participants during their first semester in college was their success in their courses and the actual strategies they were using to be successful. This notion of disconnect between what they think is important for their success in their courses and the actions they take towards reaching that goal was also apparent in Theme Two. Students seem to have the information that most any teacher would give them for their success in their courses, yet they are not using it in the way intended. All participants across the board spoke about meeting professors during their office hours as a way to get their questions answered early on in the semester. They spoke of the importance of this practice to their success, but upon interviewing them at semester’s end and after final grades, only Jaime took

advantage of professor office hours on three separate occasions, building a social interaction with a professor. Anita mentioned that she signed up for office hours but opted to meet her boyfriend instead of making it to her appointment for her biology class. She acknowledged that it was a bad choice and would want to correct it for the next semester. Karen also expressed that she did not get a chance to make it to office hours and opted to try to figure it out on her own since her schedule interfered with office hours for that professor, but she failed to try to discuss the possibility of going at a different time. Martin mentioned that his "classes were so easy and there was no need" to go since it was material he felt comfortable with. Although for these three participants visiting with a professor during office hours was not possible, the interesting fact is that the two female biology majors felt ashamed that they did not use this strategy because their grade for each of the classes suffered greatly. For Martin, his expression of not going was unapologetic and felt comfortable with that decision. It is important to note that Jaime used office hours despite the fact that he too felt comfortable with the material and felt unchallenged in his courses in computer science. He did express the importance of getting to know his professors.

> "I know that it is important for professors to get to know students…if we want to build connections and the only time that can happen is during their office hours. I try to make it a point to do that so they can recognize me because in the future I may be able to take part in a project with them if an opportunity arises."

It is clear with Jaime that he is aware of this strategy as a benefit in the long run in his academic career. He recognizes that even though he has "easy, introductory courses that did not require that I go to office hours" he sees the value in attending anyway.

For the two female biology majors, even though they could not make the office hours provided, they did not try to communicate with the professors to see if they could

set up a different time; they simply gave up despite the fact that they both express the importance of going especially since they were having issues in certain classes. For one of the male computer science major, the office hours are only important if he were doing poorly in one of the classes, but since it wasn't the case, then opted not to. The other male participant, a second-generation student, used this strategy frequently and determined there was an alternative reason to going other than just to improve the course grade; he saw it as a long term benefit later in his career.

Overall, this socializer sub-theme that emerges for Theme Two focuses on those people that play a role in the academic decision-making for the participants. Upon completing their first semester in college, the participants all were encountered with having to make decisions regarding their academics or their long term needs.

Some participants had issues about dropping classes and others about what courses to take since they were able to take upper level classes based on their high school AP coursework completed. All of the participants relied heavily on their advisers except for the female student, Anita, who spoke with her professor directly regarding the decision to drop her course. The professor encouraged her to remain in the class regardless.

> "She is an awesome professor; but she is really hard; her tests were really hard; I didn't think I was going to do as bad as chemistry; I thought I was going to fail out of biology; I was actually going to Q drop it and I told her and she said if there is anything that I can do, or we can talk about, just come and see me; she kind of convinced me not to so she was one of the professors that actually wanted me to do good so I like her a lot; and I said I would do it; 'cause I am really indecisive; so the next day I was like, oh I don't know I think I am just going to Q drop it now; and she was, oh ok, I will support your decision; and the next day I was, oh I will try it; so I tried the thing and I ended with the course with a C. so I was proud of myself for not failing."

Karina was also under the same circumstance regarding a class that she contemplated dropping due to her low GPA. She reached out to her MP program professor for critical thinking as a source of advice on what to do next. With her guidance, Karen opted for dropping the course. The similarities between the two female participants in this situation is in stark difference to the male participants who reached out to their advisers regarding what level of math to take since they qualified for a higher level math in each of the cases if they felt comfortable. For this group of participants in their first semester of college, socializers also tended to be advisers. The advisers in each of the cases for this study were also professors and responsible for teaching one of the courses in each participants course load. Although family arose in conversations regarding decision making, no student reached out to parents for advice on what to do in each case. Although the male students did discuss their decision after the fact with their family, in this case a form of validation rather than advice seeking again, the two female biology majors made it clear they would not be telling their parents about their situation to not disappoint them. For example, Anita mentions that she had not contacted her family about her possibly dropping a class because she did not want to let them down. She said, "It was not a good idea since I did not want to worry them." Here she demonstrates that even though she may be making a decision regarding her education, the fact that her parents may have a negative impression of how she is doing in school required that she remain quiet and refrain from disclosing it to them. In high school, she encountered mostly positive experiences in her education that allowed her to talk to her parents, but her negative experience with a class in college required that she turn to another socializer for support; in this case her professor. Likewise, Karen also expressed this notion of withholding the negative experiences from her family to avoid worrying or

disappointing them. She too turned to a MP staff professor. Next, I will describe the third sub-theme, the last theme in Theme Two.

Organizing their schedule

With the interests of managing time and building a network of people to help ease the new academic system, another major factor that was common for most students was keeping a schedule or making goals. Students were frequently told in their orientation or in high school that being organized with their daily tasks and goals was imperative. Most participants expressed the need or desire to get organized with a daily calendar or a white board to keep assignments and daily tasks in order. Some participants expressed this organization process a daunting task in itself. Martin expressed disliking the idea of using a personal calendar he could carry with him because he noticed that it required writing every assignment down and it required too much time. He expressed that he quickly let go of the calendar where he had to constantly look through what was coming up a few days in advance and focus on tasks on a daily basis. He opted to get a white board where he wrote down in the evenings the things he had to do for the next day. The fact that he was in his room most of his time made it easier to use and maintain on task. Jaime was also in favor of the white board method, although he expressed that he did away with it mid to late in the semester since he was spending too much time away his dorm in favor of the library. He opted for simply making a list on his folder. For the female participants, Anita and Karen, the choice of organization tool was a personal calendar they carried to each class and every day.

These three factors that participants expressed as important in their success to navigating a new system, although common for most first year college students, was met with mixed approaches. Although they all had these issues present before they started their first semester, most had already had prior knowledge of how to approach their first

semester from high school experiences. They were told these factors were common to encounter. Most participants had prior knowledge of this from various sources. The most common source of this knowledge of navigating a new system came from a teacher they thought of fondly. For all except Jaime, this was the case. Jaime expressed knowing what to encounter from his older brother who had attended the same school a few years before. He also cited his father as the person that prepared him about what to expect. "My dad always told me that I had to go to college and get a degree and follow in his footsteps, regardless of major. I guess 'cause he knew what to expect, he always tried to tell me about his experiences."

By semester's end during their first year of college, all participants remain in their major, but the two female biology majors begin to consider switching majors, yet are unsure to what. The two male computers science majors each remain in their initial computer science major and start thinking about double majoring in math. It is hard to miss the similarities between the two male computer science majors and two female biology majors and the differences between them. The sub-themes in theme two all connect and evolve from one to the next overall pointing to the navigation of a new system. From factors such as timing, socializers and the disconnect students encounter in the strategies they seek, or don't, to be successful, organization as ways to be successful during this navigation process, and the people that guide them in making decisions about their academics. For theme two: Navigating a New System, the sub-themes all come together to develop a loop in a framework for discussion that will be presented and detailed in the next chapter. Next, I will detail the findings for Theme Three.

THEME THREE: NEVER ENDING DECISIONS

As the data analysis unfolded about the students' experiences as first-year students during their second semester, it appeared that the participants' experiences continued in a similar track of navigating a new system, but with a focus on future goals, how to reach those goals, and the socializers important in making decisions academically. There was familiarity with the expectations of students after experiencing a course load of at least 12 hours. Students learned the geography of the school, made new friendships with their roommates or with peers from classes or from the academic support programs they took part in. starting a new semester became more bearable. The participants received their grades and vowed to maintain their GPA or do something different to improve it. The focus was not on the new system any longer; the focus was on their future, yet still maintaining close connections to those people vital in helping them make decisions that will prove to be important for their future outside of school.

Participants' future goals and how to reach those goals once outside of school were forefront during the second semester of their first year. Students demonstrated knowledge of the benefits of the program they were participating in, or in the case of the student that did not belong to a support program, the urge to belong to a program to gain access to a program that would help her reach her goals. Surprisingly, there was an urgency to be the perfect candidate for their dream job upon graduating. This meant that students had to meet certain requirements in order to do that, requiring knowledge of what those are, fulfilling those requirements during their academic career, and therefore reaching their goal. In order to reach a goal there needs to be some knowledge of what it takes to reach a goal. The source of that prior knowledge is very important in determining how accurate they may be in preparing to reach that ultimate goal, in this case their ideal career goal. What is striking for this group of participants is that all students had a notion

of knowledge about how to prepare for college gained from their high school experiences. Martin mentioned,

> "because of my UIL competition trips to [the city where he now attends college], I was able to ask my high school teacher about questions regarding what it takes to prepare for a life after college. There was always moments when the coach provided stories about getting through college and what to expect."

