

FIVE WOMEN IN SCIENCE, TECHNOLOGY,  
ENGINEERING, AND MATHEMATICS MAJORS:  
A PORTRAITURE OF THEIR LIVED EXPERIENCES

By

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## ABSTRACT

Numerous studies have addressed science, technology, engineering and mathematics (STEM) and their relation to education and gender ranging from elementary school pedagogy to career choices for traditional-aged college students. Little research has addressed nontraditional female students returning to the university to in the STEM fields. This study used the portraiture methodology and the idea of being an educational connoisseur (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997) to explore the lived experiences of five nontraditional female students returning to the university to study a STEM major. The study is situated in an interpretivist paradigm, using interviews, journal writing, art work, and observations of online classroom interactions for data collection and analysis to gain a deeper understanding of how the lived experiences of the five women in the study influenced their goals, interests, and outcome expectations related to studying STEM fields.

I used the social cognitive career theory to guide data collection and data analysis. The portraiture methodology enabled me to gain a deeper understanding of the role of self-efficacy; environmental supports from spouse, family, or others; and perceived and real barriers as part of the women's lived experiences.

## ACKNOWLEDGEMENTS

It is hard for me to comprehend that I am at this place already and that the end of my journey is actually here. In the Spring of 2007 I unexpectedly found myself in a position where I was about to be a single mother of 3 children. During the next several months numerous co-workers encouraged me to get started on my PhD, yet I was not ready to make that commitment. I had heard so many stories about people not finishing and I did not want to be one of them. I questioned how I would ever be able to find the time to do my school work, whether the added pressure and time spent away would have a negative impact on my family and whether I had the intellectual capacity to be successful. My children and I spent that Thanksgiving with my brother and his family. While at his house I mentioned to him I was thinking about going back to school and tried to justify why I was holding back. His response was “Just do it. I will support you and help you with whatever you need. Just take the plunge and register for classes”. This statement was the tipping point for me. I went home that night and began the process.

This was not a journey traveled alone. Without the immense encouragement and support of my children Nicholas, Anjelica and Rosalina I would not be sitting here writing this today. They were and continue to be my inspiration and, on the days when it all seemed too much, what drove me to not give up. Thank you to my bother Jim, my sister-in-law Jean, my parents and my closest and dearest friends who told me “just breathe” and helped to lighten my load when I needed it the most. I would also like to acknowledge Lorette Calix, Lisa Rapple, Dr. Evelyn Wells, Dr. Karolyn Andrews, Dr.

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## Chapter 1: Introduction

### Background

Why is it important to understand the lived experiences of nontraditional female students and how contextual factors inform self-efficacy, interests, goals, and actions related to their choice to return to the university to pursue STEM-related majors and careers?

For well over 20 years researchers have been trying to determine what factors influence a woman's choice and ability to persist in science, technology, engineering and mathematics (STEM) majors and related careers. Today, the number of women seeking STEM degrees is still of concern (Modi, Salmond, & Schoenberg, 2012). Jacobs (2005) found that, although the gap between the number of women and number of men pursuing STEM careers is decreasing, still a significantly lower number of women than men are entering the STEM fields.

More women are choosing STEM fields after high school graduation: "Women make up an increasing number of science and engineering majors, including top programs such as those at Massachusetts Institute of Technology where women make up 51% of its science undergraduate and 35% of its engineering undergraduates" (Committee on Science, Engineering, and Public Policy, 2007, p. 1). The University of Iowa, Iowa State University, and the University of Northern Iowa saw a 13% increase over the last 3 years in the number of female STEM majors. They had 11,388 women—one in three female students—enroll (Krogstad, 2012). Many of these women do not persist through college, graduate school, or in STEM careers.

Women who are interested in science and engineering careers are lost at every educational transition. With each step up the academic ladder, from high school

on through full professorships, the representation of women in science and engineering drops substantially. As they move from high school to college, more women than men who have expressed an interest in science in engineering decide to major in something else. (Committee on Science, Engineering, and Public Policy, 2007, p. 2)

Are the academic and career choices women make a result of a critical event in their lives or of the experiences they have had throughout their lives? It is important for educators, administrators and policy makers to understand why women are poorly represented in STEM fields. Enabling more women to persist in these areas of study is important for societal as well as economic reasons. It is important to remember that women make up more than half of the population and, while they hold almost half of all the jobs in the United States, they hold only 25% of the STEM jobs (U.S. Department of Commerce, 2011b). They are a huge potential resource for employers as well as society. In September 2012, the unemployment rate was 7.8% (Trading Economics, 2012). However, top technology firms cannot find enough graduates to fill all their open positions (Ante, 2012). It is important to have a deeper understanding of the lived experiences of non-traditional female students who return to the university to pursue STEM majors and careers. In 2010, one of every 18 workers was employed in a STEM-related job. Projected job growth in STEM fields is expected to be 17% between 2008–2018 while non-STEM jobs are projected to grow only 9.8% (Langdon, McKittrick, Beede, Beethika, & Doms, 2011).

Today's world is technology based, with many high-paying jobs requiring a background in mathematics or science. For example, in 2003–2004, students who had bachelors' degrees in engineering fields started out with the highest average salaries nationally (Jacobs, 2005). In 2007, a person with a bachelor's degree had a mean annual income more than \$36,000 higher than that of a high school dropout (Khatiwada,

McLaughlin, Palma, & Sum, 2007). Furthermore, women in STEM jobs make approximately 33% more than women who work in non-STEM fields (U.S. Department of Commerce, 2011b). In 2009, men with college educations earned about \$7,000 more per year than college-educated women (U.S. Census Bureau, 2009).

Studies have indicated the effect an education, particularly one in STEM, can have on quality of life for women (Bobbitt-Zeher, 2007; Thomas & Zhang, 2005), especially the 37% of single mothers whose families lived in poverty in 2007 (National Women's Law Center, 2008). If women are to be independent and self-sufficient, they must be able to support themselves and raise themselves to a higher educational and economic status. However, for women to pursue STEM careers, they must surmount the barriers they face related to traditional disincentives for women in mathematics so that they can continue to higher and more advanced mathematics classes because doing so allows them greater access to high-paying STEM careers.

Different perspectives add value, allow for discussion, and enable people to see things from different viewpoints. As Henrion (1997) put it,

There is not simply one mathematical reality. . . . [T]he sky is vaster than we know. . . . [W]e are always viewing only pieces of it. Which pieces get focused on is influenced by individual and social factors. (p. 264)

The value of STEM knowledge to the future of our world makes it imperative that these fields engage as wide a variety of stakeholders as possible.

A review of research shows many different results with respect to why some women choose and persist in STEM and others do not. Reasons range from societal expectations, stereotypes, self-efficacy, motivation, attitude, and genetic differences (Hackett, 1985). Throughout their lives, many women are sent a message that mathematics is for boys. Parents, teachers, and society both consciously and

unconsciously send girls a message that they should focus on soft subjects, looking pretty, getting married, and raising a family. It is critical we understand what leads to successful outcomes when women are encouraged to study STEM, barriers are eliminated, and needed supports provided. If more women study STEM fields, a higher standard of living for many women and children will result. It is critical to understand how their lived experiences and contextual factors inform self-efficacy, interests, goals, and actions related to their choice to return to higher education to study STEM.

Therefore, this study focuses on five women who were returning to the university as nontraditional students to study STEM. The portraiture methodology allowed for an in-depth exploration of how their lived experiences influenced their goals, interests, and outcome expectations related to a STEM career. Portraiture is important from a research standpoint because it offers an opportunity to provide greater insight and understanding as to how nontraditional female students in STEM majors experience life and construct their views of the world. It is my goal that this study, based on portraiture, may help to provide educators, administrators and policy makers with a better understanding of how they can engage more women in STEM-related careers and help them achieve success and persist in this area of work.

### **Definition of Terms**

*Nontraditional learner.* A significant portion of adult learners are categorized as nontraditional students, as defined by the National Center for Education Statistics (NCES; 2002). According to the NCES, nontraditional students exhibit one or more of seven characteristics:

1. have delayed enrollment into postsecondary education,
2. attend part time,

3. are financially independent of parents,
4. work full time while enrolled,
5. have dependents other than a spouse,
6. are a single parent,
7. lack a standard high school diploma,

*Persistence.* For the purposes of this study, I define *persistence* as occurring when a student who is currently enrolled in a junior- or senior-level STEM course and has successfully completed at least two consecutive prior STEM courses as a returning nontraditional student.

*Successful completion.* For the purposes of this study, *successful completion* is defined as completing a course with a grade of *C* or better.

*Self-efficacy.* *Mathematics self-efficacy* is defined as “individuals’ judgments of their capabilities to solve specific math problems, perform math related tasks, or succeed in math related courses” (Pajares & Miller, 1994, p. 194). Prior research using social-cognitive career theory (SCCT) has supported the model in which outcome expectations are dependent on a person’s high or low self-efficacy. When people believe they are capable and have the skills to succeed, they will typically expect a positive outcome. The SCCT expands on this idea by maintaining that people with a higher level of self-efficacy for a certain task will tend to develop interests in that area and believe their efforts will lead to a positive outcome (Lent, Paixao, Silva, & Leitao, 2010).

*Supports and barriers.* For the purposes of this study, *supports and barriers* are defined following Lent et al. (2010) and include such social, material, and financial factors as socioeconomic status (SES), family or peer support, and stereotype threat.



## Framing the Study

I used social cognitive career theory (SCCT) to guide data collection and analysis as I explored how the lived experiences and contextual factors of the women in my study informed their interests, goals, and actions related to returning to the university to pursue STEM related majors and careers (Brown & Lent, 1996; Lent, Brown, & Hackett, 1994, 2000; Lent, Paixão, Silva & Leitão, 2010). SCCT was developed by Lent et al. (1994) as a way to combine different career theories developed by Dawis and Lofquist (1984); Holland (1985); Krumboltz, Mitchell, and Jones (1976); Super (1990); and Vondracek, Lerner, and Schulenberg (1986; all as cited in Lent et al., 1994).

SCCT has been extensively used to understand how environmental factors affect the ways in which various age groups develop interests, outcome expectations, and career goals (Lent et al., 1994). Lent et al. defined *outcome expectations* as “the imagined consequences of performing particular behaviors (‘if I do this what will happen to me?’)” (p. 5). According to Bandura (1986), there can be three components to outcome expectations: (a) physical, (b) social, and (c) self-evaluative. A review of literature revealed that SCCT has been widely used to explore populations of STEM majors in a wide variety of age groups and ethnicities, from middle school through traditionally aged college students. However, research is lacking concerning nontraditional female students returning to the university to pursue STEM-related majors and careers. The purpose of this study was not to test the theory on this population but to use the theory to guide data collection and analysis of the lived experiences that affected the path they took to returning to the university to pursue STEM-related majors and careers.

SCCT provides a guide for examining the path one takes when making academic and career choices (Lent et al., 1994). Lent et al. suggested this framework can be used to examine both academic and career choices because of the interconnection between the two. SCCT emphasizes three social cognitive variables: self-efficacy beliefs, outcome expectations, and goal representation. Students graduating high school and considering college may have a range of outcome expectations related to choice of major and career such as whether they make money, whether they will like it, whether it will be too hard, whether it will be an unfriendly environment for women, or whether their parents will be proud of them. According to Bandura (1986), the choices people make are influenced both by whether they believe they can do something well (self-efficacy) and what they believe the ultimate result of their action will be (outcome expectations). In the case of career choice, outcome expectations may have an influence on choice that is independent of self-efficacy. Even if a girl has a strong belief in her ability to do STEM well she may believe that she will not be happy in a STEM career because she perceives it as lonely, “nerdy,” or work and family unfriendly (Lent et al., 1994). Lent et al. described two types of goals: aspirations—those that are prior to career entry and just an idea with no real commitment and plans—and commitment (Lent et al., 1994).

Lent et al. (1994) proposed three interlocking models: (a) interest, (b) choice, and (c) performance. Each model highlights the social cognitive variables Lent et al. (1994) believed to have the greatest influence. Figure 1 shows the basic model of how career interests develop over time.

The interest model focuses on how the environment in which one lives during the K-12 years provides the exposure one needs to develop interests. This exposure can be in

the form of vicarious experience and verbal persuasion. Lent et al. (1994) indicated it may not be possible to develop interests with either a low self-efficacy or when one is lacking any outcome expectations or has negative outcome expectations.

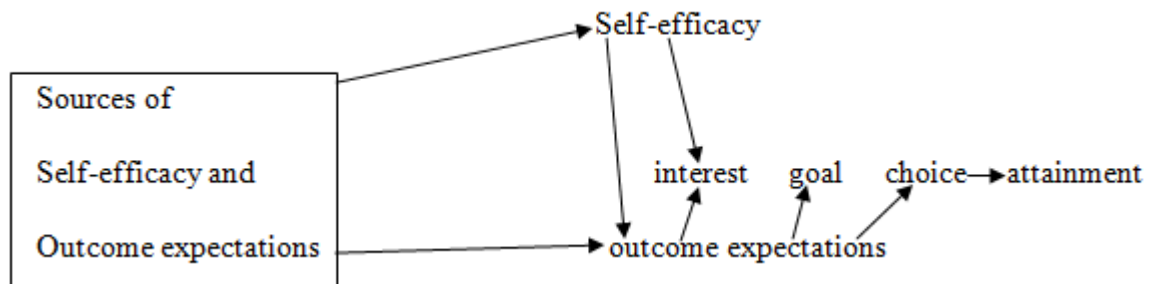


Figure 1. Basis model of career-interest development over time. Adapted from “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance,” by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *Journal of Vocational Behavior*, 45, p. 88.

The choice model is shown in Figure 2. It is similar sequentially to the interest model but creates a feedback loop that distinguishes among choice and interest, actions to implement choice, and performance attainment. This model distinguishes between the intention and the action and accounts for the interaction between self-efficacy, outcome expectations, interests, and personal agency (Lent et al., 1994). It also allows choice to be dynamic, based on the other variables. For example, one choice of major may change based on a change in outcome expectations. In this model, Lent et al. referred to goals as choice goals—choosing to major in mathematics—and not performance goals. Lent et al. described this model as a way to “explain the career and academic paths that people select” (p. 94).

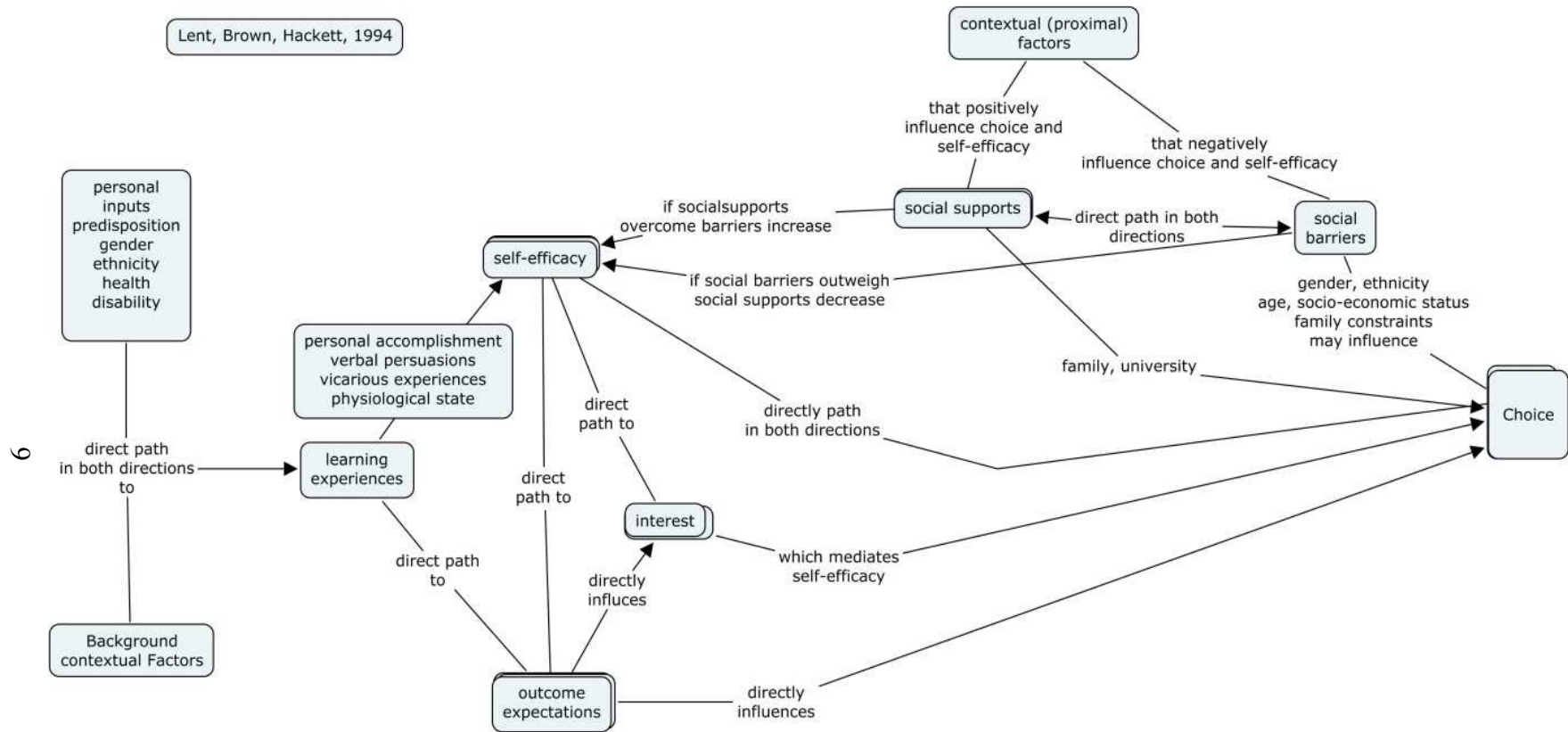


Figure 2. Choice model social-cognitive career theory. Adapted from “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance,” by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *Journal of Vocational Behavior*, 45, p. 93.

The performance model (Figure 3) focuses on the interaction between self-efficacy, outcome expectations, performance goals, and task attainment. The focus of this study was not on performance goals but choice goals. The choice model (Figure 2) is the most comprehensive and encompasses a wide range of ways in which life experiences influence choice, including learning experiences. Because the goal of this study was to gain a deeper understanding of the influence lived experiences had on nontraditional female students and their choices of majors, this model was used to guide data collection and analysis.

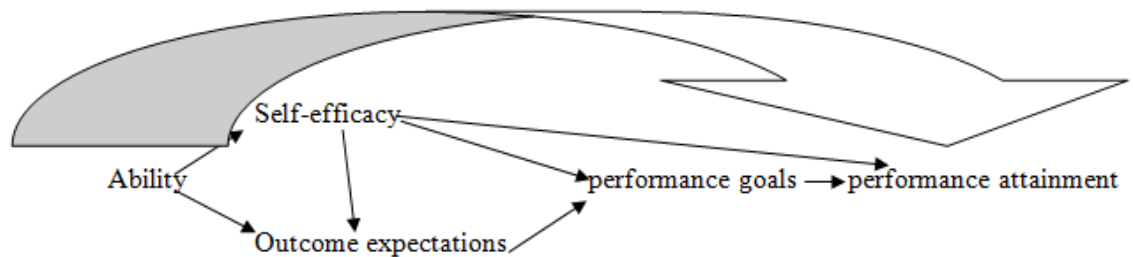


Figure 3. Performance model. Adapted from “Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance,” by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *Journal of Vocational Behavior*, 45, p. 99.

Bandura (1986) defined *self-efficacy* as a person’s judgment of his or her ability to be capable of successfully performing needed actions to attain their goal. The four primary sources of self-efficacy are personal accomplishment, verbal persuasion, vicarious learning experiences, and physiological and emotional state (Bandura, 1977). Personal accomplishment is related to mastery experiences, such as earning good grades, doing well on standardized exams, or taking math intensive courses in high school. The physiological and affective state is related to such feelings as fatigue, anxiety, depression, or stress. Verbal persuasions include feedback, words of encouragement, or words of discouragement. Vicarious experiences include observing others being successful or

unsuccessful at a particular task. This person could be a parent in a STEM field, a peer who is perceived to be “smarter”, a comparison to one’s own success, a peer at work or an instructor.

The choice model also takes into account the influence of supports and barriers. The interaction between the four sources of self-efficacy and supports and barriers is complex and dynamic because of their interconnectedness. People cannot always make the choices they want to make because of barriers such as family constraints, SES, or gender. Although someone may be interested in STEM subjects, he or she may perceive the barriers as too high and choose something else. A girl may have taken intensive math and science courses in high school, earned high grades, and have a strong belief in her ability to succeed but perceive a career as an engineer as being unfriendly to women. A girl with a strong support system—possibly a parent, mentor, or teacher—may perceive these barriers as being lower (Lent et al., 1994). If money is an issue, someone may choose a career in engineering not primarily because he or she is interested in it but because his or her outcome expectation is that he or she will make a good deal of money and the person believes he or she can be successful doing it. The choice model shows a path to choice from barriers, supports, self-efficacy, interests, and outcome expectations. Figures 4 and 5 show the paths I expected to see prior to completing this research study.

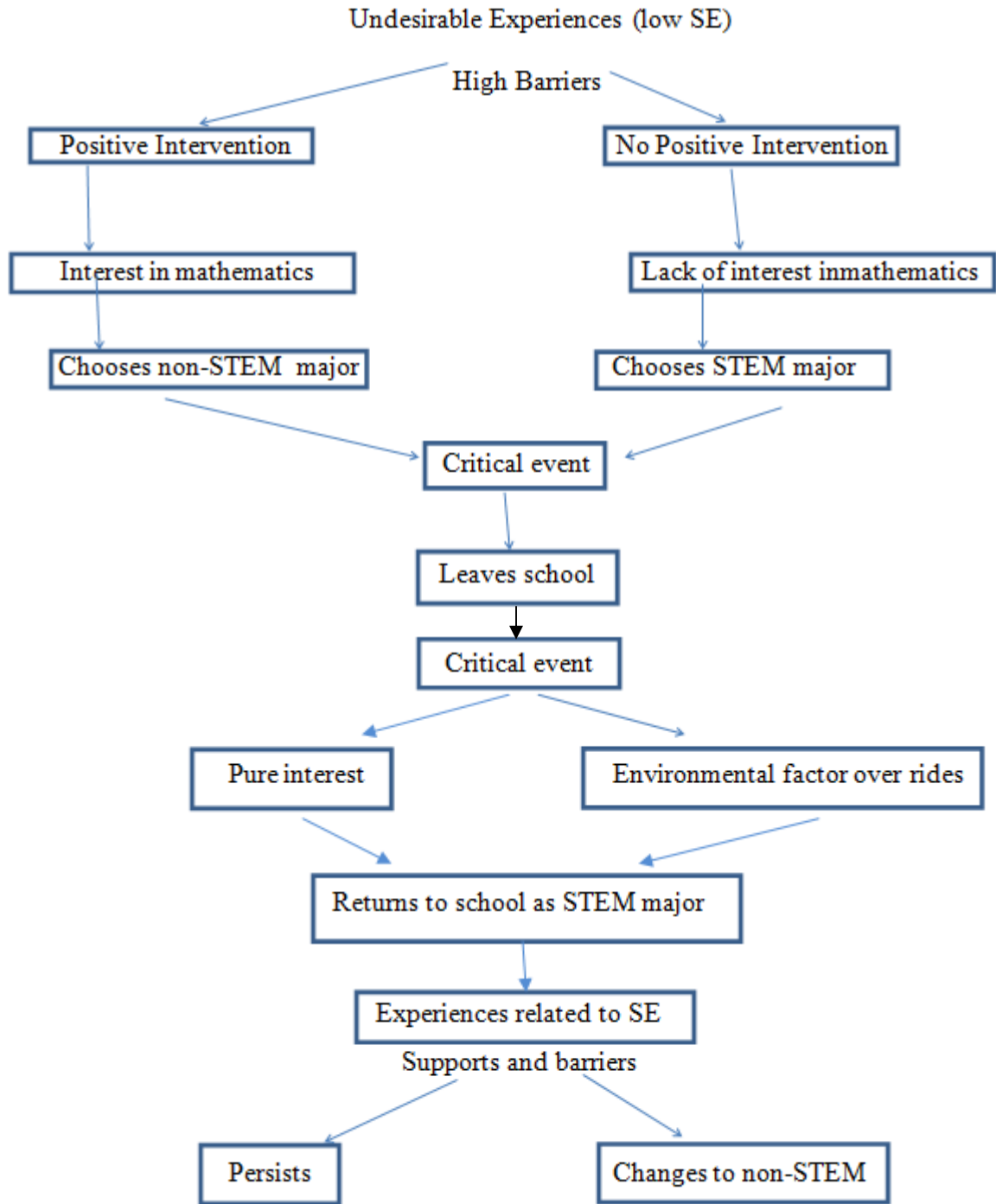


Figure 4. Potential path: Lack of interest in mathematics. Critical event leads to leaving school. A later critical event leads to returning to school.

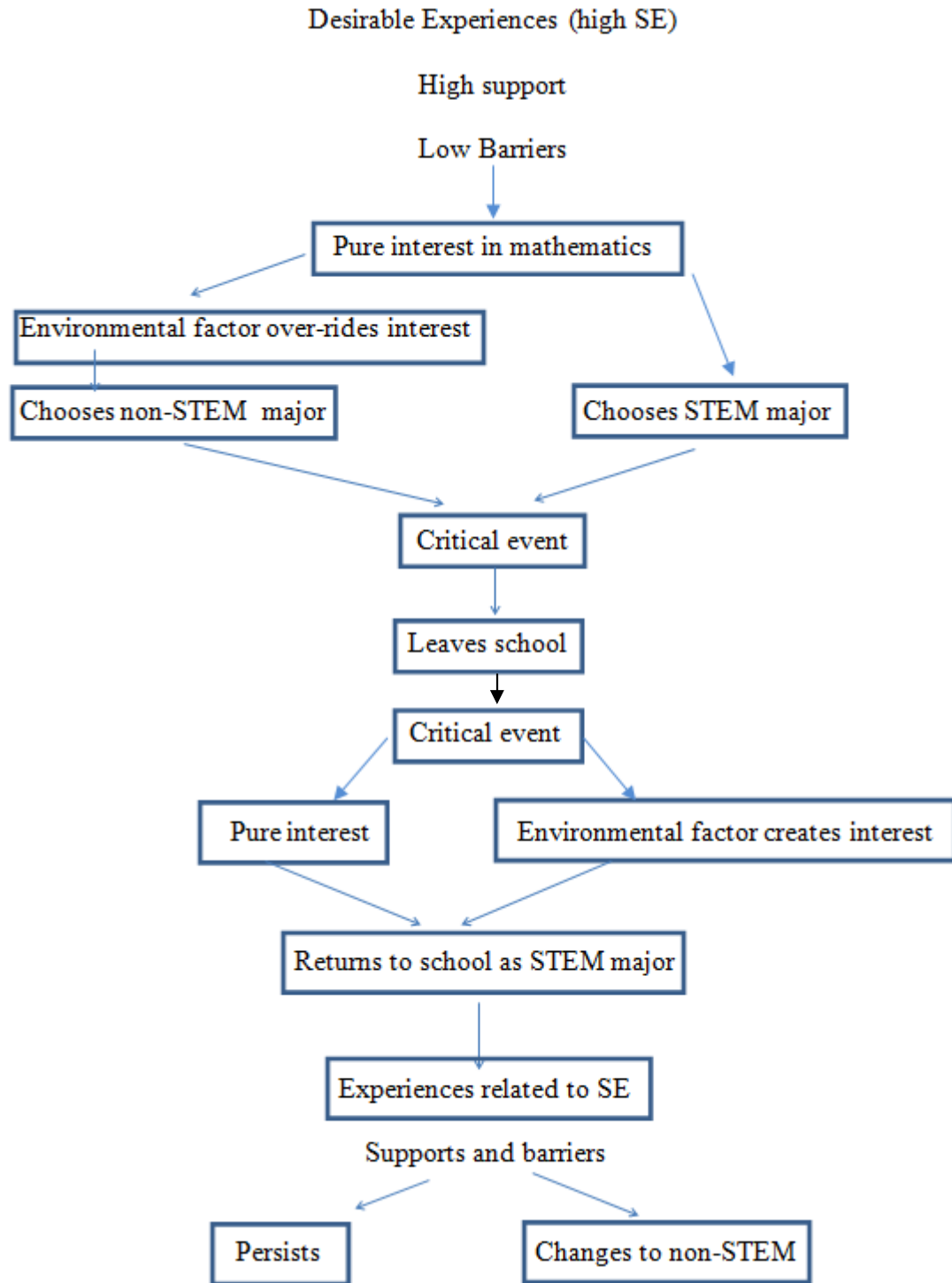


Figure 5. Potential path: Pure interest in mathematics. Critical event leads to leaving school. A later critical event leads to returning to school.



According to Tobias (1993), girls base their choices on how valuable they perceive the choice to be for them and their expectation of how well they will do. A boy may base his choice to study mathematics purely on his outcome expectation that he will make a lot of money. A girl may need some type of connection or feeling that studying mathematics will add value to her life or the lives of others. According to Karen Zunkel, director of the ISU Women in Science and Engineering program, “Women have this more aspirational reason for pursuing their STEM careers. . . . It’s not that they want a great job with great pay; it’s that they want to make a difference in the world” (Krogstad, 2012). When writing about motivation to study STEM in their college scholarship essay, men more frequently write about gaining a good job while women talk about things like how their degree will enable them to fight disease or combat water pollution (Krogstad, 2012).

A common perception is that women have lower levels of confidence with respect to mathematics and that they will have to overcome greater barriers if they choose to pursue a mathematically related career (Henrion, 1997). Henrion discussed how difficult it is to change habits, customs, and assumptions that have been deeply embedded in society. Although, as a young girl, she may have been required to simply memorize mathematics facts and content, as an adult she may see how it applies to her life and how she can use mathematics to make a difference. Understanding how the lived experiences of the five nontraditional female students in my study influenced their interests, goals, and outcome expectations related to studying STEM may lead to a better understanding of how to encourage not just more nontraditional female students but girls of all ages to pursue STEM majors. This study examined how the lived experiences and contextual

factors of five nontraditional female students informed their self-efficacy, interest, goals, and actions in relation to choosing to return to the university to pursue STEM related majors and careers. Through the exploration of their lived experiences I gained deeper insight into how they constructed beliefs related to pursuing a STEM major and career through in-depth interviews, observations of online classroom interactions, artwork, journaling, and document collection (artifacts). I gained a deeper understanding of the roles self-efficacy, supports, and perceived and actual barriers play in the development of this belief.

Four of the nontraditional female students in this study returned to the university to finish a previously uncompleted degree. Two of the women majored in STEM the first time, one was pursuing a bachelor's of fine arts degree, and one chose to study business in a developing country (location changed in this dissertation). One woman had completed a BS degree in Spanish and was returning so she could enter a physician's assistant program. From data analysis, I gained deeper insight into what motivated them to return to school and why, the second time around, they believed a STEM major was a viable option.

I wove the threads of each of their stories into five individual portraits that vividly describe the uniqueness of each of their lives. Each portrait illuminates how the lived experiences influenced the participant's self-efficacy, available supports, and perceived and actual barriers in relation to her choice to return to the university to study STEM. I examined the interaction between supports and barriers and self-efficacy, interests, goals, and the choices they made. It is my goal that these stories will inspire other women as

well as offer guidance to educators, administrators and policy makers concerning how to support women in STEM majors and careers.

It should be noted how I, as the researcher, have been affected by my personal belief system that was influenced by my own personal social and cultural context (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997; Patton, 2002), which inevitably affected my data interpretation and building of the portraits.

### **Significance of Study**

This study is important because it addresses a gap in the literature pertaining to a deep understanding of the lived experiences, across their lifetimes, of nontraditional female students who return to the university to study STEM. Many studies have examined the career issues of female STEM majors (Byars-Winston & Fouad, 2008; Fouad & Smith, 1996; Montgomery, 2009); however, a review of the literature showed few, if any, studies to date have examined the lived experiences of nontraditional female students who return to the university to study STEM. In addition, few, if any, studies have used the portraiture methodology to weave a portrait of the life histories of participants through a social-cognitive lens and illuminate how a lifetime of supports and barriers influenced the choices a participant made. By studying the lived experiences of nontraditional female students who were upper-class students, themes specifically related to successes emerged. In the next chapter, I review the literature addressing the following themes: (a) women in STEM fields, (b) nontraditional female students, and (c) SCCT.

## Chapter 2: Literature Review

### Women in STEM Fields

The economic implications for women are clear and need to be looked at from multiple directions. If women opt out of STEM-related careers they are eliminating themselves from higher paying more lucrative jobs that will raise them to a higher standard of living. Portes and Vadeboncoeur (2003) found that “low socio-economic status is a risk factor for alienation (low engagement and disciplinary problems), associated with less efficacy, perceptions of unfairness, low support, and appraisals by teachers” (p. 372). Benson and Borman (2007) concluded that “social contexts . . . exert a substantial effect on school readiness” (p. 31). Crane’s (1996) review of empirical studies discovered that “with respect to mathematical learning, various facets of socio-economic status, various facets of home environment and parental test scores have been identified as all having significant effects on children’s mathematical skill levels” (p. 4). How do these social interactions affect later career interests, goals, and outcome expectations?

Crane (1996) discovered that it was not specifically the mathematics ability of the mother that affected readiness and achievement, but the fact that women who did better in mathematics had a higher SES and, therefore, were able to provide a higher quality education to their children.

According to Brew (2002),

Rather than just the public world (the formal learning setting) being the source of new knowledge and ways of how to engage effectively with students about mathematical meaning, the private world of the parent child relationship deserves greater attention for its potential contribution to constructing new mathematical knowledge. (p. 19)

According to Benson and Borman (2007), “Within geographic areas with a fair degree of socioeconomic homogeneity, processes of social interaction and access to social resources take on patterns that influence the lives of individuals and families” (p. 9).

Prior to choosing college major and development of career goals, students must make course selections in high school. Simpkins and Davis-Kean (2005) found that students with a higher math self-concept tended to enroll in more advanced mathematics courses. They also found that females and males did not take a significantly different number of advanced courses. It should be noted that this study included only 180 children (54% female) who were White middle class, with almost half having mothers and fathers who had 4-year degrees. If family and cultural values have an effect on math self-concept, then this group, in general, may be expected to have higher math self-concepts. According to Zarett and Malanchuk (2005), parental background does not affect a student’s choice to pursue an information technology (IT) career.

Zarrett and Malanchuk (2005) discovered that self-concept of ability and the amount of encouragement given were directly related to the pursuit of an IT career. Additionally, they stated that those who perceived themselves to be good at mathematics early in their school career were more likely to pursue computer-related courses and go onto “hard” IT jobs. Even after accounting for social and psychological factors, gender still predicted that males were more likely to pursue “hard” IT career paths.

A study of 100 students (approximately 50% female, 50% male) revealed that approximately 25% of boys compared with 14% of the girls considered themselves to be above average in mathematics. . . . Yet, according to teacher assessment and commercially designed mathematics tests, there were no differences in the performance of boys and girls in any of the classes tested. (Leder, 1996, p. 99)

Girls tended to perceive their mathematics ability to be lower than it actually was. It should be noted that this study had a small sample size of children in Grades 3–6. This sample may not be representative of the population as a whole.

Sullivan (2009) used data from the longitudinal study of a single cohort by The National Child Development Study (NCDS) to look at whether academic self-concept is sex-stereotypical. This study started with a sample size of 17,414 in 1958; 16 years later there were 16,471 respondents still in the study. At age 16, 21% of the boys, compared to 11% of the girls, considered their mathematical abilities to be above average; and 19% of the boys and 9% of the girls considered themselves above average in science (Sullivan, 2009).

**Women in college.** Today, more women, overall, are attending college and receiving degrees. In 2010, 36% of women compared with 28% of men earned degrees (Wang & Parker, 2011). In an effort to change women’s perceptions of technology as a viable career option, El Paso Community College established a program called Women in Technology (WIT). The program offers education services for women and connects them with community outreach efforts and a female mentor. After 10 years, female enrollment in technical fields at El Paso Community College had more than doubled (Brown, 2001).

In 1996, as part of a gender-equity project consisting of secondary schools across Australia, Willis (1996) discovered that, while many women had made academic advances in the area of mathematics,

school mathematics continues to be gender-inflected . . . and . . . many mathematically oriented disciplines and occupations remain predominantly male domains even if they no longer are almost exclusively male domains. We still have a long way to go. (p. 41)

Overall, Willis found that school-based efforts to address gender issues were “sporadic, superficial and unsystematic” (p. 42).

Since 1950, the population has shifted from being predominantly male to 51% of the population being female (U. S. Department of Commerce, 2011a). Our society needs to hear the diverse ideas of these women. In addition, women deserve equal access to higher paying STEM jobs that can provide economic security for themselves and their families. Women who live alone have the lowest median income, and women overall have the highest levels of poverty (U. S. Department of Commerce, 2011a). Women are more likely than men to live alone (8% and 6%, respectively) and to be a single head of household (13% and 6%, respectively; U. S. Department of Commerce, 2011a). In 2009, 28% of unmarried working women with children had incomes below the poverty level compared to 6% among male workers (U. S. Department of Commerce, 2011a).

Although the number of women enrolling and completing college has surpassed men (Wang & Parker, 2011), the low numbers of female students majoring in mathematics and science continue to be a problem for our society. Whereas in 1970 only 8% of women were college graduates, in 2009, that number was up to 28% (Women in America, 2010). By 2010, that number increased to a record 36% (Wang & Parker, 2011). However, in 2007-2008, while women earned 57% of all college degrees, women earned less than 20% of all degrees conferred in engineering and computer science (U. S. Department of Commerce, 2011a). The number of females in computer science bachelor degree programs dropped from just over 30% in 1989 to under 20% in 2008 (National Science Foundation [NSF], 2011).

In 2009, worldwide, women earned two-thirds of all undergraduate degrees, but only one-third of all undergraduate degrees in technology and science (U.S. Department of Commerce, 2011b). At the PhD level, only 1% of all females earned degrees in STEM fields (Jacobs & Simpkins, 2005). The Conference Board of the Mathematical Sciences (CBMS) numbers show a similar decline in the percentage of women mathematics and science majors since 2000 (Bressoud, 2009). According to CBMS, the percentages of bachelors' degrees in mathematics and sciences earned by women were 42.2% in 1990, 43.6% in 1995, 42.3% in 2000, and 39.9% in 2005. During the period 1990–2007, the percentage of all bachelors' degrees that went to women increased from 53.2% to 57.4%. However, the percentage of bachelors' degrees in mathematics earned by women decreased from 46.2% to 44.1%. In the period 1984–2007, the number of women earning computer and information science degrees dropped from a peak of 37.1% to only 18.6%. Perhaps the most discouraging figures are for women in engineering. The period 1990–2002 saw an increase from 15.4% to 20.8% in women earning engineering degrees. However, during the next 5 years, this enrollment decreased to 18.4% (Bressould, 2009). Some of this decline may be attributed to the dot.com bust that took place in 2001.

**Professional experience.** In 1950, only 33% of the female population was looking for a job. That number is currently at 61%. In 1975, 47% of the workforce consisted of women with children under the age of 18; that number rose to 71% in 2009 (U.S. Department of Labor, Bureau of Labor Statistics [BLS], 2009a). Working women tend to spend less time at work and more time on household tasks, which could affect their views on accessibility and beliefs they can be successful in more demanding STEM careers. In 2009, employed married women aged 25–54 spent 7 hours and 40 minutes



per day on work-related activities, compared to about 8 hours and 50 minutes for men. In contrast, employed wives spent about 40 minutes more time on household-related activities (BLS, 2009a).

Information technology is a rapidly growing field in need of a large number of workers. Zarrett and Malanchuk (2005) found that, in 2003, women represented less than 30% of the entire IT work force and that the number was declining. In 2009, women held only 7% of the high-paying jobs in the computer (\$1,253 median weekly earnings) and engineering fields (\$1,266 median weekly earnings; BLS, 2009b). In 2006, according to the National Science Foundation (NSF; 2011), 55% of the employed scientists and engineers were male, whereas only 26% were female. In addition, only 10% of the executives in Fortune 500 computer companies were women (Zarrett & Malanchuk, 2005). Zarrett and Malanchuk found that males were more likely than females to pursue the “hard” IT jobs that ultimately lead to more profitable and prestigious career paths. Examples of “hard” IT jobs include system administrator, programmer, or computer engineer while “soft” IT jobs include Internet journalism, help desk staffing, and teaching.

Gal-Ezer, Vilner, and Zur (2008) studied computer science majors at Open University in Israel (OUI) from 1995-2006, using data from the university’s database. Gal-Ezer et al. discovered that, whereas 42% of men passed the initial Pascal course, only 31% of women did. In their first mathematics course, Calculus 1, 30% of the men passed, compared to 24% of the women. In a more advanced-level mathematics course, such as Discrete Math, the pass rates were closer for men and women: 48% and 46% respectively; however, for Linear Algebra, 31% of men passed compared to 26% of women. Gal-Ezer et al. are currently working on further studies on mathematics courses to try to understand

whether there is something about discrete mathematics that led to higher pass rates for women.

Enrollment in advanced-level computer science courses was between 78% and 82% for males and between 18% and 22% for female. Gal-Ezer et al. (2008) concluded that, once women had passed the initial courses, they succeeded at the same rate as men. They suggested a reason may be only women who are self-confident and motivated succeed and that the low rates of women in the major is a social problem that warrants further studies.

A literature review by Agosto, Gasson, and Atwood (2008) indicated the need for formal faculty and IT professional mentoring for women to increase retention. Agosto et al. discovered women in IT feel socially isolated and female peer support has a significant effect on persistence and retention. A reason for lack of interest by women in the field was attributed to the perception held by many women that IT is antisocial. Another critical theme that emerged was the need for role models. The research reviewed indicated that a lack of role models leads to women's lack of knowledge about the field and industry, resulting in their pursuing other interests. The literature also indicated a continued perception of IT being too nerdy. The literature indicated role models would enable women to see other women working successfully in the field, which can potentially change their perceptions of the field. Several of the studies Agosto et al. reviewed supported the redesign of course work to be more focused on learning styles and preferences of women.

Thomas and Allen (2006) surveyed a cross section of 114 IT students, both those who had chosen and those who had not chosen IT as their majors, to learn about their

perceptions and misconceptions about IT careers. Ninety-eight students responded, 63.3% male and 36.7% female. Only 11 of the 31 female respondents had chosen to study IT. Of the female respondents, 69.5% had stopped studying IT by the end of 10th grade, with 85.7% of those giving the reason they did not want to be classified as a “nerd.” On a Likert scale of 1–5, with 1 representing *definitely*, the female participants had a mean rating of 2.42 for the question concerning whether it is uncool to be interested in computers. Fifty-nine percent of the students said they did not know any women in the IT industry, and 56.1% said they did not know any role models. Perceptions about IT came primarily from course work, peers, and the media.

Ballard, Scales, and Edwards (2006) surveyed 42 women who were in career transition concerning their knowledge of women in IT. Fourteen percent were between 18 and 25, 33% between 26 and 35, 38% between 36 and 45, and 15% over 45. Forty-nine percent were married with 51% being college graduates. Ninety-two percent agreed there were a variety of jobs in IT, with 88% feeling IT jobs were creative. The perception that IT is creative was positively associated with knowing women in the IT field. Ballard et al. discovered a significant difference between women over 35, who said they were not encouraged to take mathematics, and women younger, who said they were encouraged. The results of this study indicate that working women may see IT as a more viable field possibly because they have been exposed to it and role models in the field. The population used by Ballard et al. is similar to the population for this present study.

An exploratory case study of nine women (Hua, 2010) who persisted in an IT career discovered that women who had higher aptitude, ambition, self-confidence, and better coping strategies had greater career longevity. Only one of the nine women in the

study attended college with the intent to study IT. The other eight women chose IT after having been in the working world and having some exposure to technology and computers. A pattern that emerged across all nine cases was a sense of ambition, strength, and determination. All the women described the need for women to stay true to themselves and to have a role model. They also expressed a desire to be role models and activists for other women.

**Summary.** Research had supported the theory that SES, social context, and education of parents influence mathematics mastery and that higher self-concept leads to greater enrollment in advanced-level mathematics courses. The studies reviewed demonstrated that girls tend to have a lower perception of their mathematics ability than boys. Hua (2010) found that mastery, ambition, self-confidence, strength, and determination were attributes found in women who persisted in IT fields.

Research has supported that girls tend to have lower pass rates than boys in advanced-level mathematics courses and view studying computer courses and working in that field as nerdy and antisocial. There is a lack of role models available to girls, and research has indicated the need for role models. Studies found women who either worked in the field or knew someone who did had more positive perceptions of IT as a career.

### **Nontraditional Female Students**

Research has shown that women are motivated to return to college so that they can increase their salary or receive a promotion or simply for personal satisfaction (Dey & Hill, 2007; Kramarae, 2001, 2003). Women may not succeed because of barriers such as family responsibilities or access (Kramarae, 2001, 2003).

Furst-Bowe and Dillman (2002) interviewed 40 women who were studying at a distance at both public and private institutions and found that 75% of the women were going back to school to advance their careers. Although these results are inconsistent with the reasons usually attributed to women returning to school, because of the small sample size, the significance of these results is not clear. There was also no information on the economic background of the women, which may affect their motivation to return to school. Seventy-five percent of the women in this study chose distance learning for the convenience and flexibility, which allowed them to juggle work, family, and educational responsibilities. The women in this study found cost to be a minor factor, but it is hard to know how significant that finding is without any demographic information.

Of the women in the study, only 10% were single and 20% unemployed, which could be a reason most of the women did not consider money an issue. All women stated the quality and interaction of the teacher was the most important aspect to a good experience whether online or face to face. Thirty percent said there was not enough teacher presence in the online courses they had taken. The researchers found a common complaint was that schools were geared to support campus students not ones at a distance so there was little support for them. Time, family, and work were mentioned as barriers, results consistent with other research. This study had only 40 participants, and there was no statistical analysis, so it is not clear what significance these results have.

A study by Johnson, Schwartz, and Bower (2000) of adult women attending a community college revealed that the additional burden of family and child care puts women at risk for dropping out before they complete their degree. Eighty-four percent of the adult women in the study provided child care, included not only their own children

but nieces, nephews, and grandchildren. Furthermore, Mohny and Anderson (1998) interviewed 47 women between the ages of 25 and 34 to learn what factors motivate a woman to enroll at a specific time in her life. Mohny and Anderson discovered women were motivated by a need for others to “recognize, appreciate and reward them for their real worth” (p. 272). However, the women also felt strongly about attending college only if it meant they would not hurt anyone else. The needs for security and to be able to support themselves were seen in women who were in abusive relationships, were single mothers, or had husbands who were ill. The women in the study had initially postponed college for the following reasons: a need to care for immediate or extended family or small children, an unsupportive partner, and job demands. In contrast, the factors that enabled women to enroll were the following: finally having enough money, feeling their children were old enough (ranging from 3 months to 30 years), having support of others, and having adequate child care. Mohny and Anderson also discovered situations in which women had an equal motivation to enroll in college and desire to persist but, even with a high motivation, the external barriers were too great.

Home (1998) performed a multiple regression study of 433 adult women to learn about role conflict, overload, and contagion. *Role conflict* was defined as having to deal with multiple, incompatible demands; *overload* as a feeling of being spread too thin; and *role contagion* as the inability to perform because of worrying about other responsibilities. All the women in the study had jobs and families and were at least 23 years old and enrolled in social work or nursing. Home discovered that, for many of the women in the study, their perceptions of demands on their time were often greater than the actual demands, with single mothers having the greatest overload. Women who had children

under the age of 13 were found to be at greater risk for role overload and conflict. Role overload and conflict was most pronounced in women with the youngest children. Women of low income had greater role conflict than women with higher incomes. Home suggested future studies of adult women include STEM majors.

Vaccaro and Lovell (2010) used a feminist lens to look at the role family plays in an adult woman's persistence in college and self-investment. Vaccaro and Lovell defined *self-investment* as "valuing self enough to believe personal growth, learning and education are needed and deserved" (p. 172). Vaccaro and Lovell interviewed 28 adult women about becoming better people, mothers, and employees in the following majors: computing (14%), communications (39%), and business (45%). Results of the study indicated that, while it was a constant struggle to balance family, work, and health, the women were dedicated to school and committed to persisting. Vaccaro and Lovell discovered these women had strength, resilience, and a strong drive to complete their college degree. The women's stories revealed that the families of these women were what inspired and motivated them.