Karen also mentions that the visit to her current college during her last year in high school, she was able to attend sessions related to the sciences and hear about the expectations of students upon graduating college. "It was great to have already seen the campus and hear about what professors expect from their students. They all talked about how important it was to study and learn the new system that we would encounter our first year." Anita mentioned that her personal experience in high school with her grandmother's struggle with various diseases gave her the opportunity to interact with the doctors and nurses that gave her insight from their personal experiences.

> "When I was like 8 or 9 my grandma lived with us and she was diabetic, so she had poor circulation; and so the doctor would go to the house a lot to cure her feet and everything and I would always help him, like even at a young age, so like the older she got she got Alzheimer's. As I got older, I began to learn, from doctors and nurses, what they had to do while in school."

A close teacher was also instrumental for her to learn about what was important because "she helped me get into the health related classes in high school during my sophomore year and when I took a class with her she made us research our interests and how to do that in college." For Jaime, having his older brother graduate from UT recently gave him a base knowledge about what worked for him throughout the years in various activities that made him a well-rounded candidate. "My brother graduated about 2 years

ago and before coming here he told me about the importance of preparing to be a good candidate by having experience, getting to know people, and professors to be successful." For this participant, first-hand knowledge about how to prepare affords him some important knowledge that not only gives him a sense of confidence and security that is not seen in the other participants. Whereas other students rely on what others tell them about what is required to prepare, Jaime has important knowledge passed down directly from family.

Requirements to reach career goal

Once informed, participants were able to express what those important requirements for reaching their goal of a dream career. Overwhelmingly, all participants made a reference to building a resume which involves hands-on experience in a related field through internships/research, community service, and being involved in co-curricular activities or organizations related to the field they are interested in. Those participants involved with the support programs explained that the whole purpose of applying to the program was to help them build their resume. Martin mentioned "being a scholar gave me a distinction that I was proud of and that I feel being a part of MP would open other doors along the way that would help me fulfill that purpose. To a lower level, being in MP helps me start to build a resume that I know will benefit me years down the road." In the same lines, Jaime mentioned,

> "conducting my own research would be instrumental in building my resume by getting hands-on experience in the field of computer science and getting exposure to other opportunities along the way. Being involved in honors program and planning community service activities would also make my resume more complete later in my career."

Karen mentioned that "being a part of the MP program was important in building my resume. Even though my GPA was low at years end, the fact that I could be a part of this program will be a great start." She speaks of getting involved in organizations that will give her opportunities for community service, another form of help since her options for conducting research would be difficult if she couldn't maintain her GPA. Since Anita was not a part of a program, it left her vying for other opportunities unrelated to research. She focused on two organizations that could help her make connections with professionals that would eventually allow her access to these opportunities in the long run. Meanwhile, "I will focus on doing community service through these organizations whenever possible and hopefully other opportunities arise." Anita goes on to state that the organizations that she was involved with "really didn't let you get to know the professional people they brought to the meetings. They [professionals] only went one time and we never got to see them again. It would be nice if they let us get to know them more." For Anita, the need to find alternate ways to make connections for her persistence is pronounced.

Here the women are left to feel like their options are limited greatly by their low GPA, whereas the men are focused on long-term benefits to building a resume. It is important to note that the women in this study had jobs unrelated to their major in biology; one worked at a cinema and the other at a clothing store. This is in contrast to the men. One male worked on campus in a computer science-related position, and after doing much travel to several computer science conferences in his second year in college to build his experience, lands a full time job in the summer after his second year with a major local computer software company where he is attending college. It is important to note that despite the decreased GPA for this student in his first semester in the second year, the male participant was nonchalant about it and only saw the long term benefit

missing class provided him with. The other male student went on to continue undergraduate research in the Research Program from his second semester in college, where he continued to do so successfully, also collaborating with the professor further. This differences in experiences encountered is telling of the quality of experiences encountered that may or may not be conducive to the persistence of underrepresented students in science-related careers.

This clear notion of some important requirements to build a strong resume was clear for all students, but the GPA became a factor in reaching these requirements in a timely basis. For the two male computer science majors, having GPA's 3.5 and higher afforded them opportunities easily attainable at year's end if they could dedicate the time. For the Latinas, their GPA's fell below a 3.0 after their first year. The pressure of the low GPA gave them urgency in determining if it was at all possible to build a strong resume at the end of their career and whether or not they should remain in their science related major. Next, I will focus on the findings related to the sub-theme networking.

Networking

The importance of growing and expanding the group of people we build connections with also becomes important during their second semester and up to the first semester of their second year. The two male computer science majors agree that the connections with professors are important like they did their first semester, but during this time, they both actively seek out professor office hours, breaking that disconnect of thinking and doing from high school and their first semester of college. The importance of interacting with professors as a way to build a network is more prominent in the two male computer science majors than the two female biology majors.

Martin states, "I made it a point to see professors right after class and in office hours to clear out some questions so they got to know me. I want to have a good

relationship with them in case an opportunity for research or work comes up. I feel more comfortable now approaching them and getting to know them and demonstrating to them that I have a lot to offer." Jaime mentions:

> "I continue to see the same professor for any questions and bounce off ideas related to my personal research. I feel I have already made a good connection with this professor and I even gained access to participating in his lab in the future. I am very happy about that. I think expanding my network outside and to other staff, grad students, and professors will be crucial to find a job related to CS as a student."

For the two female biology majors, networking was not as important as bringing up their GPA and finding a way to do this. Even though they knew it was important to reach out to professors, they did not. Instead, Anita got help from her roommate, who had a science-related major, and continued to study on her own, when not with her boyfriend. Karen also studied on her own, and with her boyfriend in the picture towards the end of the first semester, her commitment to improving her GPA failed.

Socializers-Who matters most in college?

During this second semester (first year) and first semester of their second year, students are strongly divided in their strategies for approaching classes and their future. The notion of the people they interact with to help them along in this time period varies, from adults to peers for some, and none for others.

When speaking with Martin, he mentioned that now that he is comfortable with the system, he relies less on the adults in the program and since he has built a strong relationship with his mentor, he feels most comfortable asking him questions related to his major CS. He was very clear in that he relies less on advisers and feels comfortable approaching his own peer mentor.

> "My mentor is so laid back and cool. He is totally approachable since day one. He has been a great support and a person that I connected with in the program, but also socially as well. I continue meeting up with him even outside of our weekly meetings. For some reason, I feel I connected with him and I go to him for any questions related to my classes since he has already been through it. He has a lot of knowledge."

For Jaime, the focus is on the professor he talked to during his first and second semester. He managed to feel comfortable enough to ask him for help if needed. On the other hand, the two female biology majors relied less on adults and even peers. Anita reached out to her roommate on occasion but stated that she tended to work out her own situations on her own.

The same applies to Karen. The two female participants seem to show a disconnect from the adults that they turned to in their first semester and have focused on doing it on their own. Karen also relies less on professor/advisor and faces struggles on her own; she does contact her advisor to learn about alternate major and later uses web to learn more about it.

There seems to be a semester-to-semester transition in the way that male and the two female biology majors in this group approaches their first and second year of college. Initially they all start out in a level playing field, but the differences become obvious in the second semester of their first year and towards the first semester of their second year. Female participants continue to disconnect in their thoughts and actions when it comes to receiving help. The male participants tend to approach receiving help as a means to an end, building their resume--reaching a long term goal of a dream career.

The whole of Chapter Four, comprised of three major themes, outlines and details an array of data displaying the wide range of the participants' experiences from their last semester in high school through their first year of college. The first theme, entitled To

Apply or Not to Apply, entails the environment in which the students first engage in making decisions related to applying to a university, what major to choose, whether to apply to specific support programs during their first year of college, or not; and discusses in detail the socializers that played a role in these very important decisions.

The second theme, Navigating a New System, explores the participants' experiences related to encountering a new system, the people that were crucial in helping them make decisions during their first semester and strategies to be successful while adjusting to a new environment.

The third theme Never Ending Decisions, explores the participants' experiences related to continue to navigate a new system while receiving support from new people that were crucial in helping them make decisions during their second semester and first semester in their second year.

Taken together, the data described in Chapter Four provided a picture of the decision-making before graduating high school and for almost two years into college. Their efforts, in most cases, were consistent yet divergent in their second semester in college and on toward the first semester in their second year. Having a second-generation college student allowed me to get a fuller picture of Latina(o) students from another perspective. In the next chapter, Chapter Five, I outline the findings and implications as result of this data analysis.

Chapter 5: Discussion

The purposes of this case study were to: 1) determine factors in Latino science students' decisions about the science major they choose, and how they access support resources; and 2) determine the role of socializers in those decisions. I will first present results relevant to the two research questions, then I will present a framework for discussion of the decision-making process based on the results of this study. Despite the fact that I cannot make a gender claim in this study due to the limitations of the participant sample, some results are consistent with gender-related trends identified in research literature and will be included where pertinent within this discussion.

RESEARCH QUESTION ONE: WHAT FACTORS INFLUENCE LATINO SCIENCE STUDENTS WHEN MAKING CAREER-RELATED CHOICES, SPECIFICALLY CHOOSING A SCIENCE MAJOR, AND DECISIONS ABOUT ACCESSING RESOURCES IN SUPPORT OF A SCIENCE CAREER?