Several themes emerged from the analysis of the stories of the women in the Vaccaro and Lovell (2010) study. Even if the women in the study had to take time away from school to care for sick family or meet family or employment demands, they always felt engaged and committed to finishing. No matter how demanding life was, the women were driven to find ways to cope and manage that would enable them to successfully complete their degree. The most illuminating finding in Vaccaro and Lovell's study, and one that is in contradiction to other studies, is the women talked about family as an inspiration rather than a barrier or added stress. Vaccaro and Lovell found that "with

commitments to family, work and school pulling at them, women found the energy, time and inspiration for education. Our findings reveal that everyday familial stressors were outweighed by support and inspiration gleaned from family” (p. 170). Vaccaro and Lovell’s review of higher education literature discovered most studies “[fall] short in describing women’s educational engagement when family is seen solely as a distracter or stressor. . . . From our feminist analysis, a new concept called self-investment” (Vaccaro and Lovell, 2005, pp. 170-171) emerged.

Taniguchi and Kaufman (2007) examined data from the National Longitudinal Survey of Youth (NLSY79), a national probability sample of men and women with birthdates from January 1, 1957, to December 31, 1964. The data they used for this study consisted of 9,634 person-years for 1788 women with nontraditional enrollment. *Nontraditional enrollment* was defined as those who never went to college after high school (HS). Taniguchi and Kaufman found that divorced women were significantly more likely than married to enroll as nontraditional students; the presence of young children had a significant negative effect on women enrolling in a four year college, and income a significant positive effect.

In 1997, the attrition for distance education was approximately 70% (Parks, 1997). Reasons for this attrition may include feelings of isolation and a lack of individual attention and lack of support services. For female students, the reasons may also include lack of experience in working with technology and frustration with their inability to use computers (Brunner & Bennett 1998).

A study by Chyung (2007) of 81 master’s level students compared the computer self-efficacy of men and women at the beginning and end of an online course in



instructional technology. Chyung hoped to determine whether, in an online learning environment, gender affected one's self-efficacy toward specific learning topics. The results showed women had a significantly ( $F(1, 77) = 6.32, p < .05$ ) greater improvement (107.45,  $SD = 23.28$ ) than men (90.11,  $SD = 28.11$ ). This improvement in self-efficacy may have been because women started with lower self-efficacy scores than men. While these results show there may be differences, this study was conducted with adults in a master's level program and may not apply across a larger, more diverse population. The paper did not provide enough detail as to the methodology of the study to determine the quality of the study. However, the statistical analysis was given in detail.

Other research into self-efficacy and online learning (Chu, 2003; Hargis, 2001; Tsai & Tsai, 2003) found conflicting results as to whether gender significantly affects self-efficacy in an online learning environment. Because this is a fairly new and emerging field of research, more research needs to be performed before any conclusions can be made.

In summary, studies of nontraditional female learners have found that divorce is a driving factor for women returning to school. Those with small children and the lowest income face the greatest barriers to success. A struggle for women seems to be putting their needs ahead of others, something some women felt they were doing if they returned to school. Women who were successful had some type of support system, were motivated by their family, and were able to recognize their needs mattered. Results are still unclear as to the effect of online learning on self-efficacy in women.

A goal of my study was to gain a deeper understanding of the contextual factors in the lives of the women in my study and how they informed their self-efficacy, goals,

interests, and actions they took in relation to academic and career choices. For this reason, I chose SCCT to guide data collection and analysis. The next section is a review of literature related to SCCT, women and STEM.

### **Social-Cognitive Career Theory**

By examining the literature, I was able to see how SCCT has been used to examine the ways a variety of age groups develop interests, outcome expectations, and career goals (Lent et al., 1994). I used SCCT to gain a deeper understanding of how the lived experiences and contextual factors of the women in my study informed their self-efficacy, interests, goals, and actions in relation to their choice to return to the university to pursue STEM majors and careers.

Lent et al. (1994) used Bandura's (1986) social cognitive theory and "integrated conceptually related constructs and outcomes of academic and career development from well-established and highly used career theories within Bandura's framework" (p. 320) to create SCCT. This theory can be used to find the relationship between interest development, career choice, and performance. SCCT also may be used to explain

the bidirectional interaction of cognitive-personal variables (e.g., self-efficacy, outcome expectations, and goals), external environmental factors (e.g., oppression and socialization), and overt behaviors (e.g., career decision) via feedback loops can either promote or impede career development processes (i.e., interests, choice, and performance). (p. 320)

Ozyurek (2005) used SCCT as a framework for looking at the relationship between mathematics self-efficacy and mathematics interest for a population of 590 students in Turkey. Results showed that a high mathematics self-efficacy and a high interest in mathematics did not predict a preference for a STEM major. This unexpected result may be due to cultural influences. Other studies (Lent et al., 2010; Navarro, Flores,

& Worthington, 2007) indicated that culture may play a role in the results and that further research is needed in this area.

Navarro et al. (2007) researched Mexican Americans' socio-contextual and cultural experiences using SCCT (Lent et al., 1994). Their interest was similar to that of this study in that they used a career theory as a way to learn about the path that leads to women pursuing mathematics and science.

Recently, social cognitive researchers have used self-efficacy and SCCT to understand the role that math and science-related experiences and beliefs play in the underrepresentation of culturally diverse groups in STEM-related academic majors and careers. (Navarro et al., 2007, p. 321)

Navarro et al. continued, "Previous social cognitive research has focused on high school and college students" (p. 322).

Byars-Winston and Fouad (2008) used SCCT (Lent et al., 1994) to examine how parental involvement and perceived career barriers have an effect on mathematics and science goals for traditional college-aged students from two campuses: the first group had an average age of 18.8 and the second group, 19.7. They found "the most frequently listed occupations were registered nurse (8.3%), physician (7.9%), business management (5.6%), and elementary education (4.6%)" (p. 6). They examined the relationship between contextual factors and math- and science-related social cognitive variables: task self-efficacy, coping self-efficacy, outcome expectancies, interests, goal intentions, parental involvement, and perceived career barriers. The results of their study supported the utility of the SCCT model in explaining undergraduate college students' math and science goals and students' perceptions of math and science ability. That study did not examine adult learners for whom, rather than parental involvement, a more critical factor may be family status (single, married, children) and family support.

Schaub and Tokar (2005) used various surveys including the Learning Experience Questionnaire (LEQ), Occupational Outcome Expectation (OOE), and Skills Confidence Inventory (SCI) to perform a path analyses that of the connection between learning experiences and self-efficacy and outcome expectation. Results found learning experiences had a significant ( $p < .01$ ) effect on outcome expectations through self-efficacy as hypothesized in SCCT. The sample in this study consisted of 320 students with a mean age of 20, which is below the defined age of 25 or older for an adult learner returning to school. Therefore, these results could not be generalized to the female adult learner.

Lent et al. (2002) used a qualitative research design based on interviews to examine SCCT factors that affect choice (supports and barriers) and the methods students use to overcome barriers. They looked at both a large state university near a metropolitan city (19 students with an average age of 22) and a small technical college in an inner city (12 students with an average age of 25). They picked two heterogeneous situations in hopes they would “identify a diverse array of contextual influences and barrier-coping strategies” (p. 65). In both situations, the results indicated non-ability was the most commonly cited impediment with financial concerns, ability considerations, and role conflicts mentioned with moderate frequency. Negative social or family influences, negative school or work experiences, and excessive educational requirements were mentioned less frequently as barriers. Because this was a small study, the results are not generalizable.

Most recently, Lent et al. (2010) examined SCCT through a sampling of 600 Portuguese high school students. Data generally supported their hypotheses that self-

efficacy and outcome expectations jointly predict interests and that interests mediate the relations of self-efficacy and outcome expectation and the resulting career choice.

However, they found that social supports and barriers influenced career choice indirectly, through self-efficacy, rather than directly as predicted by SCCT. They indicated their findings may be due to differences in culture and that further researched was needed in cross-cultural validity of SCCT.

Self-efficacy, outcome expectations, and personal goals are the three social-cognitive variables within SCCT. Because a direct path leads from self-efficacy to both outcome expectations and goals (Figure 2), that factor will be examined in more detail.

**Self-efficacy.** *Mathematics self-efficacy* is defined as “an individuals’ judgements of their capabilities to solve specific math problems, perform math related tasks, or succeed in math related courses” (Pajares & Miller, 1994, p.194). Eccles, Jacobs, and Harold (1990) found that “math ability perceptions have strong longitudinal effects (both direct and indirect) on future efficacy related beliefs and perceptions” (p. 68).

Furthermore, Hackett (1985) found that self-efficacy was highly correlated with choice of a math-related major. ACT mathematics score and years of high school mathematics had the highest correlations with math self-efficacy. ACT mathematics scores and years of high school mathematics had a statistically significant correlation and were both strongly correlated with math self-efficacy. According to a path analysis conducted by Pajares and Miller (1994), although there were not gender differences between past experiences, men reported higher mathematics self-efficacy than women.

Although women are the primary caretakers and teachers of young girls, fathers have a clear and important role as well. Davis-Keene (2007) studied 800 children over a

span of 13 years. The results showed that parents tended to provide a more math-supportive environment for their sons than daughters by purchasing more mathematics-related toys for them and interacting in more mathematics-related activities. The outcome of this study demonstrated that, as a fathers' gender stereotypes increase, his daughters' interest in mathematics decreases. According to SCCT, it follows that, if a girl's interest in math decreases, she will not pursue a mathematics-related major, nor will she enter a mathematics-related career. Supportive of this finding is a case study of six families (Bottle, 1998) that found that parents who were more aware of the importance of mathematics tended to spend more time on mathematics activities.

***Vicarious experiences.*** A woman's earliest role models are typically her parents. Bleeker and Jacobs (2004) conducted a longitudinal follow-up study to one conducted by Jacobs and Eccles in 1992. The initial study involved 143 sixth-grade classrooms in a predominantly White area. A total of 2,471 students and 1,380 mothers participated. This study included only participants who remained in the eighth wave of the study in 1996, when the participants were between the ages of 24 and 25 (1,007 students and 354 mothers). Results found children whose mothers reported higher perceptions of their success in math-oriented careers when they were adolescents reported higher mathematics and science career self-efficacy and self-perception of math ability during the 10th grade and higher mathematics and science career self-efficacy 2 years after high school. Females, regardless of whether they attended college, were 66% less likely to choose careers in physical science and computing over nonscience careers when their mothers reported low perceptions of their abilities to succeed in mathematics careers as compared to those whose mothers reported high levels of confidence in their

mathematical skills. Those who were college-bound were almost 4 times more likely to choose careers in life science and business than in physical science and computing.

Throughout their childhood, girls develop beliefs about their abilities and what it takes to complete particular tasks. Through make-believe play, as well as social interactions with peers and adults, girls are learning about gender roles, stereo-types, and what others expect of them. As they progress through these years, they are also having their first experiences with mathematics and dealing with either successes or failures. According to SCCT, how these girls interpret their successes and failures may ultimately affect their mathematics self-efficacy.

Young girls play out learned roles during make-believe play. Eccles (2005) stated that “gender role socialization is likely to lead to gender differences in the kinds of work one would like to do as an adult” (p. 3). Several studies (Eccles, 2005; Hyde & Linn, 2006) have described men as more likely to work with physical objects and deal with abstract concepts while women tend to gravitate toward social interaction and caring roles. These beliefs may later influence what career paths young women take. A person tends to study a major and pursue a career in which they are interested. Brown (2001) hypothesized that

a common reason people become attracted to a career field is that it appeals to their intellect and emotions: they are intellectually aware of the benefits of the work and emotionally committed to the work because of its personal relevance to their lives. (p. 3).

**Verbal persuasions.** One might expect the very first primary verbal interactions to take place between a mother and child. More often than not, in the United States, the mother is the primary caretaker. In a study by Johnson et al. (2000), 84% of the women surveyed were the primary caretakers of their children. According to the U.S.

Department of Labor, Bureau of Labor Statistics (BLS: 2009a), more women than men provide primary child care. Therefore, the messages a girl receives through verbal discourse or verbal persuasions may more likely come from her mother. The words the mother chooses to speak and how the child interprets these words may be central to the person the child becomes. According to SCCT, if a mother, through her speech and actions, consistently conveys the message to her daughter that she is capable and able to be successful in mathematics, then this positive verbal persuasion may lead to higher self-efficacy. Of the four sources of self-efficacy, negative verbal persuasions have been found to be a primary source of low self-efficacy, but verbal persuasion does not increase self-efficacy. Typically, a positive role model will use verbal persuasions along with vicarious experiences (Bandura, 1986).

Portes and Vadeboncoeur (2003) described how the adult-child interaction co-constructs a learning history within the zone of proximal development (ZPD). “Internalization is mediated by cultural tools, such as sign systems and concepts, that are afforded to the child through social interactions, only later to be internalized and transformed for later use” ( p. 374). Research studies cited in Portes and Vadeboncoeur found only a modest relationship between adult-child interactions and the child’s academic performance. However, a recent study by Benson and Borman (2007) on the seasonal effects of learning found that, during the summer months, when students in lower socioeconomic levels were not in school and interacting in their neighborhoods and with their families, the greatest negative effects on academic development were occurring. Benson and Borman discovered that students in high-SES neighborhoods had the equivalent of an entire month of school-year mathematics growth as compared to those in



low-SES neighborhoods. “Neighborhood social context exerted clear and consistent effects prior to school entry and during the summer months” (pp. 26-27).

I explored the role of verbal persuasion on the goals, interests, actions, and choices of the five women in my study. I explored who played this role in the lived experiences of the five nontraditional female students studying STEM in my study. The role of verbal persuasion has not been explored in this way in prior research.

***Physiological and emotional state.*** A woman may face gender discrimination because of cultural perceptions and societal views related to women and mathematics. In 1977, a study was conducted asking participants to identify personality and behavior characteristics as being typical of either men or women. The results identified men as

independent, objective, unemotional, dominant, competitive, active, skilled in business, self-confident, ambitious, frequently taking the lead and having a liking for mathematics and science. On the other hand, a normal female was considered to be submissive, easily influenced, not adventurous, dependent, subjective, excitable in a crisis, conceited and having a dislike for mathematics and science. (Harding, 1996, p. 7)

Brown (2001) investigated girls’ need for relationships and socialization with views of mathematics and technology-related careers. She suggested that a factor contributing to a downturn in the number of females who pursue technology-related careers may be that girls view these as solitary jobs with little interaction with other people. If relationships and social interactions are important to women, then the perception of technology as solitary would possibly dissuade them from this career path. This study explored whether any of the lived experiences of the adult women in this study enabled them to see that pursuing a STEM major and career did not mean a life of solitude.

**Summary of SCCT.** In summary, studies have examined the relationship between self-efficacy and environmental factors and how they relate to girls' goals, interests, and outcome expectations related to STEM. However, the literature is lacking in research related to nontraditional female students. Studies support the importance of role models and prior mastery experiences in the development of a girl's interest in STEM. My studied examined how childhood lived experiences, as well as those in adulthood, influenced the self-efficacy, goals, interests, actions, and choices of five women in relation to academic and career choices.

The review of literature of SCCT theory revealed that a large amount of research has been done supporting the application of the theory to women from middle school to traditionally aged college students related to STEM. However, little to no research has been performed using nontraditional female students returning to the university to study a science, technology, engineering, and mathematics major as the sample population.

### **Summary of Literature Review**

In summary, several studies used SSCT to examine the influence of contextual factors on interest and choice. All but one study supported SCCT. Of the six studies reviewed, two used SCCT to predict outcome expectations. Only Byars-Winston and Fouad (2008) used it to predict goals and perceptions. The populations ranged from middle school through traditional college aged students of a variety of races and income levels.

While some qualitative studies have used SCCT as a framework, most studies used a quantitative research design. Data collection typically consisted of using surveys with path analysis used for data analysis. A wide range of studies have been performed

using SCCT as a framework and testing it under various demographic conditions. Although most of the studies have applied SCCT as a framework to look at career goals related to STEM majors, few, if any, have used nontraditional female students returning to the university. A review of the literature verified the gap in research in this area.

Themes that emerged for women as nontraditional students and in computer-related majors included a sense of self, strength, and determination. For female nontraditional students, having a low income, having small children, and being a single mother emerged as the greatest hurdles while a support system and high income helped women overcome barriers. Young women consistently referred to computer-related majors as being “nerdy,” uncool, and antisocial while women with some computer-related work experience saw a computer-related career as a viable and appealing path. A review of the literature showed that little to no research has examined women as nontraditional learners studying STEM majors.

The vivid description of portraiture enabled me to gain a deeper understanding of how the lived experiences of the five women in this study influenced their self-efficacy, interests, goals and outcomes related to their belief STEM was a viable option for them. This vivid description can provide researchers with insights into exploring social interventions that may eliminate negative views and barriers. The factors affecting self-efficacy, interests, goals, and actions are complex, and the thick description provided by portraiture provide insights that a quantitative study alone could not. These insights will lead to a deeper understanding of how lived experiences affect women over time in terms of their beliefs about their ability to successfully pursue a STEM major and career. Listening to the way the women in my study spoke about their lived experiences through

the lens of SCCT helped me understand how they perceived themselves and the world in which they lived (Gilligan, 1982).

### Research Question

The primary research question guiding this study was as follows. What are the lived experiences of a nontraditional woman returning to college with regard to pursuing STEM-related majors and careers? The following two subquestions were also addressed:

1. What are the sources of self-efficacy in this pursuit with regard to their choice of major and career?
2. What are the supports and perceived and real barriers in this pursuit with regard to their choice of major and career?

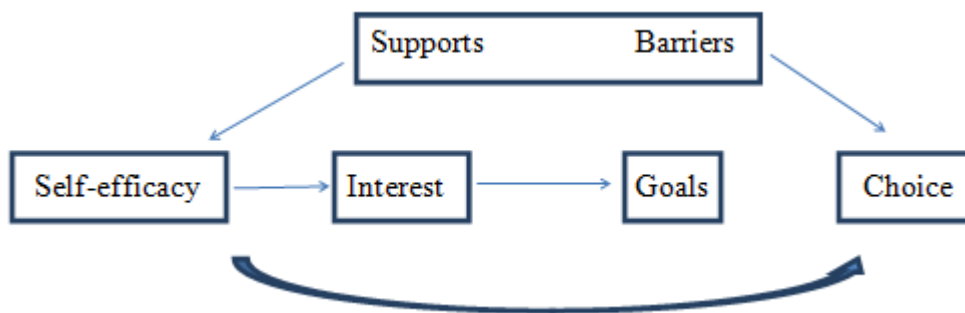


Figure 6. Path to choice.

## Chapter 3: Methodology

### Study Description

The purpose of this study was to explore how the lived experiences and contextual factors of five nontraditional female students informed self-efficacy, interests, goals, and actions in relation to choosing to return to the university to study STEM at an online college. I used the portraiture methodology to gain a deeper understanding of how the women described their paths to STEM majors within the context of the worlds in which each lived. The goal of this study was to gain a deeper understanding of how the lived experiences and contextual factors of the women informed their self-efficacy, interest, goals, and actions as they related to pursuing STEM-related majors and careers.

Portraiture “seeks to record and interpret the perspectives and experiences of the people they are studying, documenting their voices and their visions-their authority, knowledge and visions” (Lawrence-Lightfoot & Davis, 1997, p. xv). I created portraits of five nontraditional female students who, despite difficulties earlier in their lives, had successfully navigated the path to pursuing a STEM-related major and career.

Prior research using SCCT has been primarily quantitative. I chose a qualitative approach to examine the themes in greater depth and detail (Patton 2002). In addition, my research question explored the lived experiences of five nontraditional female students returning to the university to study STEM, a population not previously researched with this model. I wove tapestries of the lived experiences of the five nontraditional female students in my study and their perceptions and social construction of reality, beliefs, and views of a world in which women may or may not believe a STEM major is a viable option (Patton 2002).

## Site

**Context.** Context includes framing the terrain, setting the site, and priming the canvas. Lawrence-Lightfoot and Davis (1997) described context as “the setting-physical, geographic, temporal, historical, cultural and aesthetic” (p. 41). A portraitist views “human experience as being framed and shaped by the setting” (p. 41). The internal context or physical setting should enable the reader to feel “the contours and dimensions of the terrain . . . feel placed in it, transported into the setting” (Lawrence-Lightfoot & Davis, 1997, p. 45). I placed the women in my study in the larger context of the environment that shaped them by collecting data from multiple sources.

The college is a public state university with multiple campuses. It provides undergraduate and graduate studies through a flexible model of online, blended, and individualized face-to-face courses. The college offers associate, bachelors’, and masters’ degrees. Business had the highest enrollment followed by community and human services.

In 2010-2011, the mean ages of undergraduate students were 37.1 for women and 34.5 for men. The college awarded 198 STEM degrees, 6% of the total degrees awarded. The retention rate for STEM was 46%, which was slightly higher than the undergraduate rate for the entire college (41%). The overall college retention rate for women was 48.9% and 42.4% for men. The overall median time it took students to complete their 4-year degrees was 2.73 years, with STEM students taking a median time of 2.67 years. In 2010-2011, 13,272 students received some type of grant, and 12,359 received loans. The college is different from other typical undergraduate schools in that

it does not offer graduate degrees in any STEM subjects. The college also does not currently offer degrees at the PhD level.

By sampling women from the same college, I minimized college differences in course offerings, school environment, and available student services support. The college has a population that is similar to the U.S. nontraditional student population, and its primary target population is nontraditional students. In a national survey by the Lumina Foundation (2010) of 1500 students, the average age of a nontraditional student was 37 in large schools such as the college, and top fields of study were (a) management, business, and marketing and (b) arts, humanities, and social sciences. In this survey, a sizable proportion of students identified themselves as Caucasian (69.1%), African-American (22.7%), Hispanic (3.3%), “other” (2.6%), and Asian or Pacific Islander (2.4%). At CSE, about 61 percent of undergraduates are White, Non-Hispanic; with 13.5% African-American, Non-Hispanic; and 5.6% Hispanic. At the college, 18% of the students chose not to identify themselves.

**Classroom environment.** Prior to their first enrollment, students are required to take an online student tutorial that introduces them to the Angel Learning Management System (LMS), available student services, and the library. At the start of each course, there is typically an “icebreaker” discussion in which students are asked to share some background information. They are also able to upload a picture and include personal information in the profile section. Students enrolled in the distance learning campus experience everything entirely over a virtual learning environment (VLE). That is, all teaching, mentor, and instructor interactions; student support services; and administrative-related functions occur online. All course communications typically take

place within the learning management system (LMS) and consist of online discussions, e-mails, course announcements, the student lounge, the Ask a Question area, and messages in the private folder. Occasionally, a student and instructor may need a more personal discussion over the telephone. More recently, instructors have begun incorporating Web 2.0 tools, such as Elluminate, Skype, Google Apps, Diigo, Facebook, and Twitter.

Each student has an account that is password protected. Messages posted in public places such as the discussion area or Ask a Question can be seen by everyone enrolled in the course. Messages posted in the private folder can be seen only by the instructor and through e-mail only those on the distribution. Online discussions that take place in Angel are threaded discussions accessible only by students actively enrolled in the current course offering. Students are typically expected to make one original post and reply to two classmates in each discussion. Some instructors include a rubric to guide the response expectations.

### **Sample**

My rationale for choosing a small sample size is grounded in Lawrence-Lightfoot and Davis' (1997) portraiture methodology. They suggested that a single researcher select a smaller group of participants to ensure they have the time to develop and build a relationship of trust. Based on the literature I reviewed and the amount of data I collected, I believed that five participants provided enough data to analyze while still enabling me to explore a range of experiences and paint an in-depth, meaningful portrait of each participant (Abri, 2006; Ashby-Scott, 2005; Moran, 1998; Rivera, 2006; Semon, 2009). In addition, from an ethical standpoint, I did not want to collect more data than I intended to use from more participants.



During the fall 2011 semester, I recruited five nontraditional female students of upperclassman status attending the college and studying an advanced-level STEM course to interview for my study. Because the participants were nontraditional students, I used the college definition of an *upperclassman* rather than year of enrollment. For example, a student could be in his or her first year at the college but already have 96 credits.

According to Horn and Carroll (1996), nontraditional students can be determined by the number of characteristics they have and are considered to be (a) “minimally nontraditional” if they have only one nontraditional characteristic, (b) “moderately nontraditional” if they have two or three of these characteristics, and (c) “highly nontraditional” if they have four or more.