Two of the most common findings related to the research question presented above are that 1) students use technology and the Internet to access resources in support of their science major and career, and 2) the participants in this study made decisions that appear to be consistent with gender-related trends in career and major choice previously identified in the research literature.

Technology and Internet use

Considering the data describing the four Latino students' decision-making process presented in Chapter Four, the use of technology and Internet plays an obvious role in decision making related to choosing a science major and accessing resources in support of a science career.

Prior to the application process, the Internet played a role for the two male students in this study as they both noted the influence of playing video games online with their peers in their decisions to go into computer science. Across the four different case studies, the use of technology and Internet was abundantly present during the application process. Not only were the participants recruited via the Internet, but the participants also actively sought out the Internet via technology available to them, including personal home computers (which all participants had at home), smart cell phones, and portable tablets. For example Martin, Karina, and Julio all chose to access the Internet to learn about the Mentoring Program and the resources available to students in that program prior to applying.

This finding is notable for two reasons. First, although this process is closely aligned with technology use generally in this day in age, the influence of the Internet, although not surprising, has not has not been highlighted in previous studies of students' academic decision making. Second, this technology and Internet use is a major player in empowering students to become self-motivated about the decisions they plan to make, creating a sense of agency in making their own decisions. For students that do not have a mentor or role model that has knowledge about going to college and notions about what to expect, they can have access over the Internet to learn about what they can do to be successful. On the other hand, it also limits those students that do not have access to the Internet.

For this group of four Latino students, technology and the Internet were essential and central to their decision making, not only while in high school, but also through the two years of college the participants were followed, as will be highlighted later. Having the technology and Internet access readily available to participants facilitated gathering information as a means to make decisions related to accessing resources in support of a

science career, prior to matriculating in college. This use of technology continued as these students made decisions related to how to persist in their science major during their two years in college. For example, Karen used the Internet to access information about an alternate major while in college.

Trends within picking a major

When considering the decision making of choosing a career/major choice, trends were observed among the four participants in the reasons for choosing a science major, as well as the types of social interactions these students had. These trends are confounded by the fact that I only had two male computer science students and two female biology students in this study. However, tendencies emerge that are consistent with what has been reported previously in the literature.

First of all, for the two female biology major participants, the influence of female teachers was acknowledged as having a major role in their decision to choose a science-related major. Both Anita and Karen stated that a particular high school science teacher influenced in their major choice. This is consistent with the study by Dick and Rallis (1991) who state that females who chose science reported having a more positive influence from teachers. This finding about how teachers influenced the two female biology majors is also supported by an earlier study by Ware and Lee (1988) in which women attending a four-year college reported having been influenced by high school teachers in making plans for college. Furthermore, the finding in regard to who influences females when choosing a science major is supported by Seymour (2006). According to Seymour's study, women differed very sharply from men in that the personal influence of family, high school teachers, and other significant adults, as was the case for one of the female biology students in my study who interacted with community

nurse and doctor professionals, was a much more important factor in their choice of a science major than was the case with the men in her study. Women were about twice as likely as men to have chosen a science, mathematics or engineering major through the active influence of someone significant to them (Seymour, 2006). For this study, the trends observed in the types of interaction with people in high school are consistent with the literature related to who influences students when choosing a science-related major, specifically for women.

When choosing a science-related major, on the other hand, for the two male computer science majors cited their love of playing video games and interacting with other people through technology as a reason they chose a computer science major. Recall, that the two male computer science majors' primary reason for choosing a computer science major was their own high ability in math and computer courses, consistent with previous research that discusses that prior achievement in mathematics is a factor in choosing a science major (see Astin & Astin, 1992; Moreno & Muller, 1999; Simpson, 2001). Also, the two male computer science majors' academic experiences in mathematics (primarily University Interscholastic League (UIL) competition) during high school were crucial (Eamon, 2004). As in these previous studies, concepts of ability and achievement may be reasons the two male computer science majors chose the major they did; their teachers were never acknowledged nor their parents, in contrast with results from Dick and Rallis (1991) that although males chose more science and math majors than females, they credited parents and teachers for this choice.

The socializer influence that the two male computer science majors credit is more of an indirect interaction since it relates to their video game playing via technology and the Internet. Both participants agreed that their use of online video games and the interaction with other people online in the process were also something that interested

them and supported their decision to choose a computer science major. This form of online interaction and experiences through technology with other people is a concept worth looking into as it may help support choosing science-related majors.

Discovering the details of these indirect interactions via the Internet and technology would be interesting to further explore with more participants, and computer science majors of all genders. It is worth mentioning that Martin, as described in Chapter 4, did go on to describe his interactions with peers through online video gaming during college. Recall that he used this Internet medium and a headset to communicate with his peers about almost anything, from academics to personal things. Further delving into these forms of communication and to what extent they may influence the male students to choose a science-related major is also important to explore.

The two female biology majors noted using the Internet to access information to make different decisions about how to persist in their science major more than the two male computer science majors. For example, the two female biology major students researched other options for majors related to science, while two male computer science majors in this study did not indicate that they researched alternative career options once they entered the university. This finding is not addressed in the literature by Eccles and other colleagues since most of their studies occurred before the Internet era. Seymour and Hewitt's (1997) landmark study on why undergraduates leave the sciences also does not make a reference to it for the same reason. What is important is the possible trend of the use of the Internet to access different information. This notion is consistent with literature about accessing the Internet amongst college students. According to Jones, Johnson, Millermaier, and Seoane Perez (2009), scholars have identified differences between the ways in which male and female users spend their time online (see Fortson et al., 2007; Jackson et al., 2001; Odell et al., 2000), specifically, among U.S. college students, gender

remains a significant predictor of types of Internet use. According to Jackson, L.A., Ervin, K.S., Gardner, P.D., and Schmitt, N. (2001a), male and female college students used the Internet equally often, but used it differently (p. 374). In contrast to this study, Jackson et al. (2001a) attribute females' more communicative uses of the Internet to well-established evidence that women are more interpersonally oriented than are men and that men are more information/task oriented than are women (p. 368). Fortson, B.L., Scotti, J.R., Chen, Y., Malone, J., and Del Ben, K. (2007) point to a trend in the literature they examine: In broad terms, male college students are more likely to use the Internet as a source of entertainment. Based on a sample of 843 students from eight colleges and universities (p. 856) in the U.S., Odell et al. (2000) found that male college students were more likely than females to play games (43.6% vs. 26.6%). This research speaks to the notion of technology and Internet use by these four participants, specifically for the two male computer science majors' use of technology and the Internet for video game purposes as they make career choices in college. The details in this trend in the use of technology will be addressed further at the end of this chapter.

RESEARCH QUESTION TWO: WHAT ROLE DO SOCIALIZERS PLAY IN LATINO SCIENCE STUDENTS DECISIONS' ABOUT THOSE CHOICES?

Who Matters in the High School Setting

Socializers played two roles in these students' decisions before they entered college. First, they acted as an influence in the decision to choose a science major, and second, they provided validation in the ancillary decision-making process, as opposed to providing a direct influence on the student when choosing to apply to a resource (MP) in support of their science career.

In the first role, the people most important to two of the case study participants influenced their decisions in regards to choosing a major in science. The important people or socializers that possibly influenced the decision to choose a science major for the female biology majors included teachers and community professionals; for the two male computer science majors, it was the peers via the use of technology and the Internet as described in the previous chapter. Socializers are also addressed by Eccles as impacting students' decision making when it comes to choosing a STEM major (Eccles et al, 1986), as well as Dick and Rallis (1991), and more recently by Seymour (2006). These results are consistent with the possible trend observed in this study, although looking further at this trend amongst female computer science students and male biology students is imperative before drawing any gender conclusions.

In the second role, as validator, the socializers are reached out to by participants only after a decision has already been made by the student in regards to applying to a support program (MP). This happens during high school. Rather than relying on other socializers or people for input before a decision is made, it seems students are making their own decisions and validating their decisions with others who act as a 'socializer filter', a term coined for use in a framework for discussion presented later in the chapter. The socializers are there as a second opinion of sorts. Also, there is a possible broader sense of the socializers as validators for the students in this study. The focus is primarily on the parents, but others, such as, close teachers, counselors, and peers were mentioned by one student. This trend is consistent with the model by Eccles et al. which supports the role of socializers such as parents, teachers, counselors, and peers as the primary socializers that influence choice making for students when it comes to academic majors and/or career options and in career decisions (1983).

Who matters in the University Environment

Based on this study's results, the socializers that play a part in the decision-making of students majoring in science changes upon matriculating in college. Based on the detailed case study interviews for the four participants over the course of two years, there is a sequence of choices students must make to persist in their major or science career. In that series of choices, socializers are present consciously or subconsciously and are influencing decision making on an ongoing basis. An important trend in the data of the four participants seems to show that parents no longer have a role in decisions made in college for these particular students. It is important to note that the longitudinal nature of this study allowed me to demonstrate that not only are socializers present in decisions beyond the initial choice of choosing a major in high school, but that new socializers take part in continued decision making related to the persistence of participants in their science major or career. Upon transitioning to college, the socializers present in the lives of these students during high school are no longer present due to a physical distance resulting from the move to a university. While in this new physical environment, new peers and personal relationships, professors, program staff and advisors are encountered.