Nontraditional students may be defined in a range from minimal to high risk of dropping out. A student of average moderate risk has two to three characteristics of a nontraditional student, and high risk students have greater than three characteristics, including being a minority, having financial need, working more than 20 hours a week, and being a single parent (Breneman et al., 2007). Table 1 shows the associated risk factors for each of the participants in my study. Only Luisa was at high risk for dropping out. Addressing trend enrollments of nontraditional students from 1986 to 1992, NCES (1996) indicated that such factors as single parent, SES, and working full-time were not directly related to persistence. However, these factors may be indirectly related to persistence because the student may have to be part-time (a factor found to be directly related to a lack of persistence).

To explore the experiences of nontraditional female students who had been successful studying STEM, I selected my sample from upperclassman women enrolled in

advanced-level STEM courses. Women in their first semester or in an introductory mathematics class would not have been enrolled long enough for me to learn about their support network and perceived and actual barriers. The women in my study had been successful, allowing me to gain deep insights into their experiences and the path they had taken so far. My goal was to create five individual portraits that would provide guidance, advice, and in a sense, a role model for other women.

After getting IRB approval and permission from the institution and instructor, I initiated the process of participant selection. I began by reviewing the course catalog, which is publically available online. Doing so enabled me to determine which advanced-level STEM courses were being offered in the fall 2011 semester. Next, I contacted the area coordinators of each department, whose names and contact information are publically available on the college website. I explained to them the purpose of my research and asked their permission to post a recruitment message in the courses that met my requirements (advanced-level STEM, offered fall term). The area coordinator then put me in contact with the instructors of the courses. Next, I explained my research to the instructors and asked their permission to post in their courses. All but one instructor gave me permission.

Table 1

*Participant Risk Factors Associated with Nontraditional Students Dropping Out*

Participant	Age	Marital status	Children	Employment	Financial aid
Angie	23	Married	No	Military language analyst 40+ hrs./week	Military covering cost
Jeanie	28	Married	No	Medical Assistant/Spanish Translator 41.5 hrs./week	Federal loans, scholarships, some out of pocket
Alice	32	Engaged	No	Computer Service Delivery Manager 50-60 hrs./week	Federal loan, some out of pocket
48 Rosa	41	Married	No	Sommelier* 40-50 hrs./week	No, out of pocket
Luisa	44	Divorced	Yes Ages 21, 18, 17	Administrative Support 40 hrs./week	Federal and state loans and grants

\* Unemployed at time of interview

I recruited students by asking the instructors of the selected courses to post a message and video about my study in the course bulletin board. The message and video explained the purpose of my study and let all the students know I would be asking their permission to view online activity. I answered any individual questions through course e-mail. Students agreeing to be participants signed a consent form allowing me to view online activity, including discussion posts, the student lounge, and the Ask a Question area in the course management system. I observed the online course interactions of only the students in my study. Student interested in participating in the study filled out a short demographic survey that included questions related to my selection criteria.

I planned to use a maximum variation sample for this study (Creswell, 2007; Patton, 2002). A strength of this type of purposeful, non-probabilistic sampling strategy is that any common patterns or themes I might have found would emerge from a heterogeneous, although small, sample. My initial call for participants resulted in only seven potential participants, of which only six met the requirements of the study. Because I initially wanted to have seven participants and planned to use the maximum variation sample method, I was hoping to have a pool of potential participants from which to select. I chose to post my recruitment information again in additional courses.

I did find a second potential participant in this round; however, she was a business student so did not meet the selection requirements. Thus, a limitation of this study was my inability to use the maximum variation sampling technique and have a more diverse pool of participants. Of six participants, only five completed the study, and only one was a mother. Because of the time requirements of my study, I believe students with small

children, both married and single, may have felt they did not have the time to commit to my study.

Based on their responses, I personally invited those women who met my selection criteria to be in my study. I set up a time to meet individually with those women interested in participating in my study and provide them with additional information related to participating in the study. I conveyed the following information:

- The reason they were selected,
- That their identities would be kept confidential,
- The length and number of interviews,
- That they would be asked to journal about their experiences in the course from which they were recruited,
- That they would be asked to create artwork about their experiences as a mathematics student (e.g., collage, drawing, painting, online drawing tool).

They were informed that they would be asked for their permission to record the interviews. As part of the recruitment message, potential participants were told they would receive a \$50 Amazon gift card as compensation for their time. This incentive was approved by IRB. Pseudonyms were used in the portraits to protect the identity of the participants.

### **Data Collection**

Sources of data included reviewing data such as demographics and prior research, three in-depth interviews, three journal entries, two pieces of artwork, observation of online interactions (only from students who agreed to participate in the study), document

review, and instructor and mentor interviews. Not all sources of data were collected for each participant, due to individual constraining schedules. (See Table 4).

**In-depth interviews.** Eisner (1998) described interviews as “a powerful resource for learning how people perceive the situations in which they work. . . . [C]onnoisseurship is aimed at understanding what is going on” (p. 82). I interviewed the five participants in a place where they felt comfortable and safe, provided an assurance through the informed consent of confidentiality, and gained their confidence in me as a researcher and in the importance of their story to society as a whole. Doing so enabled me to create a setting that encouraged “expression of strength, . . . vulnerability, weakness, prejudice, and anxiety” (Lawrence-Lightfoot & Davis, 1997, p. 141) during interviews. I used a semistructured interview protocol (Appendix C).

I conducted three interviews with each participant except one, each interviewing lasting approximately 90 minutes. (For personal reasons, Alice was unable to participate in the third interview.) Table 2 shows a summary of the participant interviews and whether they were face-to-face or over Skype. All interviews took place during the semester following the course I was observing. All the students but one had completed the course I was observing. Prior to the first interview, I established a relationship built on mutual respect and trust through phone calls and exchanging e-mails and text messages. I began this process by carefully explaining to the participants what would be required of them and the purpose of my study. I then assured them I would not ask them to do anything beyond what they committed to and that my questions were directly related to my research questions. While my intent was not to keep them beyond the

agreed-upon 90 minutes for an interview, I discovered that they became so involved in telling their stories they frequently went over the 90 minutes.

Table 2

*Summary of Participant Interviews*

Actor	Interview 1	Interview 2	Interview 3
Angie	Skype Video/sound	Skype Video/sound	Skype Video/Sound
Jeanie	Skype Sound	Skype Video/sound	Skype Video/sound
Alice	Face-to-face	Face-to-face	N/A
Rosa	Face-to-face	Face-to-face	Skype Video/chat box
Luisa	Face-to-face	Face-to-face	Face-to-face

I met with Alice, Rosa, and Luisa face-to-face. Alice invited me into her home, which I saw as an expression of her level of comfort, safety, and desire to share all of herself. I interviewed Jeanie and Angie. Jeanie took photos and video and sent them along with thick, rich descriptions of why she shared each piece of her life.

My interview questions were adapted from those used in a study using portraiture methodology; a study design about the life history of women scientists and studies using a social cognitive theoretical framework. I used interviews to “capture how those women being interviewed view their world...to capture the complexities of their individual perceptions and experiences” (Patton, 2002, p. 348).

As I developed my interview questions, I reviewed research designs based upon portraiture methodology to gain a deeper understanding of the interview process and structure of interviews. Because I was exploring the life history of the women in my

study, I reviewed research designs related to exploring life history to gain an understanding of chronology and types of questions used to help the participant remember without leading and research related to SCCT to ensure I collected the data I needed to answer my research questions. Table 3 shows which interview questions were a source for each part of my research question.

While I viewed the participants as “knowledge bearers, as rich resources, as the best authorities on their own experience” (Lawrence-Lightfoot & Davis, 1997, p. 141), I used a semistructured interview format and probing questions to ensure all participants were asked the same questions and that I obtained all the data I needed to answer my research question. By following the chronology of life history, I obtained data that cover the entire span of lived experiences of participants and create a full picture of how their experiences shaped their self-efficacy, interests, goals, outcome expectations, supports, perceptions of barriers, and actual barriers.

Zeldin (2000) and Zeldin and Pajares (2000) designed interview protocols for self-efficacy studies by examining sources of self-efficacy surveys and consulting with researchers who had expertise in the area of self-efficacy. Usher and Pajares (2009) completed a study assessing questions related to the four sources of self-efficacy.

Developing questions based on those studies brought credibility to my findings.

There are four hypothesized sources of self-efficacy that both Zeldin (2000) and Zeldin and Pajares (2000) explored. Zeldin (2000) specifically explored career self-efficacy. Past research has shown that mastery is the most significant source of self-efficacy. There is little prior research on how the lived experiences of nontraditional female students influences their self-efficacy as it relates to studying STEM, so there is



little literature to indicate what experiences might be most significant or what I might want to focus on. Usher and Pajares (2009) performed an analysis of self-efficacy survey questions that I reviewed as a source of questions for this study. During data collection and analysis, I remained open to the idea that a source other than mastery may turn out to be most significant for the participants. The review of literature indicated the conflict in balancing work and family for nontraditional female students and women in STEM careers. For this reason, I included questions related to self-efficacy and work-family conflict.

Eisner and Powell (2002) suggested conducting an interview more like a conversation, without explicit criteria but letting the data speak to the researcher. I designed my protocol to avoid leading the participants, rather letting them lead the conversation. Thus, as themes emerged, they were not initiated by my questions (Ashby-Scott, 2005; Zeldin, 2000; Zeldin & Pajares, 2000). This approach enabled me to see which experiences surfaced first and which memories were the most vivid.

Because I had never conducted my own interview I closely reviewed literature on interviewing in order to get a picture in my mind of how it might unfold. Eisner and Powell (2002) suggested that approaching the interviews as conversations would give them a “natural and organic quality” (p. 137). In reading through excerpts of interviews by Eisner and Powell, I saw how they used brief guiding questions to keep the conversation moving forward. They were not turning the conversation to a different question or topic, but following the participants' lead and getting them to provide a richer description. Giligan says an interview should feel as “if you are asking a question you are not interested in then you are playing a role and the other person will play the

corresponding role. . . . [F]eel the shift from that kind of role-playing to a real conversation, driven by a genuine curiosity and directed towards trying to understand or discover something with another person” (Kiegelmann, 2009, para. 29).

Reissman (1993) discusses how “Certain kinds of open-ended questions are more likely than others to encourage narrativization. Compare ‘when did x happen?’ which asks for a discrete piece of information, with ‘tell me what happened,’ which asks for a more extended account of some past time” (p. 54). This is also the type of questions Ashby-Scott (2005) used in her portraiture study. Reissman further stated, “Respondents (if not interrupted with standardized questions) will hold the floor for lengthy turns and sometimes organize replies into long stories. Traditional approaches to quality analysis often fracture these texts in the service of interpretation and generalization by taking bits and pieces, snippets of a response edited out of context” (p. 218).

As suggested by Eisner and Powell (2002), I tried not to feel compelled to ask my questions. Holding back in this way was especially hard during periods of silence. While it was tempting to immediately fill the empty air with one of my questions, I waited to see if the participant first had any additional thoughts to share before guiding us to a new topic.

I started my first interview by reviewing: (a) the informed consent, (b) what would be asked of the participant, (c) the participant's pseudonym, (d) her right to drop out of the study, and (e) how I would maintain confidentiality of the data. One of my primary goals for the first interview was to create a relationship between the participant and me as co-constructors of her portrait. I found that through interactions prior to our interview we had already begun to create a relationship even before the first interview.

Once I asked my first question, I was amazed at how easily and quickly each of the interviews just naturally flowed like a conversation. There was such a feeling of comfort that it was easy for me to follow their lead and use my probing questions to guide them toward any topic they didn't bring up themselves.

The topic of the first interview was personal experiences and family background; the second interview focused on educational experiences during their K-12 years and through college the first time; and the final interview focused on their professional experiences and the time "in between." I found that many of the topics crossed interviews as participants talked about their experiences. I used my interview guide to ensure that I covered all the questions related to the topic I intended on covering.

At each stage of the interview, I asked appropriate questions related to sources of self-efficacy, outcome expectations, and supports and barriers. Overarching topics included asking them to tell me about (a) lived experiences that may have influenced their choices in some way and (b) sources of self-efficacy, supports, and perceived and actual barriers. During each interview, I asked the participant about interpretations I made during observations of her online classroom interactions, journaling, and artwork (when I had the journals and artwork before the interview). See Table 4 for a comparison of when interviews took place and journaling and artwork were completed. I provided the participants with a rough draft of their portraits between their second and third interviews and following the final interviews. They provided feedback on both factual accuracy and my interpretations through e-mail and by commenting within the document itself. I also gave them the opportunity to ask me to remove anything they felt might identify them.

After each interview, I reviewed the data numerous times looking for emerging themes. As soon as possible after the completion of each interview, I took time to reflect upon the interview, review my field notes, and document my thoughts in my impressionistic record (Lawrence-Lightfoot & Davis, 1997). Although I found the notes from my impressionistic journal very helpful in ensuring I did not forget important details, I was surprised at how much of an impression each interview left with me. I quickly found myself reliving the moment and vividly remembering the tiny nuances, facial expressions of participants, and the feelings that I had during the interview.

**Artwork.** I used artwork as an additional source of data as suggested by Lawrence-Lightfoot and Davis (1997) and Eisner (1998). Eisner referred to artwork as an alternative form of data representation. When discussing how artwork fits into the participant's story, he wrote, "First, we tell stories. Stories have particular features. Stories instruct, they reveal, they inform in special ways. We also use pictures. Pictures depict. They do many things; among the most obvious: They show us what things, places and people look like" (p. 5). Simons and McCormack (2007) described the use of artwork as being "open to new ways of seeing and understanding. In using the creative arts we are challenged to engage differently with the data and to see differently" (p. 295). Eisner and Powell (2002) explained that creating art is a purposeful human endeavor. He stated,

Work in art is typically directed by an idea that is realized in the material and through the form that the artist creates. These ideas can be large or small, important or trivial; they can reveal what has gone unseen, or they can put the familiar into a context in which it can be re-seen in a new and vital way. The artist can comment on or celebrate a slice of the world. (p. 51)

I found that the artwork added a perspective to the portrait and found it enlightening to see what images the participants chose to represent their feelings.

Newton (2005) used graffiti mats and poetry to bring out the underlying nuances in the stories of her participants. Newton described how artwork adds to the portrait as

anger was the hue, but what was the intensity? Did it look like cadmium red, or was it more of an alizarin crimson? Achieving the right colors on the palette is important-because colors could help me portray the very mood of the portrait. (p. 87)

Furthermore, Eisner (1998) described how one might use a numerical value for temperature to represent to the reader how hot something is. The writer of the story expects the reader to translate the number into an experience. What does it feel like to experience a certain temperature? The previous example of using color to represent a feeling demonstrates how alternative forms of data representation enable the portraitist to find new ways to represent concepts such as heat and anger. Doing so helps the reader interpret what the participant was experiencing.

Galman (2009) suggested having the participants draw a visual narrative as a way to get at the essence of their story. Galman stressed that we cannot ethically make a participant draw, so I needed to be aware that some of the participants may be uncomfortable drawing. For this reason, I gave them a choice among drawing, making a video, painting, or constructing a collage.

When deciding what forms of art work to use, I looked to the following questions posed by Eisner (1998): “What functions do such forms serve? Do we really need them? What are we trying to accomplish with these excursions onto the edge” (p. 6). Eisner stressed the importance of ensuring the selected artwork had substance and added to the portrait, that it was not simply used for the novelty. Ensuring the artwork added to the portrait is something I gave a great deal of thought to, and it took several iterations before

I felt I had composed a question that would elicit artwork with substance and meaning with respect to my research question.

Before the first interview, I asked each participant to use her choice of artwork, either by hand or computer generated, to draw a timeline of the experiences she perceived as having affected her academic decisions. Each of them asked me exactly which events I wanted them to include. Because my goal for this piece of artwork was to see what experience came to their minds as so significant that they wanted to include them on a timeline of their lives, I did not want to tell them what to include. I tried to guide them by suggesting they think about the lived experiences they perceived as having most significantly influenced their educational choices throughout their lives.

I found that each of the women was unsure how to approach creating the timeline. I sent them links to several online tools and suggested they could simply create it in a Word document. I discovered that, not only were none of the participants able to complete the task prior to the first interview, but also it took several gentle reminders over a period of 2 months. They were busy with work, school, and family and simply just forgot or did not grasp to the request. At our first interview, each expressed how badly she felt about not completing the task. I had the sense that doing what was asked of them and not letting others down was important to each of them. I also had the sense that sharing their stories and helping me reach my goal was a priority for them.

A concern of mine prior to the start of the study was that the women might be apprehensive about drawing. For this reason, I planned to allow them to choose the type of artistic rendition they would create, suggesting it could be a collage, drawing, or painting. Although I expected some apprehension, I was surprised at how each of them

reacted when I suggested they draw something. The reaction reminded me of how someone else might act if asked to do a mathematics problem on the spot. The fear in their eyes was that of a deer looking into headlights.

After the first interview, I asked them to create an artistic rendition of how they perceived themselves in the world of STEM. I asked them to think back to how they felt in a mathematics classroom and draw a picture (using an online tool or paper) that emulated that feeling. My goal was for the artwork to enable me to understand further the essence of their stories by enabling me to see feelings the women may not be able to describe in words. “When participants have the opportunity to portray their experience through different art forms, they often reveal insights that they cannot articulate in words” (Simons & McCormack, 2007, p. 297). It also took several months and gentle reminders before I received the artwork. (See Table 4 for which participants completed the artwork and the timing of their submissions).

At the next interview, each of the women again apologized for not completing the task. Participants who did complete the collage either e-mailed it or mailed a hard copy to me. (Rosa was having computer problems and did not have access to a computer to create a collage or scan the one she made by hand.) During our second interview, Alice told me that she could not draw me a picture on paper but she would draw me one with words. She then went on to vividly describe how math is like a rollercoaster ride.

When analyzing their artwork, I looked for contrasts between how they remembered their experiences during our interviews and how they depicted them in their artwork. I looked for symbols that characterized the philosophy, values, and visions of the lived experiences of the women in the study.

The artwork served as an additional form of data and a form of triangulation to increase the credibility of my study. My original intent was that they would complete their pictures before our second interview. Creation of their collages after the second or third interview may have influenced what images came to mind. Originally, they would have created the rendition of their image in a mathematics classroom before we talked about it in our interview. It was still enlightening to see what experiences were so meaningful that they chose to include them in their collage and how they expressed that experience through art.

**Journal writing.** The participants created three journal entries that served as an additional form of data collection. I planned to have them respond to journal questions after each of the interviews. Again, because of time constraints, the participants were not always able to meet this schedule or complete all three entries (see Table 4). I asked the participants to write in journals as a way to reflect on a deeper level about their experiences as nontraditional students. Clandinin and Connelly (2000) referred to journals as “a powerful way for individuals to give accounts of their experiences” (p. 102). They described deeper reflection as “an intimately reflective puzzling quality . . . a way to puzzle out experience” (p. 103). I e-mailed the participants the journal prompts (Appendix D), dividing the questions into three separate e-mails. The purpose was for participants to reflect on (a) why they returned to school, (b) what their classroom experiences in the course I was observing were, and (c) what their experiences at the college had been like. They e-mailed their responses back to me.

The journal prompts began by asking about their experiences when they first returned to school and moving forward to how they experienced the course I was



observing. Journal prompts included questions related to the four sources of self-efficacy and supports and barriers they may have perceived (see Table 3). Prompts included asking the participants about any time they needed to seek support services, their belief in their academic abilities (in general and specific to mathematics) when they first returned to school and in the current course, and relationships and interactions related to other students and the instructor. Because we touched on some of these concepts during our interviews, I was not sure what the participants would choose to include in their journal entries. I was curious whether they would simply rewrite much of what we had already discussed or delve more deeply because of having the time to reflect further. I was elated as I read each of their first journal entries. Each of the participants mentioned how the interview had brought certain experiences and memories to the surface and that, after having time to reflect, they were able to remember additional details and make connections between their experiences as an adult and those as a child. (The journal protocol is in Appendix D.)

Journal responses were triangulated with interview responses from the mentor and the instructor. Doing so enabled me to compare and contrast participants' perceptions of their self-efficacy and the classroom and college environment with those of their instructors and mentors.

**Online observation of classroom interactions.** Patton (2002) described the purpose of observation as allowing the researcher the “opportunity to see things that may routinely escape awareness among people in the setting” (p. 262). It is also “the chance to learn things that people would be unwilling to talk about in an interview” (Patton, 2002, p. 263). Observation of online classroom interactions gave me an additional form of data

collection and the opportunity to observe the kind of experiences the participants had in their online classroom. Eisner and Powell (2002) stressed the importance of understanding the experiences students had in the classroom. Because my inquiry was focused on nontraditional female students who chose to study STEM online, understanding the experiences they had in the online classroom was critical to answering my research question. Eisner suggested focusing on the following questions:

- [1.] What do students make of their school experience?
- [2.] What is their school experience?
- [3.] Where do their epiphanies come from? Do they have any?
- [4.] Where do their frustrations reside? How do they deal with them?
- [5.] What kind of relationship do they have with their teachers? (p. 143)

I kept these five concepts in mind as I developed my observation protocol and analyzed the data. Observation of participants' online interactions served three purposes: (a) to see how the participants experienced their online classroom, (b) to gain a deeper understanding of the role the verbal exchanges that took place within the classroom played in their experiences, and (c) triangulation of data. By observing their online interactions, I was able to see whether the way they perceived their self-efficacy aligned with the way they actually acted in the online classroom. I looked for words of encouragement or discouragement (verbal persuasion), examples of a role model (vicarious experiences), responses that may cause stress or anxiety for a participant (physiological), or responses that in some way reinforce a student's academic ability (personal accomplishment). In addition, I looked for examples of participants seeking such support as reaching out to student services or encountering barriers, such as not being able to complete assignments on time because of difficulties balancing school, work, and family.

I was looking for examples of mastery; vicarious experiences between participant and instructor and participant and peers, any instances that illuminated stress or frustrations they were experiencing, and examples that demonstrate supports or barriers (e.g., gender issues, asking for help). Observations included online discussions, Ask a Question area, student lounge, and e-mails between instructor and participant (with those who gave permission). As I made my observations and saw what data were available to me, I made some changes to my observation protocol. Because I had permission only from the participants in my study to observe their online interactions, I could not look at replies from other students. Not all the courses had the same types of discussions. One course had only a homework help discussion, so if a student did not have any questions about the homework, he or she did not need to participate. Some discussions asked a student only to post an article and summarize it.

Initially, I planned to observe discussions from the beginning, middle, and end of the course. After looking at the discussions, I felt it made more sense to select the discussions that offered the most interaction and opportunity to listen for sources of self-efficacy, seeking support, or indicating barriers. The icebreaker discussion was a good source because it gave the opportunity for participants to introduce themselves to the class. It was enlightening to see what they shared and how they chose to present themselves. When a final reflective discussion existed, it was a good source of data because the participants were asked to reflect on their experiences in the course. I looked for an additional discussion question that required some kind of cognitive thought so that I could listen for things like how confident the participants appeared to be in explaining something or stating their opinions.

The focus of my observations was on what was actually happening in the online classroom. My observations of the online discussion took place after the course was over, so I was not experiencing it as the course unfolded and was not able to ask participants questions concerning their experiences as they were happening. Eisner (1998) suggested an observation schedule when the researcher is concerned with things such as frequency of an occurrence. In this study, I wanted to “describe or interpret the meaning, the relevance, or the appropriateness of something” (p. 178) and therefore did not use an observation schedule in which I could track the number of instances something occurred. As suggested by Eisner, I noted in my impressionistic journal everything I thought at the time was important and the emotions and thought that emerged as I was observing. Because the class was online, I could go back at any time to observe and “re-live” the moment, so it was not as critical that I take detailed notes about interactions and what was happening in the classroom. As a new researcher, I found it difficult to know initially what was important and what was not while searching through the large amount of discussion data. The more I worked with the data and moved through the data collection and analysis cycles, the more I was able to see what was important to my study, enabling me to narrow the discussion posts to those meaningful to answering my research question and sort my way through what was interesting, but not relevant.

When observing a classroom Eisner (1998) suggested the researcher focus on quality of content, variety of forms of representation, incentives employed, and quality and form of student engagement. I was not assessing the teacher specifically but observing how each of these dimensions influenced the experience of the participants.

When observing participants' online classroom interactions, I was not looking for instances of engagement. I observed only the experiences the participants in my study were having as they related to my research questions and tried to form an image of their overall classroom experience. A behavior I did look for as an additional form of data collection and triangulation as I observed was when and how often the participants posted in the discussion. If I saw the participant always posting late and posting the minimum number of times or less, I could compare that behavior with her perception of her ability to balance and any mention of stress, anxiety, or frustration. During interviews and review of drafts of their portraits, I asked the participants to interpret my perceptions.