In those encounters with socializers such as program staff and significant partners in personal relationships, experiences arise which allow (and sometimes prompt) students to make a decision about how and whether or not to persist in their major. For example, as noted in Chapter 4, the two female biology students reported that social obligations prevented them from attending professor office hours and study sessions. They focused on their personal relationships, rather than on the professors and teacher assistants that could help them do well in their course. Furthermore, when a biology student visited with the MP staff advisor, she was prompted to consider a new major, which she took upon

herself to further investigate via help from the web to make a decision about taking an alternate major.

This is consistent with Seymour (1999), a study in which she addresses her landmark study with Hewitt (1997) and the section titled "It's OK to leave," when discussing reasons for switching science majors to a non-science major. According to her work, women in her study who discussed the possibility of switching with their families reported an easier release than male peers from family pressures to continue in or complete the major. Families expected sons to finish what they had begun and to persevere for the sake of their future family responsibilities: they were more concerned that daughters "were happy" in what they chose to do. According to Seymour (1999), women, whether they persisted or switched, described more freedom than male peers to choose or to switch from a career path on the basis of personal satisfaction or intrinsic interest alone. The finding from my study that new socializers take part in continuing decisions in college could inform considerations of who influences decision making and how those socializers can provide a positive experience that will help students persist in their science major or those that may not help in the persistence in their choice of science major.

Interactions with peers in college also influence the type of experiences students are having. In particular, recall that Karen, the biology major, had a negative experience with her peer mentor in the Mentoring Program that made her feel upset by feeling constantly compared with males with similar majors and feeling lonely for being the only Latina, as well as undermined by other peers in her lab class when her work was turned down in preference for a male group partner's work. These experiences, for this participant, speak to Seymour's findings in previous work (Seymour & Hewitt, 1997; Seymour, 1995) about the daily irritations faced by undergraduate women from the rude

and inappropriate behavior of male peers in some introductory science and mathematics classes and labs. According to Seymour, these too spring from socialization and there is a concern with undergraduate women's psychological and behavioral responses to the linked problems of belonging and identity that were exacerbated for them by male peer hostility (Seymour, 2006). Furthermore, other studies on minority students have reported on the critical role that mentors play in their adjustment to college (Freeman, 1999), and progress toward graduate studies and a career (Lee, 1999). For Karen, the role of the mentor in her case did not produce the type of experience that promotes adjusting into college or helps her progress toward a science career or graduate studies.

It is important to note that there is also a possible trend amongst the four participants in which students reacted differently to negative events. For example, getting C's and D's on tests led the two biology majors to think about dropping the class or even switching majors. The two male computer science majors, on the other hand, were not concerned about getting C's or D's since they were benefitting from attending conferences and getting a full-time job related to their major. The possible difference in resiliency demonstrated by the participants is consistent with psychology research on the resilience of students. According to Bandura, Barbaranelli, Caprara, and C. Pastorelli, 2001, p. 187), "Perceived self-efficacy occupies a central role in the causal structure of social cognitive theory because efficacy beliefs affect adaptation and change not only in their own right, but through their impact on other determinants. Such beliefs influence aspirations and strength of commitments to them, the quality of analytic and strategic thinking, level of motivation and perseverance in the face of difficulties and setbacks, resilience to adversity, causal attributions for successes and failures, and vulnerability to stress and depression."

Bandura et al (2001) further state that there are several paths through which personal efficacy beliefs affect the career choice process. One in particular is resilience to daunting tasks, as is the case in this study. The two female biology majors' reacted by considering leaving their science major when they were close to failing a class, and the two male computer science majors were not affected by C's and D's in their classes and continued to thrive in their academic career. This thriving is especially seen in the second-generation male participant, Jaime. He demonstrates a greater self-perception of success by participating in research and in the mentoring program. This supports what previous literature on the effects that undergraduate research experiences have among racial/ethnic groups. The effects of undergraduate research experiences tended to be strongest among Hispanics/Latinos and weakest among non-Hispanic whites (see Seymour, Hunter, Laursen, and Deantoni, 2004); as is the case for this male student in this study.

Furthermore, this possible notion of resiliency is highlighted by work from Dweck (2007). Dweck has worked to discover what lies beneath females' greater sensitivity to setbacks and has pinpointed a psychological basis for the vulnerability, as well as shown that interventions that address this factor shrink the gender difference in math performance. Dweck's previous work found that viewing intellectual ability as a gift (a fixed entity) led students to question that ability and lose motivation when they encountered setbacks. In contrast, viewing intellectual ability as a quality that could be developed led them to seek active and effective remedies in the face of difficulty (Dweck, 1999). In a study by Blackwell, Trzesniewski, and Dweck (2007), the authors found that as students moved into high school, the math gender gap was reduced for those girls who viewed their intellectual ability as expanding than those girls who believed that their intelligence was a gift. Furthermore, Grant and Dweck (2003) found similar results in

those students across their first semester of their premed chemistry course at Columbia University. For those students who thought of their intellectual skills as something they could develop, the gender difference was reversed. The female students earned the higher final grades. It would be important to further look at the students' perception of their intellectual ability as either being a gift or one that can be expanded to further explore this possible resiliency trend in this study.

Identifying possible trends related to technology use, to the types of experiences, and the intentions and actions taken to improve academics, was only possible due to the longitudinal nature of this study. These trends highlight nuances in the decision making process while in college that are consistent with the literature as noted and allow for the development of a framework for discussion of academic and career choice presented next.

PROPOSED FRAMEWORK FOR DECISION MAKING

Based on the findings in the previous chapter and the current discussion, I will present a framework for discussion that will represent the decision making of the participants of this case study, specifically, a schematic that more adequately details the data of undergraduate Latino science students' decision-making over the course of choosing a science major or career (while in high school), choosing to access academic support programs in support of their science-related career (while in high school), and making other decisions that will help in the persistence of their major or science career (while in college).

The Eccles et al. (1983) expectancy-value model of achievement-related choices (see Figure 3.1) was comprehensive and based on empirical evidence. Grounded in social psychology, Eccles et al (1983) model incorporates social, cultural and psychological aspects that have been shown to affect young people's motivational behavior. Important

components of the model are the expectations and values of individuals concerning their choices about participating in an activity. Eccles and her colleagues have developed and tested this model over the course of many years and in many studies (see Eccles, 2009; Eccles et al., 1983; Eccles, Barber, & Jozefowicz, 1999; Meece, Wigfield, & Eccles, 1990; Nagy et al., 2008).

Certain concepts in this model helped guide this study and will be discussed further when the framework for discussion for the participants in this study is further detailed (see Figure 5.1 below). In particular, previous achievement related experiences during their lifetime up to high school; the students' aptitude in math and science; and socializers or the people that influence in their decision-making when choosing a science-related major prior to college. When in the university environment, the concepts important from Eccles et al (1983) study include the students' self-schemata or their own goals, idea of self, and perceptions of task demands; their expectations for success in a particular situation; subjective task value or the value they give to a certain opportunity when balancing the cost; and the students' affective memories or their memories of their feelings in certain experiences.

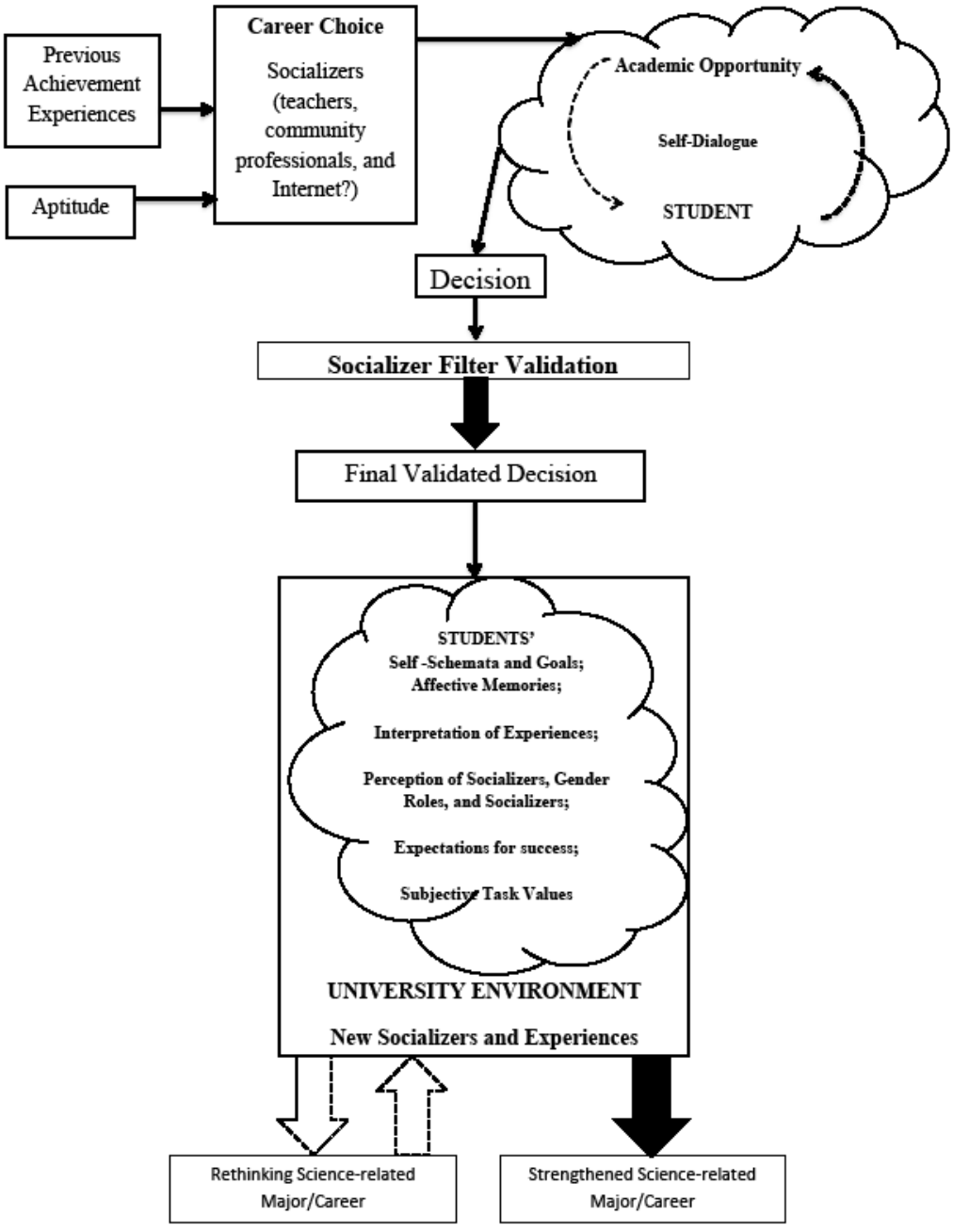

Figure 5.1 Undergraduate Latino Science Students' Decision-making.

The four important parts of my framework for discussion include: (1) the use of technology and the Internet in making decisions about applying to support programs in the new construct web environment; (2) the socializers' role in decision making in the new construct of socializers acting as a filter; (3) the University environment, which is still embedded within the web environment, where new socializers and experiences act on students and in which there is a focus on the students' self-schema ; and (4) alternate paths that students follow, where the focus is either on the present or on the future major/career. These points will be discussed next. I will describe each of the four parts of the proposed decision-making framework for Latino science student in detail.

Web Environment

This web environment involves the non-personal, non-interactive connections each individual student relies on upon in making a decision for, or against, an academic opportunity presented; in particular, the mentoring or research academic program outreach via email that the student received during the last semester in high school. Two important constructs from Eccles et al. (1983) model that feed into this web environment include the previous achievement-related experiences of each individual, as well as the differential aptitude of student. These play a role in the individual decision because it is those previous experiences and the students' own personal aptitude that affords the students the academic opportunities presented to them. In this study participants have above-average ability in high school and are in the top 10% of their high school graduating classes. They have experienced AP classes in math and science during high school before they attend college. What is important about these constructs, presented by Eccles, and feeding into the web environment in my model, is that these two constructs

allow the students access to support resources to be successful in college that they would not otherwise have access to. At the same time, these constructs do not seem to carry much value to the students beyond high school. Not one participant references their previous experiences or their own aptitude for science as crucial for continued decision-making. For this purpose, these two constructs seem to serve as a means to an end of getting initial access to academic opportunities.

Another component illustrated in the framework above is the influences involved in the decision to choose a science major. As noted, the participants have already made a decision to choose a science related major prior to this study. The primary choice demonstrates another of Eccles' concepts, socializers, which has been shown to influence in the decision related to choosing a science-related career. For this study, the socializers observed were teachers, community professionals, and possibly the peers via technology and Internet as indirectly socializing participants.

Furthermore, it is the web cultural environment where future potential academic opportunities are encountered by the individuals in the study. The web is not necessarily the only way to encounter opportunities; there are other ways such as via mail or through word of mouth, although to a much lesser degree. The academic support opportunity is any opportunity related to their education that an individual is presented with that provides additional support in their academic career. These opportunities are presented to students in this study via the web environment in the form of an email. It is in this web environment that each individual uses the Internet to access information to help them determine the value and cost this academic support opportunity has for them; as is the case with the Mentoring Program (MP). There is a back and forth self-dialogue that occurs within the individual to weigh the values and cost of the academic support

opportunity presented to them before high school graduation, to help them through college. It is through this web environment that the individual "interacts" with the Internet to learn about what the opportunity has to offer and, at the same time, weighs the cost and value of it based on the needs of that individual student. For example, in Martin's self-dialogue when accessing information regarding MP, he clearly asks himself why he should be in the program, and when realizing that he can benefit by having his classes secured and the option of becoming a mentor himself, he demonstrates this notion of interacting with the Internet. Furthermore, he also sees the minimal cost of attending weekly mentoring sessions; enough to make the decision to apply to the Mentoring Program. This process occurs via the use of the web environment in which it is solely the student investigating the information needed to proceed; will they apply to this opportunity presented to them? This notion of deciding on the value of the opportunity is closely related to the concept in Eccles et al model (1983), which is described as the subjective task value or the enjoyment one gets from engaging in the task or activity. This includes the utility value (the instrumental value of the task or activity for helping to fulfill another short- or long-range goal), attainment value (the link between the task and one's sense of self and identity), and cost (defined in terms of either what may be given up by making a specific choice or the negative experiences associated with a particular choice). The web informs the students about each one of these important elements within this subjective task value concept when they are directed to the program web page.

When the student first encounters the web page, skims the pages, sees the images, the bulleted items that stand out allow the participant to make in-the-moment decisions about these constructs related to cost and value. For example, a student from the study, upon encountering the program web page saw that the program staff is composed of

several women with doctoral degrees, a couple of which look like her. The utility value of having female support resembling her would increase the value; the small classroom size would increase its utility value more, while the investment of weekly meeting time with a mentor group of peers could attach a relative cost. The combination of science-related images and opportunities of financial scholarships would increase the attainment value. The enjoyment value could increase with the opportunity of becoming a certified mentor that would interact with incoming freshman socially and academically. Together, the right balance of these constructs for the students' needs would help make a decision about application to this program.

It is important to note that key decisions in this study, related to choosing to apply to an academic opportunity via email outreach and also looking at the decision to stay in the science major, took place in a web environment. In the web environment, these students interacted with the email from the support program and the web page describing the program in the way that earlier students might have interacted with parents, teachers or counselors to receive announcements and obtain further information. In this web environment, self-dialogue takes place within the student based on the information the student seeks out via the web regarding the academic opportunity presented.

These constructs, those revisited from Eccles' model and the new ones presented, were discussed to give a clearer picture in the first step of making a decision about an academic support program that occur in the web environment. As noted earlier, the previous experiences of these students and their own aptitude afford these students' academic opportunities through a web environment via the Internet. It is through this "interaction" with the web that students create self-dialogue to determine the subjective – task value of the opportunity presented to them and makes a decision to apply to the

program. Upon making this decision to apply, in the proposed framework, the student validates that decision by approaching socializers.

It is important to keep in mind that Eccles' model implies the socialization that goes on with the parents, teachers, and/or peers happens in support of science-related career choice that would take place prior to the actual decision made. The results of these four case studies, on the other hand, suggest that the socialization that has occurred up to this point on the part of the parents, teachers, and/or peers is not necessarily considered in the first part of the ancillary decision making taking place via the web environment, although these socializers were present prior to this decisions when these students were looking to apply to a university and choosing a major. Although each individual has had some level of socialization through personal contacts, Eccles' model describes, this new framework for discussion contributes the idea that the Latino science students have access to a web environment that has an abundance of information readily available to them via technology devices such as smart phones, home computers, and portable tablets. These devices more readily invite the students to seek out the web in a very individualized way in which, I suggest, students make their own decisions, with agency, about the opportunity presented to them. Only then do the students seem to validate that decision with the socializers acting as a filter, which I will explain next.

Socializers Filter

This next part of the model takes place after the student has already made the decision to apply to the academic opportunity presented, i.e., student has decided to apply to the program. An important possible trend identified in this study is this notion of the socializers as a validator filter of the choice to apply to the academic support program (MP). The socializers, such as parents, teachers and/or counselors, and/or peers, most

often discussed by the students as having had a role in their lives now become validators as the students make ancillary decisions or more detailed decisions about accessing resources. In my proposed framework, it is upon making a decision that each individual relays their decision to the closest people around them that, as in the Eccles model, are parents, teachers, and peers. Rather than ask socializers about what decision to make, the students seem to look to these socializers for validation of the choice they already made themselves. It is in this step where we see interaction with people, unlike in the web environment in which students do not get feedback about the decision they have taken. All participants express this notion of making a choice to apply on their own, and then relaying that information to socializers for validation. Eccles' concept of expectation of success plays an important role in this part; both expectations from socializers and those of the students. It is important to note that this filtering produces a strengthened decision to apply as noted by the darkened arrow leading towards the final decision to apply to the academic opportunity.

When considering the question about how undergraduate Latino science students make decisions about accessing academic support programs, we can see the framework for discussion so far presented as a way to describe that decision making, as well as the socializers involved in validating that decision. This process, like Eccles' model, incorporates a singular role for socializers in that decision. Beyond that initial decision, however, this study followed four students longitudinally over two years, which allowed me to further delve into the decisions these students were faced with after the initial choice of applying to an academic support program in mentoring or research.