As an educational critic or connoisseur, I evaluated the educational significance of my observations of each of the participants (Eisner, 1998, Uhrmacher, 1993). My goal was that these observations would offer the participants, other women, educators, administrators and policymakers some insight into the previously mentioned dimensions, how students experienced the online classroom and the college, self-efficacy, and needed supports and barriers faced. The goal of an educational critic is to "contribute to the enhancement of the educational process and through it the educational enhancement of students" (Eisner, 1998, p. 114). In my conclusion, I offer guidance not predictions (Uhrmacher, 1993).

As I made my observations, I was open to any themes, rituals, or metaphors that emerged within the online classroom. For example, during the interviews, a theme of caring and wanting to help others emerged. I saw this same theme emerge in my observations of online interactions. Each of the participants reached out to her classmates, offered to help, and answered questions classmates posted. The participants who came

across as strong, confident, and focused expressed these same attributes in discussion posts related to team projects and peer review of assignments. The observational data I collected were used in structural corroboration and convergence of emergent themes (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997).

Table 3

*Data Source*

Data Source	Number items	Research Question	Sources
Interview	12	Q1: self-efficacy	PA: 3; VP: 3; VE: 3; PH: 3
Interview	12	Q2: supports and barriers	Supports: 6; barriers: 6
Journal	8	Q1: self-efficacy	PA: 2; VP: 2; VE: 2; PH: 2
Journal	4	Q2: supports and barriers	Supports: 2; barriers: 2
Artwork	2	Q1/Q2: self-efficacy and supports and barriers	PA: 1; VP: 1; VE: 1; PH: 1  Supports: 1; barriers: 1
Observation	10	Q1: self-efficacy	PA: 3; VP: 4; VE: 2; PH: 1
Observation	9	Q2: supports and barriers	Supports: 3; barriers: 6

I took notes of first impressions, things that surprised me or that reminded of a personal experience in my impressionistic journal (Lawrence-Lightfoot & Davis, 1997). I captured what I was thinking and feeling during the interviews and what my immediate interpretations were. I then noted whether my interpretations changed or questions arose each time I listened to the participants' stories. By collecting data from multiple sources

I was able to highlight specific events representative of the past, present and future that illustrate their journey and a view of their “philosophical roots and direction, ideological and historical past, and practical plans for the future” (Lawrence-Lightfoot & Davis, 1997, p. 70).

Table 4

*Data Collection by Participant*

Participant	Interview	Journal	Timeline	Collage	Discussion posts	HHW	E-mails
Angie	1/20/11 2/29/11 4/13/11	1/31/11 4/12/11	3/13/11	3/13/11	Yes	Yes	No
Jeanie	1/23/11 2/8/11 4/13/11	1/30/11 7/12/11	No	7/12/11	Yes	Yes	No
Alice	1/12/11 2/15/11	1/24/11 2/13/11	No	No	Yes	Yes	Yes
Rosa	1/19/11 2/17/11 5/2/11	1/24/11	3/4/11	4/19/11	Yes	Yes	No
Luisa	1/11/11 2/25/11	1/19/11 2/12/11 3/26/11	3/22/11	No	Yes	No	Yes

Prolonged engagement allowed sufficient time to gain an understanding of the culture, test for misinformation, and build trust. The nature of portraiture calls for extended time with the participants and the need for building a relationship of trust. I collected data over a 6-month period and reviewed the online classroom interactions of a 15-week course. Observation of online interactions included the discussion area, student

lounge, ask a question, e-mail, course announcements, and bulletin board. In some of the courses, the only discussion was in an area to ask questions about homework, so the discussion data were limited.

Although I was aware that sharing the goals of my study could lead the participants telling me what they thought I wanted to hear or telling the stories they wanted people to hear, I felt it was important for them to know my goals (Lawrence-Lightfoot & Davis, 1997). The observation of online interactions served as an additional form of data collection as well as a way to use multiple forms of data collection to see if any possible discrepancies should arise.

My first observation was of the opening discussion in the first module of each course in which the participants were enrolled. Because these were online classes, I could observe the classroom at any point. I made first observations before the first interviews. The first set of interviews took place during the second and third weeks in January. The second online classroom observation took place during the mid-point of the course. Because of differences in course structure, the timing of the discussions and total number were different in each course. After an initial analysis of my online classroom observations, the first interview and the first journal entries I scheduled the second interview.

Lawrence-Lightfoot and Davis (1997) and Eisner (1998) cautioned that, although a portraitist should expect that changes may occur in the original research design, it is critical to record an initial framework. Lawrence-Lightfoot and Davis describe how portraiture emphasizes “flexibility of research design and the iterative process of data collection and thematic development” (p. 188). I originally planned to have the



participants journal between Interviews 1 and 2, again between Interviews 2 and 3, and after Interview 3 and create the timeline prior to Interview 1 and the collage before Interview 2. Because of the many obligations the participants were trying to juggle, they were not always able to complete the journals and artwork according the original schedule. The timing of data collection can be seen in Table 4.

In qualitative studies, the researcher cannot predict what a participant will say, the direction an interview may go, or what might be observed. At the start of the first interview, to the best of my ability, I restated to the participants what would happen during the study and what their rights were by: ensuring they knew I would have them member check their portraits before my study is published; clearly stating that I would not be interviewing anyone else, besides themselves, their mentor (with their permission), and their instructor (with their permission), to gain additional data; clearly explained my observation protocol; clearly explained how I would ensure they have anonymity and confidentiality of their data and ensured they understood they had the right to withdraw from study at any time (one participant withdrew after the first interview because of time constraints).

A concern I initially had was getting a level of commitment from the participants to follow through to the end. Because they were nontraditional female students who were balancing full-time jobs, families, and schoolwork, time was something they were short on. I believe that thoughtfully sharing with them my goals for this study and my belief that it was important to them as well as other women helped create a relationship with them in which they felt a level of commitment to my study. I discovered that the participants had a passion for the importance of this study that was equal to mine. They

had a strong desire to not simply tell their story, but be a source of inspiration, strength and hopefully change. I always gave my full attention and ensured the participants knew I was interested and engaged in what they were saying (Lawrence-Lightfoot & Davis, 1997). I did so by making eye contact with them when they were talking, occasionally repeating what they had said to be sure I understood, and asking follow-up questions. There were no noticeable differences between Skype and face-to-face with respect to level of commitment or development in our relationships. Jeanie and Angie, the two participants I interviewed over Skype, were the only two who completed the timeline, collage, all three interviews, and all three journal entries. Because I am an online instructor, it did not surprise me that we were able to develop such a close “virtual” relationship or that they shared their feelings and experiences with ease.

I was aware that certain situations could make me question whether I should break confidentiality and question exactly what information should be included in the final portrait. None of the participants shared any information about inappropriate or illegal behavior. During interviews, some participants shared feelings related to what they believed constituted an incompetent teacher or specific shortcoming of the college or course. In the case of this study, there were no children, however, the question of how to handle comments related to the college and staff loomed large. It is not part of my study and it would not be my place to provide feedback to one of the instructors. Because of confidentiality issues, I couldn't ethically do so unless the issues involved the safety of a student or faculty member. More frequently, I observed and heard about teachers who were exceptional. Although it was not part of my study to specifically commend a teacher, it was part of my study to paint a picture of the classroom experience. With that

in mind there are general comments related to how the students experienced the classroom and their interactions with faculty and college personal.

The informed consent form (Appendix B) was approved by the Institutional Review Board (IRB) October 2010, prior to the start of any data collection or participant recruitment. I stored all materials in a secure password-protected file on a password-protected computer and stored any materials in a locked, secure place. I was the only person with access. Figure 7 shows a representation of the data collection timeline. Note taking in the impressionistic journal was continuous throughout the entire study. Data analysis and thematic development were iterative processes and took place throughout data collection.

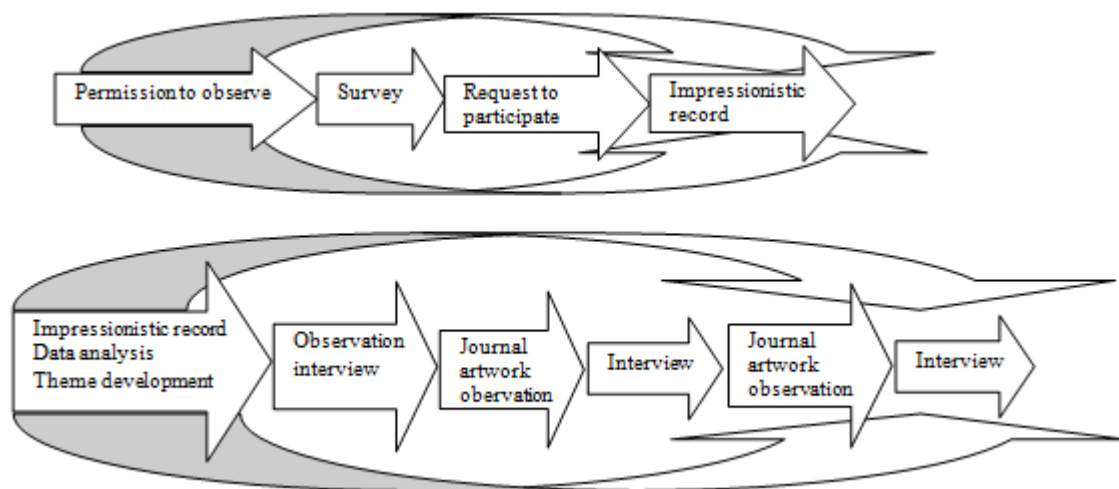


Figure 7. Data collection timeline.

### Data Analysis

Data-analysis methods included (a) portraiture and (b) thematic, based on theory. I brought my laptop to each face-to-face interview and, for all interviews, had a blank word document with the interview questions listed and spaces between them for note

taking. During the interview, I made note of any mannerisms or body language that I felt was important to associate later on with the participant's answers to each question. Sometimes the participants laughed or their eyes seemed to light up, and I wanted to remember those instances as I went back and read the transcripts. The participants' responses frequently "jumped" around and did not always directly fit with the question.

During each interview and observation of online interactions, I made notes in my impressionistic journal. Each time I read through the transcripts, my impressionistic journal, and other data, I noted the following: (a) patterns that seemed to be emerging, (b) questions that arose, and (c) connections to the theory. I reflected upon what I was thinking and feeling as I listened to the stories and any ways in which I saw my own biases potentially emerging.

As I listened to the interviews during transcription, I made additional observations as well as noted new questions that came to mind or comments that were unclear or seemed to need additional information. I noted where interview responses and pieces of other data I collected specifically addressed each of my research questions by scrutinizing, organizing, and making sense of the data (Lawrence-Lightfoot & Davis, 1997, p. 187). In my initial round of coding, I found almost 100 codes. I kept notes with descriptions of what each code meant. For example, the comment for second-college experience was as follows:

02/22/2012 08:18:10 PM

I feel like I need a code to describe experiences during college when they returned

After listening to the interviews during transcription, I read through the transcription to get a feel for the data. I created codes for all the data. At this point, I was still just trying to get a feel for the data. Because I approached each portrait individually,

I did not read all the transcripts to try to get a feel for codes across the portraits. Rather, I coded the data within the context of the participant. These were referred to as *document families*. For example, in the Alice family, I had separate documents for each interview, each journal entry, the discussions, and artifacts. I chose to keep each document separate so I could look across documents. For example, the first interview focused on family, the second on K-12 and college, and the third on their professional lives. This approach allowed me to look for codes within and across documents. For example, I compared the number of instances *role model* occurred in a family, K-12 and college, and professional interview. I could see differences in where role models seemed to be most (or least) prominent. I did notice as I moved from participant to participant certain codes arose repeatedly.

I read through the interview, journal entries, and discussion posts creating codes. My inability to collect data according to the timeline I had initially planned, affected the order of data analysis. As I continued to code, I took notes in my impressionistic journal as I started to see where codes seemed to fit within a category and how they fit within my theory. As suggested by Eisner (1998), I used SCCT (Lent et al., 1994) as a guide rather than a “recipe or script” (p. 242) when creating codes, looking for patterns and emerging themes. “The development of emergent themes reflects the portraitist’s first effort to bring interpretive insight, analytic scrutiny, and aesthetic order to the collection data” (Lawrence-Lightfoot & Davis, 1997, p. 185).

As suggested by Corbin and Strauss (2008), “If an analyst does not begin to differentiate at this early stage of analysis, he or she is likely to end up with pages and

pages of concepts and no idea how they fit together” (p. 165). I began to create code hierarchies like the following:

family influence <is> Root  
    extended family <is part of> family influence  
    family <is part of> family influence  
    home environment <is part of> family influence  
    immediate family <is part of> family influence  
    parent pressure <is part of> family influence  
    siblings <is part of> family influence  
    values <is part of> family influence

Networks of codes

CF: role model

**Codes (4):**

family

friend

immediate family

teachers

I created code hierarchies by first printing out my initial list of codes and looking for codes such as immediate family, extended family, and siblings and categorizing them as family. I also looked for codes that I had created that seemed to have the same or very similar meanings. In some cases, I went to the dictionary to look up a definition, went

back to the data, and noted a comment as to what I was thinking to remain open to the idea that I may recode later.

Resilience

02/07/2012 12:56:00 PM

Definition: an ability to recover from or adjust easily to misfortune or change  
<http://www.merriam-webster.com/dictionary/resilience>

I think this may better describe than perseverance

I next went through my data using SCCT (Lent et al., 1994) as a guide. I did so by coding data related to the four sources of self-efficacy: sources of support, perceived and actual barriers, and experiences the participants perceived as influencing academic and career choices they made. I next created maps of the data (Miles & Huberman, 1994, p. 70). Because all my subcategories were created based on the theory, I had to give thought to how important it was to distinguish between each code within the context of my theory. For example, initially, I had VE\_Academic\_k-5; VE\_Academic\_MS; VE\_Academic\_HS; VE\_Academic\_College; VE\_Academic\_ReturntoCollege. I merged these codes, so an example of a code and subcode became as follows:

VE: Vicarious Experience (main code)

Subcodes

VE\_Academic

VE\_Society

VE\_Family

VE\_Other

VE\_professionail

I then went back and recoded my data and used these new codes in my next analysis. As I continued to code new data, I applied the new codes and continued the

process. I looked for the most prominent codes and noted in my impressionistic journal why they seemed most prominent and how I was creating the code families. Then, I began to think about how these codes could be categorized (patterns) and how the emerging themes fit within my framework.

I continuously kept my eyes open to where the data were important to the research questions, as well as where they diverged (Lawrence-Lightfoot & Davis, 1997). I did so by constantly reflecting on the data and interpreting and reinterpreting their meaning in relation to the contextual factors, personal inputs, learning experiences, interests, goals, expected outcomes, and self-efficacy of participants.

I noted such phenomena as repeated words that are “clearly and persistently articulated by the actors in the setting” (Lawrence-Lightfoot & Davis, 1997, p. 193), metaphors as “words or phrases resonate with meaning and symbolism, sometimes representing . . . the dominant dimension of a life story” (p. 198), and cultural and societal frameworks. In addition, I looked for sources of personal input by listening to examples in which participants described themselves, their educational backgrounds, and the job histories of their parents. I looked for sources of mastery experiences by listening for examples of academic successes or failures and looking at GPA and test scores. Sources of contextual factors were identified by listening for stories of supports and perceived barriers. By listening for stories in which participants talked about someone leaving a lasting impression on them or they compared their actions to their earlier actions or to their peers’ actions, I identified sources of vicarious experiences. I looked for sources of verbal persuasion by listening for examples of words of encouragement or discouragement, examples of help with homework, course selection, or college decision



making. Finally, I looked for sources of the learning environment by listening for stories related to the atmosphere of their classroom and the SES of their schools.

Because the women in my study were participating in a class online, there was no physical classroom to describe. I described the online classroom environment so that the reader could “feel” what it would be like to be in their classroom. I analyzed the following features of the online classroom: course announcements; course syllabus; class discussions; Ask a Question area; and where permitted, instructor-student e-mails, and home work. This data analysis served as a form of triangulation as well as acting as a lens into the learning environment. Using SCCT (Lent et al., 1994) as my guide, I coded with contextual factors and sources of self-efficacy in mind. I looked for sources of mastery experiences by examining homework and listening to how participants applied their knowledge in the discussions. Sources of supports and barriers were identified by examining discussions, Ask a Question, e-mails, and homework for examples of the instructor, peers, or participants providing words of encouragement. Finally, I examined the course discussions, Ask a Question area, and e-mails for sources of stress or anxiety.

I noted in my impressionistic journal my interpretation of the tone of a post or message, whether a different tone or style was used when interacting with peers or the instructor, the tone of the instructor, and statements that seemed to reinforce or contradict what a participant said during an interview. I continued to be amazed at how one could “hear” the tone of a person in e-mails and discussion posts. As I read the discussion posts of my study’s participants and e-mails between the participants and their instructors, I could hear a range of emotions that were coded as anger, frustration, a lack of sympathy, caring, support, and desperate cries for help.

I continually compared each interview, observation, piece of artwork, and journal entry (Figure 3). This process of simultaneous data collection and analysis continued with each interview, observation of online interactions, review of artifacts, and reading of journal entries. I kept the data for each participant in a separate family and created a “collage” for each participant with codes and emerging themes. At the end of the data-analysis process, I investigated where codes and themes converged.

After I created the first draft of each portrait, I sent it to the participant for review of facts and her own interpretations of the meaning. I did the same with each new draft.

Each time I reviewed the data, I kept notes in my impressionistic journal and kept track of “the discovery of patterns, the development and dialogue of ideas, and the development and convergence of phenomena” (Lawrence-Lightfoot & Davis, 1997, p. 188). Eisner (1998) referred to this type of note taking as “crucial . . . details that make for credible description and convincing interpretation” (p. 188). As I continually reviewed my data and refined emerging themes, I used my impressionistic journal to track my data analysis journey.

I continually analyzed the data and developed themes by comparing the emerging patterns from the interviews to the emerging patterns from observations of online interactions, artwork, and journal writing. As I read the drafts of each portrait, I listened for overarching themes (Lawrence-Lightfoot & Davis, 1997). Continuously constructing and reconstructing themes enabled me to present the uniqueness of each participant’s story (Lawrence-Lightfoot & Davis, 1997).

By analyzing my data in iterative cycles, I was able to refine emerging themes. “The ultimate power of field research lies in the researcher’s emerging map of what is

happening and why” (Miles & Huberman, 1994, p. 65). I was not able to analyze data according to my original timeline because of not receiving all sources of data at the same time.

I found I needed to listen to each interview multiple times so that I could listen for all the voices of the women and feel what they were feeling. As I did so, I continually made notes of my impressions in my impressionistic journal. I found that, after the first round of data analysis using Atlas I, needed to work with hard copies of the data and active listening of the interview. I found this form of data analysis more intuitive for my initial coding. As a new researcher, I found it overwhelming to learn a new type of software while simultaneously learning how to analyze data. This feeling made me empathize with the participants who said it was more of a struggle to learn the software than the content.

Lawrence-Lightfoot and Davis (1997) discussed the tension a portraitist faces between

organization and classification on the one hand and maintaining the rich complexity of the human experience on the other-the tension between developing discrete codes and searching for meaning, and the tension between the researchers desire for control and coherence and the actors’ reality of incoherence and instability. (p. 192)

I did discover this tension and used my impressionistic journal to note where I saw or felt this tension, ensuring I was able to “experience the dialect between these two approaches to thematic development” (Lawrence-Lightfoot & Davis, 1997, p. 192). I used my impressionistic journal to record the process I went through as I moved between following discrete codes and being open to whatever complexities emerged from my participants’ stories. Because I was new to portraiture, I reviewed the following books by Lawrence-Lightfoot: *The Essential Conversation* (2003), *The Good High School* (1983),

and *Respect* (2000) and literature (Gary, 2010; Good, 2010; Hill, 2005; Newton, 2005; Semon, 2009) to gain a feeling for how to present my portraits.

After all data collection was complete, I listened to the interviews again and reread the textual data and artwork, noting new interpretations, and continued to create code families, looking for patterns and refining my themes. I simultaneously looked to see how the emerging themes fit within my framework while being open to where the data showed something new or different emerging. I continued to keep notes on why I changed a code, where the data were diverging from the theory, and where I noticed themes converging across portraits. The intent of this study was not to do a comparison, so I did not compare one portrait against another but looked at similarities across them.

I began the process of creating a macro-picture by performing a literature review. Doing so enabled me to describe, through demographics and prior research, attributes related to women and STEM in our society. Through their stories, observation of online interactions, a review of their personal histories (family background, SAT scores, mathematics courses taken, and GPA), and interpretation of artwork, I was able to drill down to the micro-environment in which these women lived and live. Additional descriptions I provided included a description of the communities they grew up in and where they currently lived, the types of industries prominent in those locations, demographic statistics, and quality of available education. Instructors and mentors who were available were interviewed as part of triangulation and to give their perspective of the college environment and their perception of nontraditional students' needs.

As I developed Chapter 5, I again refined my codes and themes, ultimately seeing where the themes converged across portraits. I created my own model of the interaction

between sociocognitive variables and self-efficacy in the lives of the women in my study. The goal of each portrait is that the reader gain a deeper understanding of how the lived experiences of each of the five nontraditional female students influenced her choice to pursue a STEM major and career through self-efficacy, outcome expectations, and supports and perceived and actual barriers.

**Initial code list.** The following are examples of my initial codes.

Academics

Achievement

Aspirations

Attachment

Boredom

Caring

Challenge

Change

Children

Collaboration

Communication

Community

Connection

Crying

Defeat

Dreams

Educate

Education  
Elementary school  
Enrichment activities  
Extracurricular activities  
Extended family  
Immediate family  
Family  
Friends  
Future  
Helping others  
High school  
Hope  
Interconnections  
Isolation  
Knowledge  
Networking  
Make a Difference  
Meaning  
Middle school  
Motivation  
Music  
Opportunity  
Optimism

Pessimism  
Perseverance  
Priorities  
Power  
Pride  
Questioning  
Quality of life  
Work life balance  
Role models  
Responsibility  
Resources  
Sacrifice  
Second College  
Self-confidence  
Siblings  
Struggles  
Resilience  
Resources,  
Responsibility  
Trust  
Time  
Teachers  
Teaching

Understanding

Unity

Values

Voice

Work

Wages

**Example of initial emerging themes.** The following are examples of themes that initially emerged.

**Critical relationships**

Community, collaboration, connections, extracurricular activities

Extended family, immediate family, family, friends, isolation

Interconnections

Networking

Role models

Siblings

**Work-life balance**

Children, quality of life, time,

**School**

Elementary school

Middle school

High school

Motivation

Pessimism



## Questioning

### Example of network view: Academic accomplishment

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Nodes count: 27

#### Codes (1):

Academic accomplishment {25-1}

#### Quotations [rich text] (26):

~1:16 I got honors and awards in eve . . . (5:5)

1:19 K-9 A's all way (5:5)

1:88 I kept the lab and got an A in . . . (32:32)

1:91 got a B and I felt a million t . . . (32:32)

~2:6 My parents divorced when I was . . . (3:3)

~2:7 My mother got to the point whe . . . (3:3)

~2:8 I ended up passing everything . . . (3:3)

~2:19 And she said "well, you know b . . . (3:3)

2:29 I think I scored an 840 as a 7 . . . (3:3)

2:32 I got a 92 or 93 on the course . . . (3:3)

~2:102 My dad is really technical, I . . . (4:4)

2:112 I didn't realize until probabl . . . (4:4)

~2:198 I was so afraid, I took physic . . . (13:13)

~3:31 I played it very smart my firs . . . (38:38)  
~3:38 The only surprise for me is re . . . (48:48)  
13:15 So then the next one I was bac . . . (5:5)  
13:22 And I remember it was fraction . . . (7:7)  
13:49 In looking back I think I miss . . . (17:17)  
13:52 I passed it, and then when I w . . . (17:17)  
13:58 it was like I got an A and B, . . . (19:19)  
13:171 And I ended up with a B and I . . . (35:35)  
~13:176 Yes, definitely compare the tw. . . (35:35)  
13:177 Well just for instance to with . . . (36:36)  
13:189 because they were in between s . . . (38:38)  
15:80 So stuff like French, language . . . (29:29)  
~17:51 even though I wasn't there I s . . . (15:15)

**Codes for portraits.** The following are the codes and sub-codes for the portraits.

**Personal Accomplishment:** education, work recognition, pride, power, academics, achievement, knowledge

**Vicarious Experience:** parental background, role models, siblings, enrichment activities, extracurricular activities, comparison to self or others

**Verbal Persuasion:** words of encouragement or discouragement

**Physiological:** defeat, failure, overwhelmed, anxiety, stress

**Themes and codes** The following are the three themes that emerged across the five portraits.

## **Barriers:**

- **Personal issue**
  - Personal choice: stopped going to school, chose to stop doing homework
  - Bored: Bored at job or in class, talked of always wanting a new challenge
  - Stress: When I specifically heard them talk of being stressed, or overwhelmed
  - Family issue: abuse, alcoholism
  - Life Events: health, death in family, family crisis
- **Lack of Support**
  - Family: family not involved in course selection, college choice, or support when feeling stress or overwhelmed
  - School: Lack of guidance from counselors, teachers, peers
- **Work-Life Balance**
  - Time: working long hours; not enough time to complete homework; don't have time to spend with family, friends.
  - Job: loss of job, not making enough money, not fulfilling
  - Family: choose between work and family; want a job that will enable them to meet needs of family
  - Social: isolation
- **Money**
  - Tuition: unable to pay to do loss of job or aid

- Job: need to take a certain job in order to make enough money, loss of job, desire for different job to make more money
- **Supports**
  - Family: Spouse, parents, children, extended financial help, encouragement, advice, guidance
  - Peers: helping hand when needed, encouragement, advice
  - Teachers: support balancing work-life as nontraditional student, teacher presence in online course, responsive to questions and e-mails, formative feedback, encouragement or advice during K-12
  - Mentor: guidance in course selection and major, support balancing work-life, support with instructor conflict, guidance with financial aid, suggest support services when needed and follow-up
- **Learning Environment**
  - Classroom: described as fun, gender issues, size, relationship with teacher and students
  - Online classroom environment: course announcements, pictures used in course, syllabus
  - School: socioeconomic, environment, size
- **Personal Inputs**
  - Personality: planner, always wanting to be challenged, a planner, inner motivated
  - Background: Education of parents, community grew up in, home environment

## Methods of Verification

**Trustworthiness.** Words such as *credibility* and *dependability* are occasionally used in place of *reliability* and *validity*, which some qualitative researchers feel come from “oppressive positivists” (Kvale & Brinkman 2009, p. 244). Kvale and Brinkman stated that “reliability pertains to the consistency and trustworthiness of research findings . . . [and] validity refers to ordinary language to the truth, the correctness, and the strength of a statement” (p. 246). Miles and Huberman (1994) suggested a researcher “confirm” and “verify” in a way that gives readers confidence in the data; Lawrence-Lightfoot and Davis (1997) suggested using “various strategies and tools of data collection, look for emerging themes and looking for the points of convergence among them” (p. 204); Lincoln and Guba (1985) suggested establishing credibility, transferability, dependability, and confirmability; and Eisner (1998) referred to *structural corroboration*, *consensual validation*, and *referential adequacy*. Whatever term is used, what is common is the need for the results to be trustworthy and to establish credibility (Patton, 2002). I will outline how I established trustworthiness following the four strategies defined by Lincoln and Guba and explaining how those strategies align with those defined by Eisner and Lawrence-Lightfoot and Davis in portraiture methodology.

**Credibility.** *Credibility* is “the naturalist’s substitute for the conventionalist’s internal validity” (Lincoln & Guba, 1985, p. 296). To achieve credibility, the researcher must conduct the research in a way that increases the likelihood it will be credible, and the findings must be approved by the participants whose multiple realities have been constructed (Lincoln & Guba, 1985). Lincoln and Guba stated that the “naturalist must show that he or she has *represented those multiple constructions adequately*” (p. 296).

Furthermore, Lincoln and Guba suggested the researcher can increase the likelihood of achieving credibility through prolonged engagement, persistent observation, reflexivity, triangulation, member checking, peer debriefing, and clarifying the researcher's bias. The methods used to achieve prolonged engagement and persistent observations were discussed in the previous section on data gathering.

*Triangulation* refers to collecting data in a variety of instances, from a variety of sources, using different methods (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997; Lincoln & Guba, 1985; Miles & Huberman, 1994). Patton (2002) pointed out that the purpose of triangulation is not to confirm the results are consistent across various data sources but to “test for such consistency” (p. 248). When consistencies are discovered, they offer “opportunities for deeper insight into the relationship between the inquiry approach and the phenomenon under study” (Patton, 2002, p. 248).

The process of triangulation involves cross checking and comparing data collected from multiple sources in multiple instances. Triangulation also addresses construct validity as “multiple sources of evidence essentially provide multiple measures of the same phenomenon” (Yin 2009, p. 116–117). I used multiple sources of data: (a) interviews of the five women in my study, (b) mentor and instructor interviews, (c) observation of online classroom interactions, and (d) document review of written coursework, journal writing, and artwork.

Analyses of these data sets enabled me to confirm emerging themes, ensure accuracy, and look for alternate explanations by cross-checking data from the multiple sources. When collecting data for triangulation purposes, I ensured that all data collected for purposes of triangulation supported the same fact and did not use multiple data

sources supporting different facts (Yin, 2009). I did so by comparing the observations of online interactions to those from the interviews and data from documents such as written work, journals kept both by me and the participants, artwork, and instructor and mentor interviews.

Examples of how I triangulated data include the following:

- I asked the instructor, mentor, and participants about student services provided by the college that the participants sought out. I then compared what the participants shared with what their mentor and instructor told me.
- I asked the participants about words of encouragement they perceived they either received or did not receive from their instructor. I compared their responses with what I observed in the online classroom interactions and e-mails and asked the instructor about words of encouragement they perceived they provided.
- I asked participants about their belief in their mathematics ability and compared their responses to factual information, such as GPAs, SAT scores, the types of mathematics courses they took in high school, written coursework, observation of online interactions (how well they were able to express mathematical concepts, whether they explained things to others or were the ones asking questions), and how the instructor and mentor perceived their ability.
- I compared how participants described their image of themselves as mathematics students during the interviews with their pictorial representations.

Thus, I looked at the data from “multiple perceptions to clarify meaning” (Stake, 2000, p.443) and search for “additional interpretation rather than confirmation of a single meaning” (Stake, 1995, p. 115).

Lawrence-Lightfoot and Davis (1997) referred to *triangulation* as the use of various tools and methods of data collection as a means of looking for points of convergence. Emergent themes may come out during different interviews, in factual evidence, and through observation of online interactions. I heard the participants’ voices in three different interviews, journal entries, and artwork; reviewed the facts by examining demographic information, prior research, SAT scores, GPAs, credits completed, time to completion, and coursework taken prior to college; and saw the data in action through observation of online interactions.

I asked participants about role models in three different contexts: in the first interview related to family, in the second interview related to school experiences, and in the third interview related to their professional lives. I also asked their instructor and mentor about any role models they may have heard the participants mention or if they see themselves as role models. I compared what the participants said as nontraditional female students returning to school to study STEM subjects to what prior research has indicated about role models. I also looked at points of convergence across the five women by listening for similar experiences, symbols, metaphors, and patterns. When listening for points of convergence, I compared both factual information of the participants, such as demographic information, SAT scores, and GPAs, and subjective data, such as interview questions, journal entries, and observation of online interactions.



**Transferability.** *Transferability* is the naturalist term for generalizability and is related to external validity. Eisner (1998) defined *generalizability* as “transferring what has been learned from one situation or task to another” (p. 198). The content that can be generalized includes (a) skills, (b) images, and (c) ideas. While randomization is required for formal inference, one can also use attribute analysis or pattern matching (Eisner, 1998). Eisner suggested we can make inferences based on partial information about a unique attribute or a generalized image he referred to as a *gestalt*.

**Dependability.** Lincoln and Guba (1985) described dependability as “whether the process of the study is consistent, reasonably stable over time and across researchers and methods” (p. 278). Other terms used to describe dependability include *reliability* and *auditability*. Triangulation is one way I increased dependability and was discussed previously in the section on credibility. By clearly describing each step of my research design from participant and setting selection to data collection and analysis, I created an audit trail. I did so by carefully organizing and storing my data and conclusions. My goal was to create transparency and clarity by going into great detail describing the process of data collection and analysis, identifying emerging themes, and how I ultimately wove each portrait.

Specific steps I took included taking detailed field notes and observations and reflecting upon the events of the day as soon as possible in my impressionistic journal and continually reviewing emerging themes and noting my thoughts and revisions in my impressionistic journal. My goal was to enable other researchers to understand the process I used and replicate the study. A documentation matrix helped me organize the data sets I used, steps I took, decisions I made during data collection and analysis,

preparation of the data for analysis, emerging themes identified, and conclusions I made (Miles & Huberman, 1994).

**Confirmability.** Confirmability is related to external reliability. Miles and Huberman (1994) described confirmability as “relative neutrality and reasonable freedom from unacknowledged researcher biases—at the minimum, explicitness about the inevitable biases that exist”. (p. 278). I ensured confirmability through the steps previously described in the section on dependability, triangulation, and researcher bias. Through the steps previously described, I ensured procedures were described in detail, the sequence of data collection through analysis and final portrait can easily be understood, an audit trail documented all my work and was stored in a safe place, my personal biases were made explicit, and other researchers could review the data and discuss competing theories.

**Clarification of researcher bias.** Portraiture requires the researcher to be reflexive. The researcher needs to let the reader know “from where I sit, this is what I see; these are the perspectives and biases I bring” (Lawrence-Lightfoot & Davis, 1997, p. 50). Doing so will further enable me to create a portrait that is referentially adequate, allowing the reader to “see what they would have missed without the critic’s work” (Eisner, 1998, p. 114).

Understanding and describing any biases I may have is critical to the validity of my study. In qualitative research, the researcher is the instrument, which can either enhance or detract from data gathering and, therefore, must be discussed in the report (Patton 2002). Patton continued, “The principle is to report any personal and professional information that may have affected data collection, analysis and

interpretation” (p. 566). I was concerned that my closeness to the topic might somehow affect my data collection. In high school, I was encouraged by several people, including my male teachers and my brother, to pursue mathematics. Until I reached college, I never felt my gender was a barrier and felt no limitations as to my career options. However, in college, I had several negative experiences and was made to feel I did not belong because of my gender, yet I persisted. As an adult, the STEM background I have has opened many doors, and I feel strongly it is beneficial for women to study mathematics. My experience as a female of a certain age, with a bachelor’s degree in engineering and a master’s degree in business administration, and currently a single mother returning to school to pursue a doctoral degree in educational theory and practice may have swayed how I collected my data, analyzed it, and interpreted the results.

In addition, I am an instructor and mentor at the college I am using in this study. While none of the students were in my classes and I do not currently teach any STEM courses, I do have preconceived notions about the online classroom and the type of support a mentor and instructor should provide. I have worked with nontraditional students in an online environment both as an instructor and a mentor since 2001. This past experience has led to my own beliefs about the experiences of a nontraditional student.

### **Summary**

In this chapter, I described in detail how I followed the portraiture methodology and collected and analyzed the data in my study. I described how I selected the participants, the setting, the steps in data collection and analysis, and my weaving of the final portrait. My study included five nontraditional female students who successfully

returned to the university to study STEM subjects. Data were collected over a 6-month period and included three interviews, observations of online classroom interactions, journal writing, document review of coursework, a demographic survey, and artwork. Data were analyzed following the techniques described by Eisner (1998), Miles and Huberman (1994) and Lawrence-Lightfoot and Davis (1997).

I described how I increased the trustworthiness of my study and created portraits that will provide a “unity of interpretation that the reader will find and comprehend the work as an aesthetic whole” (Lawrence-Lightfoot & Davis, 1997, p. 281). My goal for this study was to investigate what the sources of self-efficacy and supports and perceived and actual barriers were in the lives of the five women in my study. The results will add to the emerging literature on nontraditional female students studying STEM fields and inform future studies.

Portraits were woven based on analysis of interviews, artwork, observations of online classroom interactions, document review, and journal reflections. Using SCCT to guide data collection and analysis, this study explored the role of self-efficacy and supports and perceived and real barriers in the path the participants took in choosing to return to the university to study STEM.

#### **Chapter 4: Five Women Determined to Reach Their Goals**

The women in my study were five nontraditional female students who returned to the university to study STEM areas online. One was divorced with three grown children, three were married with no children, and one was engaged at the time of the study and had no children. All of the women except one were employed at the time of this study and ranged in age from 23 to 44. Each of these women returned to the university to complete an unfulfilled dream and return to a passion they now saw through a new lens as a viable and meaningful career. They returned to school with a range of prior completed education and areas of study. Alice and Luisa began their college careers the first time in a STEM field: Luisa in engineering and Alice in computer science. Both Alice and Luisa completed their first year of college instead of their senior year of high school, and neither successfully completed college the first time. Jeanie, Alice, and Rosa cited wanting a better work-life balance as a primary motivation for their return to school while Luisa and Angie had financial motivators for returning. When discussing their chosen careers and expected outcomes, all the women cited the opportunity to make a difference as being critical to their choice of career goal.

Their reasons for returning are in line with research that shows women are motivated to return to college to increase their salary, receive a promotion, or simply attain personal satisfaction (Dey & Hill, 2007; Kramarae, 2001). Results of this study are similar to those of the study by Vaccaro and Lovel (2010), who found that, although it was a constant struggle to balance family, work, and health, the women were dedicated to school and committed to persisting. Like the women in that study, the women in this

present study demonstrated their resilience through their inner motivation, strength, optimism, and a commitment to complete their college degree.

All of the women cited the opportunity to study online as critical to their ability to persist. Furst-Bowe et al. (2002) found that 75% of the women in their study chose distance learning for the convenience and flexibility because it allowed them to juggle work, family, and educational responsibilities.

### **A Brief Introduction to the Participants**

Jeanie spent most of her childhood in doctors' offices with her twin sister, who was born with numerous health issues. Jeanie's own struggle with health issues prevented her from completing her dream of medical school and caused her to take a semester off from school during her junior year. After completing college, Jeanie worked in the health-care field, initially as a translator, with a goal of eventually going to medical school. One day while speaking with a co-worker, she learned of a career as a physician's assistant and decided that career would enable her to have a better work-life balance. She returned to school having already completed a BS degree in Spanish to gain the prerequisites for admission to a physician's assistant program. By the time data collection was completed, she had been accepted and was enrolled in a program at the time of this writing.

Rosa returned having never completed her bachelor's in fine arts degree because of the loss of her scholarship half-way through senior year. Without the financial means to complete that final semester, Rosa dropped out of college and returned home, where she worked long hours as a sommelier. She returned to school with little direction, except a desire to have a job with "regular" hours and a steady income. During her first

science course, she made a connection with the instructor and content that enabled her to rediscover her passion for science. Learning about her friend's career as a pharmaceutical researcher enabled her to translate this passion into a career. She planned to pursue a life science degree with a goal of completing a bachelor's of science in nursing (BSN) and going into pharmaceutical research.

As a young child, Alice dreamed of being a teacher like her mother. After enduring years of abuse, Alice became fearful she would be just like her mother and therefore ill equipped to be a teacher. Despite a high school career that included the lack of a support system, a battle with drug use that resulted in a drug overdose, and poor grades, Alice persisted on to college, where she pursued a degree in computer science. She never finished because of financial constraints but went on to complete a technical degree and worked for years in the computer science field. Alice returned to school to fulfill her life time dream of being a teacher. Alice had chosen to pursue mathematics because of her passion for the topic, the need for teachers in this field, and her desire to provide others the guidance and support she never received.

Luisa had a strong relationship with her mother and a father who was an alcoholic. She loved mathematics and was always good at. Luisa began her college career during her senior year of high school, studying engineering. For the first time, Luisa did poorly in mathematics and eventually dropped out because of poor grades and a lack of finding any meaning in what she was studying. After a divorce, Luisa returned to complete a degree in operating systems, primarily motivated by the desire to be more than a secretary. She saw that degree as leading to a career that could support her and her family and give her the opportunity to make a difference.

An abusive father and negative learning experiences drove Angie to want to distance herself as much as possible from her family and community. This experience led to her enrolling in school in a developing country, where she was kidnapped. While she did eventually escape after several months of captivity, she never finished that first semester of school and upon her return to the United States enlisted in the military. Angie returned to school to pursue a BS in physics, primarily motivated by the financial incentives provided by the military and her passion for mathematics and science. She had a goal of going on to complete her PhD in physics and starting a school in Africa with her husband, who is also in the military and pursuing a degree in mathematics. Participant portraits are presented in this chapter to give the reader a deeper understanding of the lived experiences of these women and the paths they took to returning to an online school to study STEM and the role self-efficacy, supports, and barriers had in their belief they could succeed.

### **Background**

One of my goals in creating these portraits is that the reader will identify and “feel as if he or *she is there*, . . . transported into the setting” (Lawrence-Lightfoot & Davis, 1997, pp. 44-45; emphasis in original). To achieve this goal, I had to reflect upon my own journey as an adult woman returning to school, an online instructor, a mother, a woman who was always just good in mathematics and science, a woman who holds a mechanical engineering degree, and a woman who no longer actively uses that degree. Had I dropped out of the STEM pipeline? Am I returning through my research? What do I want for my daughters and other young women? I found myself constantly thinking about these questions as I went through the process that Lawrence-Lightfoot and Davis



referred to as moving from silent observer to an active participant and back again. As I reflected on each interview in my impressionistic journal, I discovered how much of my reactions to the stories and what I was thinking as the stories unfolded were influenced by my personal history and prejudices.

The personal perspective I brought to the setting description has become part of the context as well. This is the place where I made my presence “explicit, not masked or silenced . . . [so that] the reader can better interpret the product and process of [my] vision” (Lawrence-Lightfoot & Davis, 1997, p. 50). By weaving in self-reflections from my impressionistic journal (Lawrence-Lightfoot & Davis), I opened myself up to the reader, allowing the reader to make his or her own interpretations. While I described the general setting of the school in the previous section, in this section, I share a view from a mentor and instructor to give additional context to the school and classroom experiences of the participants in my study.

### **A Mentor’s Perspective**

All of the students mentioned the critical role their mentors played in the academic choices they made and their ability to persist. A mentor’s role is different from that of a traditional advisor. A mentor sees his or her role as more than giving advice on selecting courses. A mentor works closely with the students discussing personal and professional goals and learning about their personal lives, the support system they have, and barriers they may face. The mentor guides the student through the process, taking all these factors into account. Mentors have in-depth understanding of their mentees and what they need to be successful. This indicates traditional colleges may want to consider the role advisors play and think about how they can reshape this role into being more of a

mentor. This relationship may better provide the guidance and support female students need. Luisa, Rosa, and Alice all recalled a situation in which they had an issue with an instructor and turned to their mentor for assistance. This again supports the critical role of the mentor in their persistence.

An excellent example of this is Dr. V., Rosa's mentor. Prior to my first data-gathering interview, I had "met" Dr. V during several work-related virtual conferences but never sat down to talk and meet with her until we were both at a conference in Orlando. While I knew "of" her, I did not really know her. Based on my virtual interactions, I had a picture of her in my mind, and face-to-face she was just as I had imagined she would be. Her voice is always bubbling with excitement and a passion and positive energy that were contagious. When she talked about student-related issues, I could feel the sincerity in her voice.

Because we do not work in the same location, we made plans to get together for the interview at the conference in Orlando we would both be attending. After several failed attempts to connect, we decided to set a time when we both could meet over Skype. Dr. V had her camera on, and her office was warm and inviting, just as I had imagined it. Students who are studying completely online do not meet face-to-face with their mentors, although in some cases they do meet over Skype. I began by telling Dr. V the name of the student in my study. I was impressed with how she immediately knew the mentee and could recall details about her. I mentioned how strange it felt to be interviewing people I work with. Dr. V's response was "Yeah, it's kind of weird isn't it, but in some ways it is kind of cool" (Interview 1).

When students have their first meeting with Dr. V, she always starts by asking, “What would you do for free; what would that look like?” What are you passionate about?” (Interview 1). She described herself as a “freestyle mentor” who tries to work with her mentees in creating a degree plan from the lens of what they are truly passionate about and seeing if they can turn that into a career. A challenge students are facing is the change in the economy and “what people are looking for has changed” (Interview 1). While she feels it is not all about the degree and wants her students to go on a reflective journey, many students just want to know “What do I need to take; what do I need to do?” (Interview 1).

Part of a mentor’s job is to develop a personal relationship with mentees so that there is a level of comfort and trust such that they will seek out help and support when needed. Dr. V felt the writing skills of the majority of students was poor and described the frequency with which she sends students for help as needing an “electronic bee-line corridor to student services to help students” (Interview 1). Dr. V frequently referred her mentees to student services but described a lack of consistency in follow up. She found that, unless the student reached out to student services, typically, her referral did not result in the student getting the needed assistance. Dr. V felt writing skills were the weakest link for most students and stronger support services were most needed for those skills.

We need a much stronger focus on writing resources. . . . I mean we have small stuff; they can go through those exercises, but it is not good. We need an actual department, an actual group that that students can be fed into, that students can go to for help to hone analytical skills. I mean we need that big time. Because we are online, we service a lot of students, and as an instructor, you end up spending an inordinate amount of time on papers instead of different stuff. (Interview 1)

## **An Instructor's Perspective**

The primary population at the college is nontraditional students, so instructors need to be aware of their unique needs and learning styles. They constantly need to balance the line between rigor and high expectations and understanding and leniency when warranted. An excellent example is Dr. T, Rosa and Jeanie's instructor. I had known Dr. T for about 2 years. Several months prior to our interview, we both happened to be at a local coffee shop correcting student work and discovered it was a favorite place for both of us. Thus, when it came time for the interview, the coffee shop seemed like the perfect place to meet. We could have privacy and be away from the college, and it was a place we both felt relaxed and comfortable. When I arrived, Dr. T was just finishing lunch. She said she had had a dentist appointment earlier and had gotten out early and when she finished up wanted to grab some lunch. Like me and the participants in my study, she was juggling work and family and just trying to keep all the balls in the air. We started with some small talk about how each of us was doing. She told me about her busy travel schedule and her daughter. She stressed the critical role her husband played in her support system as well as the flexibility of teaching online.

As we began the interview, we both commented on how it seemed strange to have me interviewing her. Once we got past the first interview question, the conversation flowed, and it was as though we were just two faculty members talking. Dr. T described her course as an advanced-level STEM class that meets general education requirements. She had a range of students, from those taking the course as part of their degree plan to those thinking it just sounded interesting. She explained that, when she initially taught the course, it had already been developed by someone else and it "feels weird but I knew

the developer and it was a very sound course” (Interview 1). It is common at the college to have a course developer who is different from the instructor who will teach the course. Frequently, more than one section of a course is taught simultaneously by multiple instructors. It is important that all courses are structured to ensure all students have the “same” learning experiences.

After 2 years of teaching this course, Dr. T worked with a developer and another instructor to update it. She discussed how teaching it for 2 years enabled her to get a feel for the course and what areas needed changing to better engage students and increase persistence. She applied the results of two research studies she conducted when updating this course. “I was able to see how the students in this study interacted with the new learning experience as I observed them in the course” (Interview 1).

Dr. T said it was a “gut feeling” that she gets more female students than male and that she “tends to see female students needing more reassuring and they are very concerned about submitting things” (Interview 1). Dr. T described her role in discussions: “I don’t participate actively in discussions but do give individual feedback. . . . I tend to be very generous with grading and feel feedback is very, very important so they know someone is listening” (Interview 1). When she saw someone having an issue, she “[let] them know they are not the only ones having issues. I encourage them by letting them know they are not the only ones with questions” (Interview 1). A frequent problem she saw with online learning is that “students often feel off on their own and feel like they are the only one. They don’t get the face-to-face feedback of a traditional classroom to know they are not the only ones struggling” (Interview 1). Dr. T’s prior experience teaching in a face-to-face classroom was a constant frame of reference for her and something she

went back to when interacting with students in an online environment. “I tend to write long announcements as more of a dialogue. I think about what I would say face-to-face to try to help them feel a part of class” (Interview 1). She described how, in a face-to-face class, she would just say “drop me a line” (Interview 1), and in her online course, she tried to send them the same message and “make them feel more comfortable” (Interview 1). Dr. V started with a friendly greeting such as “Greetings! I hope you have a great Monday” (course announcement, 10/24/11) and ends with “Have a great week, everyone!” (course announcement, 10/24/11). In each announcement, she included an overview of the assignments and discussions. She also included tips, information on how she grades assignments, and college policies and support services.