The third part of the model, which I call the university environment, will serve to address this notion of making decisions about persistence beyond a single decision to enroll, which will be detailed next.

The University Environment

This third part of the framework for discussion, the University Environment, is meant to describe the Latino students' decision-making over the course of two years in college. The important components within this third part address how decisions about persistence are made when it comes to (1) accessing new socializers and (2) the use of technology within a web environment. This part of the model adds to the many studies addressing the need to look at decision making beyond a single choice, and as a series of complex choices over time. Some authors (see Cleaves, 2005; Holmegaard, Ulriksen, & Madsen, 2010; Vaughan, 2005) address this notion of making complex choices and the complexity of these over time. According to Boe, Henriksen, Lyons & Schreiner (2011) there is value in this type of research that concerns young people's expectations of success and subjective values at one point with qualitative in-depth and longitudinal studies, such as this one, to assess how expectations and subjective task values develop and affect choices over time.

Seymour and Hewitt's (1997) landmark study on choices about leaving the sciences supports the need to research decisions over time since they consider the decision to enter science not a final one. They too see the value of looking at choice making over time and how the performance at one time affects later choices through the personal experiences it leads to. The individual is faced with the ongoing need to make decisions related to their persistence in their major, for example decisions about what

classes to take or drop, and over the course of their academic career and a lifetime of decisions thereafter.

This third part of the model is new, yet contains some constructs of Eccles' model as described next. An important aspect of this complex, university environment is that it is a physical environment; the university. In this physical environment, new constructs such as new socializers and new experiences are important, along with the revisiting of the web environment and the incorporation of Eccles' constructs of the students' self-schemata (relates to the student's own idea of self) and self-goals; affective memories or feelings had due to experiences that help solidify or rethink certain decisions; the students' interpretation of new experiences; their perceptions of new socializers, the gender roles they may play, and the new socializers; their expectations of success; and subjective task values. All of these concepts from the Eccles et al. model (1983) are relevant especially in this university environment when students encounter new decisions, experiences, and people.

Based on the possible trends observed within this university environment, which is enveloped by the web environment, it is important to discuss the final piece of the framework for discussion related to the possible different perspectives students in this study take in relation to the people they interact with and the experiences they have.

Present and Future Outcomes

Considering the above-mentioned complexity of the many new experiences within the university environment, with new socializers and access to technology and the Internet, informs this fourth piece of the framework, in which students in this study take one of two perspectives, 1) a focus on the present and negotiating the immediate school environment, or 2) a focus on the future career they have chosen. All participants had

many new experiences, and the quality of the experiences in some cases propelled them to revisit their initial choice of choosing a science major. In these cases, the experiences had by students focused them on the present, and deciding whether to persist in their major, while in other cases the students' focus remained on the career they chose initially. For example, the two female biology majors were focused on a pressing decision to pass a course to persist in their major (present). The two male computers science majors were unaffected by getting low grades in their classes and focused on the benefits of doing research and attending conferences to help their future career upon graduation (future). This relates to the literature previously mentioned on resiliency by Bandura. Furthermore, the experiences had by the two male computer science majors in this study demonstrate a strengthening of their persistence while in the university environment indicated by the bolded arrow that strengthens an original decision to choose a science-related major/career. The schematic shows a straight path towards this future career in that case.

In the other cases, the focus is on the present moment the students are living since there is a revisiting of their original choice of major, in which case another dashed arrow indicates a returning to rethink that initial decision with the help of new socializers in the university environment, e.g., advisors for the female biology students when they needed to drop a course or look into an alternate major. Their focus was on the present and not on how to strengthen their initial choice of major in the long run. Interestingly, according to an integrative commentary (abstract) by Valla and Ceci (2014), "Having one dominant aptitude (e.g., for mathematics) increases the likelihood of a strong self-concept in that domain and decreases the likelihood of equivocation about career choices in comparison with individuals with equivalent mathematical aptitude who have comparable strength in non-math areas" (p. 219). They also add that "males are more likely than females to have

an asymmetrical cognitive profile of higher aptitude in math relative to verbal domains." The authors state that, "together, these two points suggest that the academic and career pursuits of high math ability males may be attributable to their narrower options among STEM fields, whereas females' more symmetrical cognitive profile means their math and verbal interests compete in the formation of their ability self-concept and, hence, in their broader career choices" (p. 219). For the four participants in this study, the fact that the two female biology students were focused on strengthening their initial choice of major may very well be for their asymmetry in interest and aptitudes. The males went on to strengthen their major choice in a long-term route.

Although I cannot make a gender-related claim, due to the limitations of my sample, the trends may be consistent with literature about the quality of the college learning experiences. Seymour and Hewitt's (1997) study on why undergraduate students leave the sciences supports the notion that "the most effective way to improve retention among women and students of color, and to build their numbers over the longer-term, is to improve the quality of the learning experiences for all students –including those non-science majors who wish to study science and mathematics as part of their overall education" (p.394).

In contrast, Seymour (1995) acknowledges that it is reasonable, according to Baker (1990) to expect that girls' precollege experiences in science and mathematics will have consequences for their subsequent experiences as undergraduate or graduate women, the opposite of what I found in this study. The pre-college experiences did not seem to have a continued effect for the women in this study. Furthermore, as stated in Chapter Four, one of the female biology majors experienced sexist comments from her peer mentor making her question her ability in the science lab, while the other female

participant experienced feeling shamed for "asking a dumb question" to another peer, thus making her less likely to ask questions regarding science concepts. These two students encountered new experiences with new socializers, in these cases, peers. These negative experiences along with the fear of failing their pre-calculus class and their chemistry class made them question if they were doing the right thing by having chosen a science major. In their account, the participants demonstrate what is indicated in Figure 5.1 by the dashed arrows leading away from and returning toward the university environment as a weighing of their self-goals and expectations of success, while developing affective memories in those negative new experiences.

If their goals had changed, based on any reason, against staying in their major in science, the participants would have had the option of leaving, but because all participants continued in their original major selected when they started college, I cannot say what a next step could be upon leaving their science major. In the case of one female student in the end of her first semester of her second year in college, referenced in Chapter 4, the participant turned to a new socializer, her previous professor who was on the staff of the mentoring program. This particular instructor, who also shared her ethnic background, made her feel safe to discuss her concerns about dropping a class. This role of program staff and professors that resemble the ethnicity of students in science majors in helping in the persistence of students in their major is described by Seymour and Hewitt (1997). The participant then turned to using the web to learn more about pursuing a physician's assistant degree and enrolled for a class in such a degree to try it out before deciding to switch. In this case, the quality of the learning experience this student has in the class will greatly influence her decision to remain as a biology student or switch to another degree.

For the other female biology student, the only option was to reach out to the professor of the class that she was contemplating dropping since she was not accepted into the support program that she applied to. For all of the participants, parents were never contacted regarding any decision related to their academics, especially not by the two female biology majors. Avoiding disappointing their parents was a major reason for not reaching out to them for advice, aside from the fact that they knew their parents would not know how to help them since the female students' parents had not attended college. They also did not reach out to high school teachers or peers.

Only one male, the second-generation college student Jaime recalled that his father and brother where readily available if he had a question regarding academics. For the two male computer science majors in this study, encounters with the socializers, e.g., their class professors, were more frequent and for different reasons. The two male computer science majors visited their professors not because they were concerned about failing the class (despite the fact that they too performed poorly in some cases) or had second thoughts about choosing a science major, but because they saw it as an opportunity to get to know the professor and create a network of people that they could reach out to in the future when they needed to ask for a recommendation letter or find a research opportunity to build experience. So, in that sense, these new experiences are affecting the male students also but just solidifying their decisions and helping them with the next ones after college.

The new experiences encountered by the students in this study allowed me to see how the difference in the quality of experiences pushes them to revisit or strengthen their initial major choice, demonstrated by the broken arrow leading away from and returning to the University Environment in Figure 5.1. There is a cycling of sorts for the two

female biology majors that sends them to revisit the initial choice of major. The new socializers they encounter range from peers to professors, who can also serve as program staff advisors. For the participants in this study, except for a male computer science major, all refrained from reaching out to parents, high school teachers and peers. The trends observed do not stop there. They get more complex with the notion of technology access.

The trend observed related to socializers is closely connected to technology use in this part of the framework. It is because of lived experiences with new socializers, such as peers and professors as just discussed, that participants, particularly the two female biology majors, found themselves turning towards the web environment once again to get further information about what options they had in regards to their negative situation. For example, one of the female participants found that the staff advisor suggested different biology routes. In particular she considered turning to taking a physician's assistant route, or pre-physician assistant major. Upon accessing the Internet for further information, she first looked to find an organization that was related to that new major to learn more about it. Upon attending a meeting, she further turned to the web to find more details about what to expect in the physician assistant career field. She took a step further to discuss with the same program staff advisor the possibility of trying out a science-related course in that degree plan to see if she enjoyed it. This complex sequence of decisions all involved revisiting the initial choice of choosing a science major and using technology to access the web environment to help her make a decision.