Dr. T felt that students’ technological abilities overall have improved, although, at the time, they were struggling with the new lab software the college had recently starting using. She described the students as very tentative and afraid to explore. They want to know exactly what they are supposed to do, what link they need to click on to find an assignment or other content in the course.

Some of them are very afraid to click on things and if words aren’t the same . . . when I updated the course I updated the directions. . . . [S]tudents want things very literal” (Interview 1).

She described students as “sometimes frustrated. . . . [T]hey want to be the best they can be every time” (Interview 1). A common problem she was faced with was plagiarism: “They Google answers all the time” (Interview 1). She described one situation in which a student posted answers to an assignment on Yahoo! Answers <http://answers.yahoo.com/> and two students copied their answers from there. This public posting of answers resulted in her having to change the assignment questions. It was a constant struggle for her to “try to write questions they can’t Google” (Interview 1). As

far as assisting students in getting help in their coursework, she posted the link to the Smarthinking writing tutor but did not know of anyone who used it.

For the nontraditional students in this class, it was difficult

keeping on time with assignments, things snowball quickly. One female student with an incomplete did a few things the first week then disappeared. . . . I guess that is the challenge, no one to look over and say do this now. (Interview 1)

She tried to help them with time management by suggesting they “print out the schedule and check things off. . . . [I]t will make you feel good . . . ask questions . . . reach out . . . it is the nature of adult learners” (Interview 1).

### **The Portraits**

From the mentors, instructors, and all the data I collected from individual interviews, artwork, observation of online interactions, journaling, and review of artifacts, I was able to “step into” the lives of the women and the experiences that brought them to this point in their lives. In the next sections, the individual portraits are presented. The path each participant took to choosing STEM can be seen in Appendix G.

#### **Alice**

“There was never any doubt in my mind THAT I would return to school to obtain my bachelor’s degree” (Journal 1).

Alice is a full-time student planning to graduate with a BS in mathematics in the spring of 2012. She is 33 years old, engaged to be married in June 2012, and has no children. We first met in cyberspace, through e-mail. Just from a few short e-mails, I already felt like we had connected. I could feel her excitement and passion come through in her words and was already developing a perception of who she was: easy going, flexible, and comfortable with herself.

She suggested we meet in her home but that I needed to “please excuse the mess in advance, we’ve been renovating” (E-mail, January 9, 2012). On the day of our interview, Alice texted me asking if I was okay with dogs. “We have my dad’s lab (they stay with us) and our boxer mix, Maddy. Maddy told me earlier that she really wants to meet you : )” (text, January 12, 2012).

The road Alice lives on is a main, fairly high traffic road. The driveway was just as she had described, with a small, shoveled path. The garage door was open, and Alice came out to greet me with a big smile. She was just as I had imagined she would be: enthusiastic and full of excitement. The energy around her is that of someone ready to take on the world. Her family room, where we had our interview, is a large, beautifully remodeled, open space with high ceilings.

The first thing that caught my eye was the coffee station in her family room. Alice had a coffee pot and an espresso maker. As a person who lives on coffee, I felt an immediate connection to Alice and the load she is trying to balance. She commented, “The espresso maker is a new addition for this upcoming term” (Interview 1).

I was surprised at the ease with which Alice’s story unfolded. It seemed clear she had spent time reflecting on her experiences and how they had shaped her life.

**I am stronger than my past.** Alice perceived her intelligence as being inherited from both her parents. “My dad is really technical; I mean I have my two parents’ brains, my mother with the reading aptitude and my father with the math technical” (Interview 1). Alice was concerned she had also inherited her mother’s tendency toward violence. “I was very worried that my mother’s violence was genetic. I was like “I am never going to have kids; I shouldn’t be around kids.” I mean who in their right mind hits kids and is a



teacher?” (Interview 1). I am struck by the paradox between my image of Alice’s mother as a teacher and as an abusive mother. Growing up, Alice struggled with undiagnosed ADD.

Alice’s desire to be a teacher stayed with her throughout her life. Her perseverance and inner motivation are illuminated in her first journal entry when reflecting about her decision to return to school. “First let me preface this by saying, there was never any doubt in my mind THAT I would return to school to obtain my Bachelor’s Degree. However, I didn’t know WHEN I would return to school” (Journal 1). Her inner motivation can also be heard here: “I learned a long time ago that if you spend your life worrying about what other people think of you the only person you have to please is yourself. If you don’t please yourself then you will never be happy” (Interview 1). In her third journal entry, she wrote,

At my age I am happy to say that others do not influence my choices. My abilities to persist are based on my own internal motivations. My interest has not changed. My goals have changed simply based on financial updates (i.e., I received my student loan bill and it will have to be paid down before I can engage in further learning). (Journal 3)

Previously, Alice was planning on attending graduate school immediately after graduation. In the following story about how she came to the decision while working in India, the logical way her mind thinks and her optimistic outlook surface:

I had always wanted to be a teacher. I was living in a third world country, and worried about whether my job would be outsourced. I made some revelations. 1. I wanted a job that could not be outsourced. 2. I had an awareness of a need for Secondary Math and Science Teachers. 3. I had the necessary skill set. I knew that I needed the degree and so while in India, I started to research to determine the feasibility of making this dream a reality. (Journal 1)

Alice's deep sense of caring and desire to help others emerged as she described the time her fiancé signed up for courses and needed help. "I would help. I couldn't pull the 'you signed up for this.' This is just what I do" (Interview 1).

Alice brought up her difficulties with remembering things several times during our interviews. She contrasted the type of thinking needed to be successful in a history class with that needed in mathematics and related that to the difficulties she is having with proofs.

Well, for whatever reason, my memory retention is horrible when it comes to things I have read. If I can physically do it, I understand. That is why I am having trouble with proofs. You are not solving a math problem. You are thinking in hypotheticals. I know that it is a block, . . . so my biggest thing with proof writing is, if you get stuck on one move to the next, because I know I am going to get more frustrated and it is going to get harder for me to understand. (Interview 2)

In assignment M0A1, Alice wrote the following note to her instructor: "Here is my problem with writing proofs. My memory is horrible. I cannot remember all of the rules" (September 14, 2012).

**Nobody cares that I am drowning.** At the time of this research, Alice lived in a suburban town with a population of about 42,000. The median age of people living in her town is 40, with a median income of about \$60,000. Alice grew up on the rural outskirts of a small farm town where over half the population currently had at least a high school diploma and over 25% had at least an undergraduate degree. Although she lived in a less-populated area with a dairy farm at the end of her road, the school district she attended she describes as wealthy and large. Her graduating class consisted of 650 students while the current class is 1,000. The biggest employment industry is health/education with manufacturing and retail second and third. Alice's mother taught

French and Spanish, and her father worked for the phone company and was on the school board for 13 years.

Alice perceived her home life as influencing her academic abilities:

In 5th grade, I'm reading *The Lord of the Rings* trilogy. I mean I had nerds for parents. We had books. I wasn't allowed to watch TV. I was told read a book or go outside. I would sit there with my book so my reading levels were higher than most of the other students. (Interview 1)

Alice's parents divorced when she was 13, and her father got full custody of her. Her dad went on to remarry, and she hasn't seen or had any direct interaction with her mother since she was a teenager.

I am not surprised at the black-and-white image Alice has of her parents' educational values: "Good grades, you're gonna go to college." Thinking back, that was the same image I had, and if someone were to ask my own children that question, their response would be the same. I think about the contrast between growing up in a suburban school as opposed to an inner city school, where I imagine the values are very different.

She spent her teen years surrounded by friends who were drug addicts and experimenting with drugs. Alice almost died during her junior year because of a drug overdose. She found herself being homeschooled most of her junior year and did not even remember her prom being announced and never took the SATs. Alice described her high school years with a sense of being lost and a regret that nobody in school was there to guide her.

And they only really gave direction to the good students, so for me I was a little upset. Because now, looking back, not one teacher, I got a 92 or 93 on the Course III Regents, I mean with not doing home works and barely doing work. I wish someone had said to me, "Hey, you have an aptitude for this. You could do this someday." (Interview 2)

As Alice reflected back on this memory, it dredged up feelings of regret and missed opportunity.

I was excited to get it (the regents grade), but no, to be honest, I was more concerned with hanging out with my friends. . . . I was not in a good place. . . . I had no guidance from anybody telling me that I actually did a great job in math and maybe you should do this. My brain wasn't there. I wasn't thinking of the future. I wasn't thinking of the present. I wasn't even thinking. I always think if I had a do over, what would I do? I would start over from probably like seventh or eighth grade. Eighth grade is when I stopped. (Interview 2)

As I listened to Alice's words, I couldn't help but wonder who Alice would have been. If she had not faced the challenges in her life and overcome them, would she still have the same strength and resilience?

At the end of her junior year, it was suggested she finish her high school year at a local community college. Alice described the 5-minute conversation that led her on this path:

I mean when it came down to the 11th grade what do you want to do with your life meeting, it lasted 5 minutes. My guidance counselor said, "What do you want to do with your life?" and I said, "I have no idea; I just know I don't want to be here." And she said, "Well, you know because you took the 9th grade classes in 8th grade, you could go to the community college your senior year." I was like, "Alright, whatever, just tell me how to do it." (Interview 1)

Alice doesn't ever recall conferring with her parents or anyone when making academic decisions. Unfortunately, she didn't make it through her freshman year.

Alice described what happened when she flunked out of college:

When I turned 18, my step-mother kicked me out of the house, . . . so I was pretty much like, "Alright, I got to be able to get a job." It isn't waitressing, because I had this thing about other people determining whether or not I could pay my bills. (Interview 1)

Alice chose to go to technical school, which eventually led to her getting a job with the company she still works for today. That job would help her find her way and eventually lead her back to teaching. Alice started out working for a large computer company from

1999 to 2000, as an education broker responsible for data input of class scheduling and course descriptions. Alice changed companies in 2000 and began work as a computer instructor. In the spring of 2001, that company went out of business, and she went back to the computer company she worked for previously as a contract employee working the help desk. In 2002, she was hired as a full-time employee in the same department. Her employment placed her in an environment that exposed her to teaching and the opportunity to work in India.

Eight months later, when Alice returned to the United States, her company gave her the opportunity to work from home. Alice decided, “I am going to go back to school, get a degree, and somehow become a teacher” (Interview 1). Alice chose the college because it was online and set up to support adult learners.

I was struck by the caring words of her instructor when Alice shared the long hours she was working: “Wow, those hours are horrendous. You deserve applause for keeping up with your schoolwork so well.” I thought back to when I was carrying a full-time course load and trying to juggle course work with travel. I remembered the support I received from my own instructors allowing me to attend class via Skype and providing just the right words when it all seemed like too much. The supportive words and actions of instructors had helped us both overcome what would otherwise be impossible obstacles.

When speaking of the support she received from her fiancé, she stated, “He is not empathetic. He just walks off, says don’t whine to me. You signed up so do it” (Interview 1). I am both surprised to hear her say this and amazed that she is able to

persevere without this support. The incongruence between the lack of support that she receives and the support that she gives stuns me.

When in need of support, Alice felt it was difficult to seek it from people who were not going through the same experience. She sought most of her support from classmates and likes

getting things from a student's perspective; like I love peer review. . . . You get someone at your knowledge level, and they are seeing things from a different perspective, so I think that is really important; just sometimes if another student gets it, they can explain it better sometimes. (Interview 1)

When talking about support, Alice frequently mentioned a classmate, Shelly:

Having Shelly—who is not only a fellow student, but is on the same path in terms of major and career—has been extremely helpful. Nobody can truly understand what you are going through unless they are going through it or have gone through it. The fact that she and I can call each other and complain or cry or scream or do whatever we need to do when we are stressed is a huge plus. (Journal 2)

Two of my classmates are folks I've worked with for quite some time. We have been helping each other. (Journal 3)

Alice avoided certain courses because of bad previous experiences with instructors. Alice occasionally sought support from a tutor. She knew that she needed help and took the initiative to seek it out. Alice was also fortunate to have her fiancé's brother who had taught calculus 1, 2, and 3. He had provided a significant amount of support in the past. She described a situation in which her brother-in-law provided support: "He helped me out when I was taking calculus I, II and III. . . . However he has a full time job and four children so his free time is very limited. Sometimes it just helps to know that he is there if I need him" (Journal 2). "[His wife] had a baby last year. So now unfortunately he has no time" (Interview 2).

Alice described the support systems the college offered as not being adequate for those in advanced mathematics:

Support systems the school offers, like peer tutoring, do not really help those in upper level mathematics courses. I would like to see the college branch off and provide cross-campus peer tutors . . . to have bad instructors audited and removed . . . in a mathematics major where a lack of understanding in a lower-level/prerequisite class can literally mean the difference between success and failure in upper level courses, this type of effort on the part of the school should be mandatory. To date I have had poor instruction in Calculus I, Linear Algebra, and now statistics and abstract algebra. (Journal 2)

Alice did find her relationship with her mentor a source of support and guidance.

She described how her mentor helped to guide her when selecting the needed general education requirements:

I also took Science and Technology in Western Cultures. My mentor thought I would like it and it completed my Gen. Ed. requirement for Western Civilizations. She was right, it was right up my alley. My two favorite topics made studying History (my least favorite subject) much more enjoyable. (Journal 1)

In an e-mail from Alice on March 15, 2012 she wrote the following after reading the first draft of her portrait,

I do have some bad news. I am 4 weeks behind in my studies now because my father had his second stroke on February 21st. This one was massive and has pretty much crippled him. On top of that I am being laid off from IBM. I was notified on March 6th that April 8th is my last day. I'm now job hunting on top of everything, so unfortunately, my studies have taken a back burner. I am still convinced I can finish the work before end of term. My teachers are being extremely understanding and I am hopeful . . . I love your comments about me saying how I wanted to get ahead in my studies. Unfortunately that hasn't panned out. Oh well. Right now I am also doing Girl Scout Cookie Cupboard. I'd be happy to share the insane sized bites that I have bitten off and am now having trouble chewing! Let's just say that I have 7000+ boxes of cookies in my house, right now. :)

**Challenge me, please.** When Alice thought back to her image of herself as a mathematics student, the first thing she said was that high school was her last mathematics classroom experience. All of her college mathematics courses have been taken in a virtual classroom. Because of her negative experience the first time around, Alice was hesitant to try online learning again, until she had a conversation with a

colleague who was on unemployment and attending this college. The colleague said, “It was the greatest school I’ve ever been to; it’s a state university so the prices are affordable but online” (Interview 1).

Alice told me about the way she approached each course. First, she looked at the course schedule; then, she put everything on a calendar and made lists. She described this step as critical to her staying on track and managing her time. Alice appeared very at ease with the technology related to online learning, as well as with reaching out and creating a support network. She had taken online courses before, and her technological background enabled her to quickly set up online support groups as well as virtual student meetings. A virtual meeting tool she uses at work enabled her to do so. Alice was thankful she had a prior teacher who did a good job explaining how to use the software because she felt this teacher did not. To help her stay on track, Alice set her discussion posts up so that she would get e-mail notices when someone posted. She complained about students who post late, especially those who post after the term is over.

Alice was in her last semester and had an arsenal of tips that enabled her to balance work and school:

This semester I am trying to get ahead. I actually started my coursework in December. When I first got my book, I had a heads up about abstract algebra being all proofs again. So, I had the syllabus in December. I said, “Alright, let me start working on these problems now so I can get ahead.” (Interview 1)

The instructor for Alice’s course posted course announcements each week that gave a brief summary of what was due. Each week the students had a reading from the text, a discussion, and an entry in their learning journal. There was a final project that required the use of special software along with written assignments that used software required in several other courses. Alice reached out to her instructor for help with the software. “My



question is the software because I need the subscribing. I think I will have to take you up on your offer to have a phone call” (E-mail, September 10, 2011).

Alice was having a very frustrating semester because of what she perceived as a lack of communication and care from one of her instructors. These are two traits high on Alice’s list as being keys to her success:

This is the worst semester for me to get incommunicado professors. I don’t know how I am doing. I don’t know what is going on. I’ve got four months until my wedding. I’ve got two months to find a new job. Everything is happening at once and this just adds to my stress. (Interview 2)

Alice described her experience that semester:

. . . frustrated. I just don’t understand how you can get away with the bare minimum. . . . There is a website. . . . It is called rate my professor. . . . I just submitted a request to add him. . . . People need to know. . . . I submitted to my mentor. She got me in touch with department people. (Interview 2)

She reflected on a range of experiences she had had with instructors and intensely described how critical instructor support had been to her success:

. . . hands off. Didn’t participate at all. I am totally put off by that. I understand this is adult education and educating yourself. I understand that. We’re adults and self-learning but, there is still only a certain part you can teach yourself. You do need some input from someone who has more skills than you. Thank goodness I had professor Smith and professor Black, which was my saving grace because the two of them are phenomenal in terms of feedback and participation and giving help and explain things in a different way if the text book is not clear. (Interview 2)

Alice vividly described the obstacles she faced because of an instructor of a prerequisite course not meeting her needs:

I had a horrible professor for one course, and a disaster course for the other course, and those are two of the prerequisite classes for every other course in your math major. . . . I am grateful I had professor Smith and professor Black right after the disaster courses because they pretty much caught me up to speed. . . . It was hard because I didn’t have some of the basic understanding. (Interview 2)

I am struck by the disparity in support she received from her instructors. After reading the second draft of her portrait, Alice shared the following in an e-mail on September 21, 2012:

End of term. That is a sore spot. One professor still hasn't given me feedback or graded my first 4 assignments. She graded numbers 5 and 6 with minimal comments and some questions marked as "oops, I didn't mean to assign this." I am beyond frustrated. I started reaching out to her other students. Statistically, based on the feedback I got, it takes an average of two semesters to complete her course (due to the volume of work and lack of "teaching"). I never finished the final 6 assignments because I find it hard to move on without feedback on my earlier work. She said her eyes hurt, and I gave up asking for feedback and took my INC into a No Credit (NC).

In addition, I reached out to my favorite professor. She is designing a new version of the course and gave me the name of her textbook. I used it as a companion but without any feedback from my teacher, I decided it wasn't worth my stress to continue on. So my graduation is deferred. Her class is slated to be available in Spring 2013. I will take it with a teacher who gives feedback readily and is always willing to help her students and I am confident that with her I will succeed. Plus, I'll actually get to walk in my graduation! I guess graduating this past spring wasn't meant to be.

Alice is appreciative of the support she received after her father had a stroke. Her instructors told her, "I could have extensions on all of my work and to take all the time I needed to be with my father. . . . They were understanding about when life happens" (Journal 3).

**Bumps along the way.** Throughout her high school career, Alice's belief in her mathematics abilities never wavered. Alice repeatedly spoke of how easy mathematics and science had always been for her and the straight *As* she received up until her middle school years, when things in her family life took an unfortunate path. "I could have gotten straight *As*, but it just wasn't a focus for me anymore" (Interview 1). Alice's pride in her personal accomplishments came through as she described how, although she stopped doing homework, she continued to get good grades. "Even with not trying, I still

managed to get phenomenal grades in math. And it was just that I loved it. I understood it. It clicked for me” (Interview 1).

Alice vividly remembered being bored in school. She shared her memories of elementary school.

I was totally bored. . . . I had students in my class who were completely illiterate. I was reading at a high school level in elementary school. I read all *The Lord of the Rings* books in, like, second grade. Those are pretty advanced for that age. . . . I was just bored. (Interview 2)

As Alice recounted this story, I gained insight into how important her childhood academic accomplishments were to her current belief in her academic abilities. While I am initially surprised to hear what sounds like a lack of empathy for students who struggle, Alice’s caring side emerges:

My whole pet peeve about classes as a whole is you are always going at the speed of your weakest link. I don’t like to say that negatively because I understand there are people who learn at different speeds. . . . That is a difficult part of teaching, the range of abilities of students. In some ways that is a nice part of online studies, that you can individualize learnings. (Interview 2)

Alice was passionate about her love of mathematics. She was very hesitant to create an artistic representation because her “artistic abilities and creative abilities tend to be toward linear things. I design houses. I draw floor plans. So, it is all square” (Interview 2). As Alice thought back to high school mathematics, the picture she verbally painted was colored with her excitement and love for mathematics:

I am excited because I love math. I love learning, and it is almost the rush of you have to figure what the answer is and getting there . . . that mild anxiety as you wait for the paper to come back. It is exciting. I guess it is like being on a rollercoaster. Where you are antsy until you get to the very top and then you are like woo as you go down. (Interview 2)

Alice was not academically successful as a student completing her last year of high school at the community college:

I failed the entire second semester so it was like, I mean I barely passed my first semester. I clearly wasn't ready for college. I had to go to summer school in order to graduate high school to make up the classes. I maybe should have stayed in high school. (Interview 1)

Alice was successful at her job. The company cut 15% of its workforce, but Alice described how her "having the right attitude" enabled her to be one of the five people still employed out of 500. Alice's job as a trainer would eventually take her to India, where she found herself with a lot of free time to "create my five year plan" (Interview 1). She contrasted her own life experiences and outcomes with those of her classmates:

I look back, and if I hadn't given up like I did, I probably would have gotten scholarships to great Ivy League colleges. . . . I look at other students. . . . They knew what they wanted. They had direction and really good home lives. One of my classmates, her mom was our physics teacher. Her mom was stupendous. She was an amazing teacher and an awesome parent. (Interview 2)

Alice's never-ending belief in her math abilities emerged:

I got a 92 on the Course 3 regents. After the drama with my mother, I was still in the mindset of kind of paying attention but not really doing homework. I got a 92 on the regents, and I was like, "Wow. I must be really good in math if I could halfway pay attention and sort of do my homework and still get a good grade. So, that was like, I mean I was like my brain was all messed up back then, but when I look back, that is kind of when I realized, "Hey, you are good at math. Maybe you want to do something involving math." I never did anything with it until much later. (Interview 2)

Alice's difficulties remembering things emerged as she discussed why she believed she would struggle in her current course:

I am getting more and more frustrated. . . . I learn by doing which is why I always enjoyed math. However, I look at the pages of the book and they swim. . . . I am seriously worried I won't be able to finish this degree. . . . If I am having this much trouble with module 1, I have serious doubt in my ability to be able to survive the semester. (M1A1, October 6, 2011)

In her introduction in the course, she wrote, "I think this will likely be the hardest semester for me because this class and my geometry class are full of proofs which I am terrible at" (September 5, 2011).

Alice recounted several experiences throughout her adult life that ultimately enabled her to reclaim her dream of becoming a teacher. She described an experience when she worked as a summer camp counselor and a connection between her and a camper. She developed a relationship with the girl, who was depressed. Years later, the girl came back and told her she had saved her life. She described the effect this experience had on her as “to have that effect on one person is almost, is just like a drug. You want to help others. I want to feel like I can make a difference. I don’t make a difference in my job now” (Interview 1). I heard in her voice how meaningful this experience was to her and how it was at the core of what drives her.

It wasn’t until Alice had a direct experience with the daughter of a previous boyfriend that she was able to overcome her fear of being like her mother. She described an encounter she had with the girl and her reaction:

She picked up a tennis racket one day and smacked me in the chins with it because I wouldn’t give her a soda. . . . I am thinking my mom would have smacked me for that. I had absolutely no urge, I mean I saw that I didn’t have that violent tendency. I thought, “Alright, this is teaching me that I am not her, and I am an idiot, and I should have just gone straight into math and teaching, and I could have been done. . . . I am not a threat to society. I am not going to hurt children. It actually helped me move on with wanting to get married and wanting to have kids. (Interview 1)

Although I could hear the regret in her words, Alice’s resilience emerged:

You have to go through life and learn and grow before you are ready to take those steps. So now I will go into teaching with 10 plus years with reality, you know real life. And I would be the teacher that could say to the students honestly, “I know what you are going through because I have been through a lot.” (Interview 1)

Shortly after starting her job as an education broker, Alice found herself finishing assignments with time left: “I could type faster than them. I was bored most of the time” (Interview 1). She ended up spending her extra time helping out in the classrooms. One

of the instructors told her, “You pick up stuff fast. I’ve been watching. Would you like to come work for me? I need someone to teach an Intro to Unix class programming” (Interview 1). Alice’s strong belief in her abilities enabled her to accept this offer: “I am horrible at programming, but I was like, “Alright it is intro, and it’s a three day class” (Interview 1).