This particular scenario demonstrates the complex sequence of decisions constantly in the female biology majors' minds in regard to the initial major choice. The female biology students in this study both searched the web as a way to find answers to

their questions upon speaking with a socializer about a situation. In contrast, the two male computer science majors reached out to the web to find opportunities related to their major to reach their goal of building a resume for when they were ready to graduate and find a career in their major. Male participants just never did revisit the initial decision to choose a science major. In fact, one male was never hesitant about choosing a science major and was confident despite, at times, getting C's and D's in his classes. The justification was that he was actively traveling to conferences related to his field and looking for a job related to his major. His success in building a resume and finding a job related to his major reassured him that his lack of attention in class was the right thing to do if he wanted to reach his other goals. For the two male computer science majors, the web access was not related to negative experiences or to finding new routes away from their original science major. For the male students in this study, the web was not used to revisit their initial choice of major.

Another important trend seems to be the relationship commitments of the two female biology students. The two female biology majors in the study were the only ones involved in personal relationships. Both male computer science majors were not involved in any personal relationships and were happy to keep it that way. The boyfriends, as socializers, influenced the opportunity to take advantage of office hours and study sessions. Recall, Anita made the choice to visit with her boyfriend instead of attend her scheduled office hour appointment. As mentioned in the previous chapter, the two female biology majors recognized that, as much as they tried to visit with the boyfriend and also attend to school and homework, they were easily distracted and failed to get their work done adequately. Choosing to have a sentimental relationship is an important choice as it relates to accessing resources because their time was limited by it. By rushing out of class

to meet with their boyfriends, they missed out on several academic resources that could have benefited them positively, such as office hours and study sessions and other kinds of resources available through the mentoring or research programs. A previous study that found that women are more likely to attend to personal relationships is that of Cole and Zuckerman (1987) in which they found that "women, far more than men, bear the burdens of marriage and child care and that this fact of social life best accounts for gender differences in scientific publications. Whether or not this is true, the belief that it is so affects women's career opportunities, their decisions, and the way they are actually treated, p.157." On the other hand, in a study by Cech, Rubineau, and Silbey and Seronfound in which they examine behavioral and intentional persistence among students who enter an engineering major in college using original panel data found that men and women find raising a family and developing a long-term intimate relationship equally important (2011). According to Cech et al., these similarities speak to the importance of considering women's and men's experiences as they try to reconcile their professional and personal goals (2011). These sections within the third part of the proposed framework relate to the trends observed and elucidate the need for possible future research that addresses this notion more thoroughly.

In summary, there are four important parts of the framework for discussion for Latino science student decision making: (1) web environment; (2) socializers' filter; and (3) the university environment, and the (4) the focus on present challenges or future outcomes as influenced by (1) interactions with new socializers and (2) the use of technology while in a university environment enveloped by a web environment.

An important aspect of the university environment enveloped by the web is that new socializers have a greater role than in the earlier filter step. This is important to note

because students all failed to seek parental support on what decision to make. All but one male computer science student, Jaime, turned to people with experience in how to navigate the new territory encountered and the possible change in direction from a science major.

The quality of these students' experiences in this university environment is very important in determining the reasons for reaching out to new socializers and also for using the web. When it relates to persisting in a science major, the two female biology majors encountered more negative new experiences in college that potentially can divert them from science majors or, at the very least, switch them to another science major, and reached out to socializers about possible alternatives. The two male computer science students reached out to socializers to secure opportunities that would support their long-term careers.

This observation is consistent with the broad body of research that speaks of gender equity issues in STEM fields. Decisions such as wondering whether they would pass a course, whether they should study or spend time with their boyfriend, or whether they should explore a different career aspect of their science major all made the female biology students in this study question what step to take next. This cyclical process, illustrated in Figure 5.1 by bi-directional dashed arrows, consists of constantly debating working towards persistence, vs. leaving their major, and applies to choices about what to do when failing a class, who to go to for help, what steps to take next in their class, their major, their future career, and in life.

This framework is intended to help describe the process by which the Latino science students in this study make decisions about how they access academic resources over time. Each of the four parts contains important constructs of Eccles' model of

achievement-related choices, and also incorporates new constructs based on the data from this dissertation study. Thus, drawing from these findings, this study yielded a schematic of Latino science students' academic decision making. The importance of the web in initial decisions has digital equity implications, and indicates the importance of Internet outreach. Further, differences in the decision process imply a need for personalized support structures. These implications will be discussed next in Chapter Six.

Chapter 6: Implications, Conclusion, and Limitations

IMPLICATIONS

Based on the framework for discussion about undergraduate Latino science students' decision making presented in Chapter five, implications are presented related to (1) further research and researchers, and to 2) program directors/designers, these implications will be discussed next.

Implications for Further Research

Prior models present the notion of decision making as related to a singular choice. The iterative notion of making decisions related to science persistence identified in this study is important to continue to address with further research. An important implication for further research is to not assume that science students only need to decide once to choose a major and that then nothing follows. In a revised model of achievement-related choices (see Figure 1 in Eccles (2011), Eccles explicitly indicates this iterative characteristic of decision making. Future research should look at longitudinal decision making to further explore the process of making decisions that are connected to prior decision related to science majors and careers. Exploring the framework proposed in Chapter 5 with further longitudinal research on Latino students could potentially refine the model and uncover nuances limited by the scope of this study, providing new areas of research.

Furthermore, it would be interesting to explore further if there truly is a role for technology and the Internet as a vehicle for peer socialization as it related to choosing a science major for the two male computer science majors. It would also be fitting to look at what drives students to turn to socializers only as validators and why they do not approach socializers before making a decision, if that result from this study is confirmed

in further research. Is it simply that the students in this study did not feel their teachers and parents, with limited college experience, could inform their decisions? Or is this a trend among students raised with the Internet regardless of their socializers? For example, understanding the "self-dialogue" that occurred between the student and the Internet as they explored an opportunity presented to them might heighten our understanding of students' decision making and the process of mentoring.

In a recent critical review of the literature about mentoring college students between 1990 and 2007, Crisp and Cruz (2009) also support the need for researchers to add to their theoretical understanding by unpacking the ways in which mentoring is personally experienced and constructed by students (see Wallace et al. 2000) including students with different perspectives and backgrounds such as African American, Latino, and international students. They too suggest that mentoring theory should be expanded to include the underpinnings of critical race and feminist theories in an effort to better understand how women or minorities may perceive and experience mentoring differently than men (Wallace et al. 2000).

Finally, the possible gender differences in how students make decisions based on positive or negative experiences merits further investigation to explore details of these experiences more closely.

Implications for Program Design

For implications related to recruitment and support programs, it is important to address recommendations for 1) high school program directors/designers, and for 2) the university setting.

High School

In the high school setting, I would like to focus on digital equity and the implications it may bring for high school programming directors or designers. Based on the results of this study, providing all students access to the Internet and technology could be important to provide an equal opportunity for students to receive recruitment and academic support opportunities more readily for college. For example, programs that provide all high school students this digital access can be in the form of a class in their junior or senior year in high school that would allow them to explore college opportunities by researching the universities they are interested in applying to, determining the requirements for acceptance into the university, considering what major to choose, and finding academic resources useful for their persistence in college, as well as how to apply to them.

University

One implication suggested for program directors and designers is to reinforce elements in a program that will promote the success of all students in science-related majors. A suggestion would be to include opportunities for conversations or dialogue about science expectations directly from professionals by creating a long-term commitment between the student and professional to learn about a science career, as opposed to a single meeting with professionals, as noted by Anita when discussing her singular experiences with professionals in a student organization related to her major at Research University. This would commit the participants to connect with a professional, a new socializer, with experience in the science field and create a network of people, which was perceived by the two male computer science students in this study as important to their success.

Another suggestion for program directors and designers would be to allow the participants of mentoring programs to play an active science mentoring role for younger students in middle school or high school, or earlier years in college. This opportunity would provide them with a potentially positive experience in which they could succeed and feel confident about their efforts. Recall that one of the male students in this study was excited about an opportunity to become a mentor for the Mentor Program (MP), in which he would be prepared for future mentoring of a first year student in the same major. Also, providing these opportunities beyond the first year would be ideal and this tier-placement of support elements within and beyond the first year in college may provide students, particularly women, with several opportunities to anchor their confidence in their science major with hands-on experiences, rather than only playing a passive mentee or student role.

This study also supports further examining of the quality of experiences lived by undergraduate science students while in mentoring programs. The support should go beyond just mentoring and include support for science-related experiences that will confirm students in their science major through graduation. The quality of experiences encountered by the two male computer science majors in this present study suggests that there is a need to provide all science majors access to similar opportunities. For example, as reported in Chapter 4, the two male computer science majors were involved in science-related research through Mentor Program (MP) or via the jobs they had. They were also exposed to science-related conferences in support of their major. Combined, these experiences were beneficial to the male students and allowed them to focus on their future science-related career. Future programming could include some of these types of experiences in support of all students, particularly female students, so that they take part

in meaningful experiences that will support them as they move through their academic career. This could mean that mentoring programs should try to provide all students, regardless of GPA, a science research experience that will provide those students an equal opportunity to gain valuable experience that will help them solidify their confidence in science. Further work is needed on how this resource-intensive proposition for mentoring programs could be accomplished.

CONCLUSION

In conclusion, this study focused on how undergraduate Latino science students make decisions about accessing academic support programs, and second, the role of socializers in the students' decision making, including the socializers that play a role as they continue on to their first and second year in college. Although this study focused on individuals at one university, it shed light on decision making over the course of two years in college and the ongoing decisions related to persistence in science fields. This study presented emergent data from the three themes summarized as follows in relation to the two research question. Data from the first theme To Apply or Not to Apply, indicated the environment in which the students first engaged in making decisions related to applying to a university and whether to apply to specific support programs during their first year of college, and reveals in detail the socializers that played a role in these very important decisions. Furthermore, the experiences leading up to the point at which students are required to make choices about their future education reveal that the use of technology is prominent in the process by which they make those choices and gives powerful insight into the importance of the Internet in the choices students make.

Data emerging in the second theme, Navigating a New System, explored the participants' experiences related to encountering a new system, strategies to be successful

in courses, and the people that were crucial in helping them make decisions during their first semester. This theme addressed the socializers that impact student decision making in research question two. Despite all students entering college with the same intentions in regard to their academic careers, there is a disconnect that develops between the two female biology majors' intentions and their subsequent actions. As a result, a difference arises in how the male computer science and female biology students in this study make choices to seek out resources and contact socializers.

In the third theme, Never Ending Decisions which explored the participants' experiences related to continuing to navigate a new system by using various strategies, the support they receive, the people that were crucial in helping them make many decisions during their second year that allowed them to persist through it. What participants intend to do and what they actually do continues to take different forms among the participants in this study, suggesting the variety of experiences and interpretations of experiences along the path toward a career in science.

I also suggested a new decision-making framework to describe the experiences of these four undergraduate Latino students, in which there are four important parts: (1) web environment; (2) socializers' filter; (3) the University environment; and (4) alternate paths students follow, where the focus is either on the present or on the future major/career. It is at this fourth part of the framework for discussion presented where the observed trends were discussed that demonstrated the complexity related to (1) interactions new socializers and (2) the use of technology while in a university environment enveloped by a web environment.

Consequently, the results of this study can help focus further research with implications for support programs. Implications for further research include 1) looking

into the decision-making over time as a complex process for persisting in science majors, as opposed to a single decision model; 2) the role of socializers when choosing a science major and their role as validators of choices; and 3) the possible gender differences in how students make decisions based on positive or negative experiences. Implications for program directors/designers encompass high school programs and university programs. Suggestions include 1) addressing the digital divide so that all students have equal access to the internet and the web for equal access to future college support resources, and 2) creating a class targeting students later in high school to research the various important decisions in getting college ready. For the university setting, I suggest 1) designing support programs that add reinforcing elements, such as conversations and support elements in the form of meaningful experiences with science professionals in long–term, 2) creating opportunity to play an active mentor role to younger students as opposed to playing a passive mentee role in efforts of creating positive experiences that promote confidence, and 3) providing various opportunities for positive experiences beyond the first year in college in a way that would solidify the student's persistence in their science major.

LIMITATIONS

Limitations are inherent in any research undertaken including my own. The methodological approach selected intentionally focused, narrowed, and limited the scope of research to address my interests and assumptions, as well as the selected conceptual framework. Also, any researcher, whether he or she employs qualitative or quantitative methods, brings biases to the research endeavor. Therefore, it is "incumbent upon all researchers to address limitations so that consumers of the research use and interpret the findings in an informed manner (Glesne, 1999)."

One perceived limitation has to do with the fact that the sample of case studies is narrow in scope in that all students were first year students at one university enrolled in a science-related major; biology and computer science specifically. The ability of researchers to design a methodological approach that will address the research question and elicit rich and detailed information from study participants is always a possible limitation. Qualitative research is defined by the fact that the researcher is a research instrument (Creswell, 2007). Therefore, it is possible that I as a research instrument designed an interview protocol that failed to elicit reflective and rich feedback from my participants. Given the nature of case study research, the data, by necessity, was subject to interpretation by a single principal investigator, albeit with the review of peer reviewers. The researcher's voice, interpretive authority, and representation (Chase, 2007) all play a role in the interpretation of data, as is the situation in these case studies. Despite all efforts made to retain the quality of the study, qualitative research is interpretive and therefore, subjective to the principal investigator's analytical stance.

Also, the fact that all participants were high achieving high school students, who graduated in the top 10% of their class, limits the transferability of results to other non-high achieving students with science majors. Only students invited to apply to a mentor program or a research program their first year in college in a selective, research university which served as the site for this study, were invited to participate in the study. This narrowed the pool of students that could participate in this study and means that the results of this study cannot necessarily be generalized to other institutions.

Possibly of more significance, only two males and two females volunteered for this study. Both the volunteer nature and the small size limit the transferability of these results. Further, both female students were biology majors and both male students were

computer science majors. Although this reflects national trends, in the US, a higher percentage of biology majors are women (60% earned biology degrees) than men (40%), and a much higher percentage of computer science majors are men (about 82 % earned CS degrees) than women (about 18% of CS degrees go to women (National Science Board, 2012). The confounding of major and gender makes it impossible to isolate trends by either gender or major. This certainly creates an additional limitation of this study.

A further perceived limitation of this dissertation lies in the fact that the study did not follow the participants further through graduation; the decision making process was only up to their second year in college This would have allowed a closer look into trends related to decision making for persistence in their science major.

Another consideration is that the interview process relies on the participants' contribution and recall of events prior to arriving in college. It is possible that participants did not accurately recall memories during their last semester in high school.

Appendices

APPENDIX A: DEMOGRAPHIC SURVEY

Gender: Please check one.
___ Male
___ Female

Please provide your Age: _____

G.P.A: Please check one.
___ 2.00 or below
___ 2.01-2.49
___ 2.50-2.99
___ 3.00-3.49
___ 3.50-4.00

Race/Ethnicity: Please check all that apply to you.
___ African-American
___ Hispanic-American
___ Anglo-American
___ Asian-American or Pacific Islander
___ Native American
___ Other (please specify): _____

Current major: _____
Current Minor (if applicable): _____
Advising area for Fall 2012? _____
Do you receive financial aid: Yes ___ No___
Are you first generation to college? Yes ___ No ___
Please list any academic support program(s) (MP, RP, or FP), organizations, or academic resources you use or are actively involved in.

_____

_____

_____

For the following two statements write NA if it does not apply to you.
Besides a high school degree, please list any other degrees you have earned up to this point.

_____
_____
_____

Please leave any further comments or thoughts you wish to express privately about the focus group topic in the space below. Please use the back of this page for extra space if needed.

Family-related questions:
Combined family household income: Please check one that most applies to you.
___ Less than $20,000
___ $20,001 to $29,999
___ $30,000 to $39,999
___ $40,000 to $49,999
___ $50,000 to $59,999
___ $60,000 to $69,999
___ Above $70,000

Highest education level for each parent:

Mother: Please check one.
___ Did not finish high school
___ High school diploma (or GED)
___ Some college
___ Associate degree
___ Bachelor's degree
___ Graduate degree

Father: Please check one.
___ Did not finish high school
___ High school diploma (or GED)
___ Some college
___ Associate degree
___ Bachelor's degree
___ Graduate degree

If any questions arise regarding the data collected or clarification is needed, please provide a valid UT email address in the space provided IF you would like to be contacted: _____

Thank you for your time and participation in this study!

APPENDIX B: SEMI-STRUCTURED INTERVIEW PROTOCOL OPEN QUESTIONS

1. Can you please tell me a little bit about yourself?

Where did you grow up?

What are your interests, hobbies, experiences in high school?

How did you end up at this university?

2. How would you describe your experiences in college so far?

How would you describe your experiences in the classroom?

How would you describe your experiences with the social life at this university?

3. Can you describe the experience of choosing your academic major?

What did this process entail?

What thought processes did you follow?

4. What was the role of your academic experiences so far at the university?

Can you describe the different people and experiences that may have influenced this decision?

What was the role of your academic experiences (e.g., class, faculty, school work, academic peers)?

What was the role of your family and/or siblings? [pressures]

What was the role of your peers? [acceptance, pressures]

What was the role of teachers?

What was the role of other high school personnel?

What was the role of your community?

5. Please tell me about where you were when you first heard you were invited by MP/RP to take part in their program?

What was your first impression of the opportunity?

6. When you first received the letter of invite in your hand, what was your first impression of the letter itself?

What did you like about the letter? Dislike?

How do you suggest the programs improve future invitation letters to students?

7. How did you arrive to the decision to apply (or not) to the program?

Was anyone involved in helping you make the decision to apply (or not)?

If so, tell me about them.

8. How would you describe your experience as a college student up to now?

9. How would you describe your experience as a MP/RP participant?

10. How has MP/RP impacted your college experience?

Or how do you think MP/RP would have impacted your college experience?

Why?

11. Tell me about how your semester went.

What could you have done differently?

12. What are you expectations for next semester?

Did you meet your expectations for this semester?

Why or why not? Tell me more.

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