Alice described the words of encouragement from her family:

My family and friends are supportive in that they continue to tell me they are proud of me, or that they are amazed that I am working full time, and also completing my degree. That type of praise feels good. It doesn’t really help me out. Being a math major means I am in the minority. Most of my friends don’t do math, . . . so I can’t really turn to them for help. (Journal 2)

Alice’s instructor provided words of encouragement in her assignment feedback:

You are being much too hard on yourself : ) You are doing a fantastic job . . . you really do understand more than you are giving yourself credit for . . . you are making great progress and you have a natural talent. I know you can make an A in this course . . . The fact that you can achieve all this while also working and planning a wedding is simply astounding. You should go out and treat yourself. (Assignment M1A1, October 27, 2011)

Alice found her years in the computer field gave her an advantage with the technology. She shared her knowledge and experience with her peers, and it seemed important to her to be able to provide this kind of support. I saw several examples of her reaching out in her discussion posts, especially in the ask-a-question area. In a response to a student who titled her post “Please help I am going to kill the software!!” Alice replied, “hi, do you have any time today to do a remote takeover with me? I can call and view your computer with you at the same time. This will allow me to see your error messages you get as they pop up and maybe identify a problem in the code” (December 21, 2011). In response to another student having difficulties, “I got the same error if my PDF was open. However, if you get it again with the PDF closed, and you want someone

to work with you, I'd be happy to see if I can help. I have a utility that will allow me to look at your screen with you, and we could talk on the phone. I'm not with. . . . Tech Support, but I do Tech Support for my job, and I've been able to help others in the past. Let me know. Sometimes all it takes is another set of eyes" (December 5, 2011).

Alice's dad traveled a lot as a member of the school board. While she remembered that as having a positive effect on her life, it also had a negative effect. She described how he traveled all over the country looking at what other districts were doing and the opportunities that she and her classmates had because of her dad, such as outdoor education, team-building exercises, and an extensive foreign language program. With her dad gone all the time, her mother became abusive, and nothing Alice did lived up to her mother's expectations. At our first interview, she described the following as a vivid memory:

Coming home with my report card. It had three 100s, two 99s and a 98 and a 97, and she beat me and said what happened to the other points. And I said, if she is going to do that I am going to give her a reason to and I stopped doing homework. I just stopped. (Interview 1)

When Alice initially returned to high school after recovering from her drug overdose, she was so overwhelmed with anxiety she couldn't function without anti-anxiety medication that made her sick. As Alice recounted this experience, I was imagining feelings of isolation and missing out on fun, as well distress over missing so much school. However, it didn't seem traumatizing to her at all:

I had a tutor bring me assignments. I wasn't a social butterfly. . . . Honestly I didn't mind. I got the same assignments as everyone else. I just did them at my own pace. Academically, I did well that year. I did better that year than I did previous couple . . . because all I had to do was my homework and stuff. (Interview 2)

I am surprised to hear that, not only did she enjoy not being in school, but she excelled academically. It makes me realize the effect Alice's school environment had on her.

Shortly after Alice left community college, she returned to school but found it difficult to balance the heavy work schedule with school and took a leave of absence. Because of a missed communication about her change in address, her student loan went into default. With a big loan to pay back and no extra money, Alice couldn't afford to return to school:

I'm like, "Alright, well, I have a job that has a career path, so I won't worry about it; I'll just pay it off, pay it off," and I still had that bug in the back of my head about wanting to be teacher. (Interview 2)

As I was listening to Alice's story, I thought back to my own college experience. I remembered what a hardship having to work a 10-hour week work-study job seemed to be, but beyond that, finances were never a concern. I can now empathize with the difficulties of balancing work and school under a constant financial strain.

Alice's sense of exhaustion was illuminated by the following e-mails to her instructor:

Weekend Please - I'm going straight to bed when I get home. I've been down here since Sept 6th and we were even asked to work on the weekends. I'm now immune to coffee and suffering from sleep deprivation :).

In her introduction to the course, she wrote, "The demands of my job will be double this semester . . . so wish me luck and send me coffee : )" (September 5, 2011).

In her third journal entry, she wrote, "It is really hard to stay motivated this semester especially since I have run myself into the ground . . . taking courses continuously since January 2010. . . . I am not happy in my current job. . . . I want to be there for my family" (Journal 3).

She wrote the following in an e-mail to me:



Your work gives me hope that I might also be able to accomplish a Doctorate someday. For some reason, I have this irrational fear of Doctoral studies. However, in my interactions with you and now reading excerpts from your research, I realize that the work is what you make it and as long as I choose a topic I am passionate about, I should be fine. I won't let getting a PhD someday, be affected the way my ability to take Physics was affected. The difference being that I'm more apt to push through things and "just do it."

After reading the second draft of her portrait, Alice said,

Regarding your document. You make me get all choked up because of the way you speak about your interpretation of my interpretation of my life experiences. Especially since my father's death, I get down more often than usual and I forget the reasons why I'm doing what I'm doing. Reading what you wrote about me is like receiving a reset button. I feel the spark come back to life. It is like a fresh set of batteries.

I still haven't decided what I want to do for a PhD yet, but I've got ideas. . . . Maybe when the time comes, you'll still be around and I can select you as a Doctoral Mentor (do they have those?). (September 21, 2011)

### **Angie**

"I am more proud of being a physics student than being a linguist. It is funny and when people ask they are like wow, and I am like yes physics" (Interview 2).

Angie is a 23-year-old, married woman, serving in the military. I can hear in her voice the immense pride she feels about being a physics major. She had no children at the time of this study. Although Angie was young in years, she was old in life experience, wisdom, and perspective. Angie worked over 40 hours a week as a language analyst in the military. Angie was pursuing a BS in physics, and her husband, who was also in the military, was pursuing a BS in mathematics at the same college.

A typical day for Angie was waking up at 5 AM, working from 6 AM to 5:30 PM, eating dinner at 6 PM, showering and preparing her uniform for the next day at 7 PM, followed by homework for her language class from 8-10 PM and finally going to bed at 10:30 PM. She did her college homework on weekends.

Angie lived far enough away that, between the distance and her military schedule, we couldn't arrange a face-to-face meeting. We decided to do all three of her interviews over Skype. Angie showed me around the apartment she shared with her husband at the military base where they were both stationed. I felt an immediate connection with Angie, seeing her bicycle sitting in the corner of her room. I found myself feeling surprised when Angie showed me the piano that she still had from her childhood, sitting right in the middle of her home. It was not something I expected.

**There is nothing I can't do.** Angie did not see her mathematical skills as being inherited from either her mother or her father. She described herself as someone who liked to study, was inner motivated, and liked to read and not really socialize:

I used to hate recess, so when everybody else was outside playing I stayed in, curled up in a corner, and read books by myself. I was always the one who would rather be studying. I hated recess, always, so much. (Interview 2)

Her caring side surfaced throughout our time together. When she received extra help, she felt guilty:

proud of myself, but I also feel bad for other students who may have needed the extra push where I was able to kind of motivate myself on my own, . . . but they probably should have been working with kids who needed it so I feel guilty. (Interview 2)

As I listened to Angie recount this story, I was touched by her ability to recognize that the extra help she was receiving was taking away from other students who might need it more. Even at a young age, Angie was cognizant of the needs of others and cared about those around her.

Angie had a predisposition to always see the bright side of things. When thinking back to the difficulties she had in high school, she said,

I learned from it because now I really pay attention. That is what is important; we learn from our mistakes. Yeah, I know I kind of look at everything like that has happened. I don't really look at it as a failure but I guess it is. (Interview 2)

When thinking back to her decision to study abroad and the resulting kidnapping she said,

To this day they [her parents] still give me a hard time about it. I've been back 4 years now, almost 5, and they still give me a hard time about it. Just drop it guys. They don't understand how it helped me in my life. (Interview 2)

Angie described how she felt about mathematics: "I still like to see the logic behind things and I definitely prefer being in a math-related course than something like history, where you have to just memorize facts and dates that don't necessarily follow a logical progression" (Journal 3). In her collage, she included pictures that represented her desire to be challenged. In the essay that accompanied her collage, she wrote, "I have to rely on myself to keep up the motivation. . . . This is a challenge that I have gladly accepted".

**A journey across the globe and back.** Angie grew up in a small town where she always felt she didn't quite fit. She described her town as closed minded and "I was disgusted with the majority of people around me in my town" (Interview 1). When describing where she grew up, Angie stated, "I grew up in the woods" (Interview 1). Angie described her town as small, with one traffic light. Her house was in the mountains, where she was isolated and had no nearby neighbors. Her town was so small that the school had to be combined with that of another town. Her graduating class had only 80 students. Although her town was small and isolated, Angie was only about 30 minutes from a large city, where she found herself escaping to during the weekends. She credited these trips with her desire to see the world and go far away to college. Unlike most children of her generation, Angie was not influenced by TV, music, or the Internet.

TV and music, we didn't have. TV we only had rabbit ears. TV, I never saw MTV. So the first time I used Internet I was 15. We got satellite TV, and of course, I didn't watch because my dad watched whatever he wanted to watch. I was very sheltered. I didn't know anything about real life. (Interview 1)

Angie had no exposure to STEM role models in her home. Angie's mother was her school bus driver and cleaned houses on the side. It was this job that exposed Angie to many successful women and led to her own the piano she still had at the time of this study. When Angie talked about the household roles of her immediate family members, I heard a sense of disappointment in her father and compassion for her mother:

My dad was kind of, didn't do anything. He was a carpenter. He would get home late, shower and open a beer, and wait for my mom to make dinner. She was bus driving, cleaning houses, and she did everything although we did go to babysitting and she took care of everything. (Interview 1)

She did not see her parents as a source of support when it came to schoolwork.

When Angie recalled the environment of her home, I heard regret creep into her voice:

When I was young, I never asked for homework help . . . and did homework by myself in my bedroom and doing homework right before it was due. I wish my mom had been more hard on me . . . in terms of academic homework if I had a question on math they couldn't answer. They had only finished high school so honestly my memory was that my parents couldn't help. (Interview 1)

Beyond her home, Angie didn't perceive any type of support system. I heard the regret in her voice as she recounted the following story about the lack of anyone noticing she was crying out for help.

No, nobody did, and if they had, I think I would have listened to them. I wish they had. I wasn't really mature enough at the time to say, "Hey, it is going to matter when I apply to college." . . . That whole year was probably my greatest academic failure, and I really wish that I had been mature enough at the time to kind of take it seriously, maybe that somebody had sat me down and said, "Hey, what is going on?" My parents kind of turned a blind eye. I don't know why they didn't say anything. I guess they had their own stuff to deal with, but that was a pretty big fail. (Interview 2)

Angie recalled a constant sense of disappointment in the lack of guidance she received when it came to course selection or college planning:

I mean, basically, there were only two choices, regular and advanced, and there were never any names like algebra or geometry. They were always like math A and math B. Yeah, I never really knew what I was taking. I was just taking math until pre-calculus and calculus. We weren't that involved in our educational planning. We just got our schedule in the mail. (Interview 2)

She vividly recalled a lack of any guidance from her guidance counselor: "Oh we had them. We had two. I don't think they knew who I was until my last year, and I didn't have any interaction with them" (Interview 2). "I kind of just decided on my own I was in that program right from the beginning, so obviously you will take AP English, so I guess when choosing, so I will take AP" (Interview 1).

When it came to college planning, Angie had completely given up on seeking advice from anyone at school: "It would have been helpful probably instead of trying to do it all on my own" (Interview 2). Angie's memories of college planning were summed up in the following words: "College planning, nobody cared; nobody helped; my mom just didn't know how because she just didn't know how . . . I just picked some schools . . ." (Interview 1). I thought back to my own experience selecting colleges and now my own children's experiences. I found myself thinking about the advice I received and the advice I am now giving to my son and daughters. I realized how context not only affects the words spoken but how they are heard.

Angie's strength emerged within the first minute of our first interview as she described her decision to attend college in a developing country and the events that led her to where she is today:

So, it was interesting, even just from the beginning. So I moved . . . in 2006. I started college over there [third world country]. Well, it took a little while to get enrolled in everything. I got going, and I was there for a while, and this is a crazy

story. Yeah, so I actually got kidnapped into [another country], and by the time I got out of there, I kind of had been disenrolled from school. I missed all my final exams and everything. I ended up not getting, like, not any credit at all for going to college. And obviously, I couldn't stay there anymore after I got out. So I came back here, and for some reason thought it would be good to be in the military. (Interview 1)

While studying abroad Angie did find support in a classmate and the maid of her boyfriend. She described her best friend, the one who taught her to speak French, as the Philippine maid at her boyfriend's house. As part of her marketing course, Angie had to find a business on which to base her business plan. Because of her inability to communicate, drive, or even know her way around, Angie needed to reach out to another student and ask for help. She was there with no car, and no idea as to how to approach and find a business sponsor. I can hear the appreciation Angie had to this day:

I remember feeling so helpless and, like, without that other girl, I could not have done anything because I needed somebody who knew how to speak. . . . And I couldn't speak. . . . yet. So she had to take me around to the places, and I would just kind of sit there looking stupid, and she would do all the talking. (Interview 2)

I remember back to when I studied a term abroad and all the places I have traveled to as part of my job. I try to imagine myself in her shoes and wonder what it must have been like being alone in a foreign land, unable to speak the language.

Upon joining the military Angie made it a priority to finish school but had a hard time finding an online school that met her needs and expectations. She did a significant amount of searching, even speaking with the military education office who told her she couldn't study math and science online. Life experience has given Angie a renewed perspective about school and studying. "I want to study. I want to take notes. I never studied before, now I realize this is how you are supposed to do it" (Interview 3).

"My husband is one of my biggest motivators. . . . [H]e is my support system. He has been there for anything. . . . [H]e makes me be strong. He supports me in everything,

even little thing like taking the time to not do homework. My mind says you shouldn't stop. He supports me in saying take a break or he will say we will sit at a coffee shop and do things together (Interview 3). "Basically, I've felt that aside from my husband I've been working through all of my courses alone" (Journal 3). "My husband used to teach math at a college in Florida and taught intro to physics so he has been able to help, he is a genius" (Interview 1).

I realize how critical spousal support is in overcoming obstacles as I reflect upon the lack of support I received from my ex- husband when mentioning I wanted to return to school for my PhD. This lack of support prevented me, at the time, from returning.

**Somebody reach out and show me the way.** Angie felt out of place in her high school and never really connected with most of her teachers or the students. "I kind of disconnected myself with everyone and I kind of wanted everyone to just leave me alone. And everybody thought I was so ridiculous for doing this [going abroad] which I thought was a really good idea at the time. Nobody seemed to be listening to me and I kind of just stopped talking about it and just stopped talking to people in general" (Interview 1).

Prior to enrolling at the college in the developing country Angie knew she was interested in science and mathematics but wasn't sure what she wanted to concentrate in. Her choice to attend school abroad had more to do with "life experience and learning about a third world country and how they live and to appreciate my life" (Interview 2). She enrolled in mathematics, computer science, English, history and business marketing with a concentration in business. Her decision to concentrate in business was purely because she, "had to choose something" (Interview 2).

It is evident that memories from high school continue to influence Angie as she reflects on her feelings about previous school experiences. “I really missed being a student and having a reason to go sit for hours in the local coffee shop or public library to study and do homework or write papers. This may sound strange, but the most exciting time for me is the very beginning of the term when I get to buy the new textbooks. I used to really love the first week of school because I couldn't wait to get my new books to look at, and that definitely hasn't changed. I guess I have somewhat of an obsession with books” (Journal 1).

The course Angie was enrolled requires a textbook as well as two different types of software to complete the homework assignments. The software has support features including ask the instructor and video. As part of the course students needed to complete multiple choice questions, homework applications using the software, a learning journal and a final research project on a topic of interest to the student. This type of final research paper gave each student a chance to learn more in-depth about something that they felt a connection to. The instructor maintained a presence in the course by consistently posting in the course announcements 1-2 times a week. He tried to keep the tone friendly and encouraging with comments such as “Greetings class!”, “Happy Thanksgiving!”, “Happy New Year!”, “Hi everybody!” “[I]t’s been a great course this term, and I’ll sure miss all the fun discussions we’ve had.” In each announcement he invited students to ask questions or let him know of any concerns letting students know he is there to support them. In each post he gave an overview of the topic they would be studying, what the assignments were, when they were due and reminds them to plan their time accordingly. The work load was heavy. An example of a 2 week module might include a discussion,



two written assignments using the software, work on a team project and a learning journal entry.

The course had posed discussion questions that asked the students to relate to real world examples and provided for a lively and engaging interaction. Analysis of the data illuminates how these discussions helped the student gain a deeper understanding of the topic through reflecting and learning from each other as well as created a meaningful connection to the material and how it fits into their life. Dr. R. actively tried to make these connections with Angie, “I was interested in talking with her about real world applications. . . . My feedback was make sure you are fleshing out the application side. I gave her an idea she might want to research . . . design of cars, how that affects the turning, handle on the roads” (Instructor interview).

The teams had to submit drafts of their team projects for other teams to review. Both of these discussions encouraged students to reach out to one another for help and allowed them to feel comfortable. It seemed to reduce the anxiety level in the course as it allowed students to share what they were struggling with and realize they were not the only ones. In response to a classmates post related to using the software Angie says, “Sometimes I had a hard time figuring out just what I need to do. . . . I was really happy to see you posted here! I think the type of representation that you’ve included by inserting the graphs makes things crystal clear. . . . It definitely helped me” (October 2, 2011). In a discussion reflecting on what they enjoyed about the team project Angie says, “So, far, I’ve been glad to have my teammates to help me out with some issues . . . [T]hat has definitely been my favorite part. . . . [M]y team has been struggling a bit, . . . but I think we’ve been working well together getting through it” (October 10, 2011).

Angie doesn't feel a connection with other mathematics and science students, which she feels is due to the online setting, but does feel a sense of support from her mentor and instructors. "I think it is difficult in the online environment" (Interview 2). "I find it very difficult to develop any relationships with the students in the courses because the only interaction I every have with them is in the mandated discussions, which I really dread having to participate in any way since I never feel like there isn't anything productive to say in response to other people's post" (Journal 3). I am struck by the incongruence between how Angie describes her experiences in the discussions and what I hear when reading the posts.

"My mentor was really great. I took her a lot of work. I really appreciated she has really helped out a lot. The teachers are great, as long as you turn it in you are good. My physics teacher is good" (Interview 3).

She describes her courses as not being challenging and would like to be a peer tutor except "then I realized I've been super busy and just dealing with the classes has been enough. They are like keeping me very busy" (Interview 2). In her collage essay she describes the courses as being challenging because of the need to be not only self-motivated, "read through the text books and understand the material on my own for the most part" (Collage essay).

Angie reflects upon her own high school experiences when thinking about her strong sense of belief that she will be successful as a teacher. "Back in high school I always thought there were ways teachers could do things better. I want to go in there and be like there are ways you can do things better . . . I always want to fix things that I feel

are not going properly. I just like to teach people. I feel that is the root of the problem is people are not taught properly” (Interview 3).

**Music is at the center of her world.** When Angie reflected on her academic abilities in our interviews, her journal entries, and in her collage her confidence and belief in her abilities never waivers. “Things came easy to me and I got awards for high grades and people started to make comments like of course she did this. So eventually I started to see that I can do this and now I think if I want to get a physics degree I am going to. So I am” (Interview 1).

“I think things were generally easy for me. . . . I didn’t have many other distractions and I didn’t really study outside of school. The time in school was enough since I was at school and paid attention” (Interview 2). When Angie went abroad to study she enrolled in classes that were taught in the local language, not English and that she “just picked it up as I went along. I kind of self- taught myself a little bit. . . .” (Interview 2).

She describes how she narrowed down her area of study to science and mathematics, “I thought back to high school and which subjects did I like and I ruled out history, that was my worst subject ever and I wanted to do something with music. I don’t have flexibility and a lot of practicing hours that I don’t have. I knew math always came easy and thought science had more dimension. I knew they were the most interesting to me” (Interview 1).

Angie vividly recalls, in her timeline and the following story, her first physics experience at the college and the sense of personal accomplishment she felt. “I finally started physics classes and got my book and it was an independent study so the teacher

had me put together the course schedule and create the course. That is when it hit me now I am really studying and this is my second degree and it is kind of still sinking in. I realized this is serious and I can really do this and I have put together the course schedule for this, I am more proud of being a physics student than being a linguist it is funny and when people ask they are like wow, and I am like yes physics” (Interview 1). In her timeline she includes creating the syllabi for one of her physics courses on her own as “felt challenged & as if I could actually succeed at this stuff!”

Angie credits her military career as a source of her confidence in her belief that she can be successful in a STEM career. “I think being successful in my military career. Before my military career I still thought a PhD was a daunting task. I really think getting to the point I got to and seeing the people you don’t see in a small town really helped a lot” (interview 3). She recounts her most recent accomplishment with a sense of pride and disbelief, “They do these military awards . . . In all these people why would one person be recognized? They nominated me. . . . I was recognized as the top performer in my field. It is surreal to me and it was really crazy to be the actual person recognized as the very top . . . it is still weird. That kind of recognition . . . tens of thousands of people . . . I think I can do it” (Interview 3). As I listen to this story I feel in awe of this accomplishment, and struck by her humbleness. She includes this event in her timeline with the following description, “Happy, as if hard work paid off, recognized, motivated”.

Angie’s instructor describes her as having a, “very strong background” (Instructor interview). “When I look at her work, her proposal, had a strong interest in the topic . . . didn’t have many questions” (Instructor interview).

When Angie compares herself to those around her she perceives herself as an overachiever and the teacher's pet. Angie recounts the following story when thinking back to her image of herself as a student, "I think of me being the one that people joke about but in like a friendly way as being the overachiever of the class and always being the one that's like set aside to do extra work. Especially like in the younger years, I would always be the one who always got the extra enrichment work. People didn't dislike me for it. They would like joke about it to my face" (Interview 2).

Angie's describes her father's actions as one of the things that drive her academic pursuits. While many daughters spend their whole lives trying to please their fathers, Angie seems to be spending hers trying to distance herself from him. While Angie excelled at everything and was a source of pride and bragging for her parents the same was not true for her brother who dropped out of high school at the age of 16. Hearing her father call him a failure and watching him give up on her brother is a source of motivation for Angie, "it makes me want to gain more knowledge and get my degree and be smarter than my father" (Interview 1). As Angie shared the story of her brother I thought of the similarities and differences between our brothers and how each influenced us during our high school years. For me it was my brother's success that was a source of motivation to constantly work harder and strive to set high academic standards for myself.

Thinking back to people beyond her family who influenced her in some way the first thing that came to Angie's mind was the person who gave her the piano. Her mother cleaned the house of a composer and while her mother cleaned they would hang out and talk about piano. "I always said he was my idol" (Interview 1).

Piano and music were close to Angie's heart throughout high school and provided a role model for her during those years. "My band teacher really liked me a lot because he thought I was a piano virtuoso. So he got me this keyboard, just for me he got the school a keyboard so I could play the base and we went to Disney World and he paid for my ticket because my family couldn't afford it and when I graduated he gave me a CD of jazz music as a graduation present" (Interview 2). I can hear in her voice how much her band teacher's belief continues to be a source of support for her.

Angie lacked any clear direction as to what she wanted to do after high school and recalls the unsystematic way she selected from the range of topics that interested her. "There were so many fun things I couldn't make a decision. I liked the piano, language. . . . I just tried to figure, I don't even know why? I think I tried to figure out what the most useful but difficult language was . . . so many things I would like to do" (Interview 2).

Several of Angie's teachers had a lasting effect on her. "My Spanish teacher was very proud of me because I was in AP Spanish and she thought that language was a good idea" (Interview 1). "My math teachers were always the coolest and I wanted to be like them" (Interview 2). She also mentioned a female mathematics teacher she knew most of her life and who she describes as someone who kept tabs on her. "Talking to somebody about being a math teacher? No, not really. I may have talked to that woman math teacher a little bit about it. She always thought I was like one of her best math students but I don't think we ever talked about me actually. We talked about me going to NYU for math and she was going to recommend me" (Interview 2). "I talked to my piano teacher about

wanting to be a piano person and I even started to . . . prepare my audition repertoire but that fell through when I stopped going to piano lessons” (Interview 1).

“I did have this one teacher. . . . She was my chemistry teacher but she had lived in Africa. She used to be in the Peace Corp. and she was like so eccentric but so cool . . . because she just seemed so cool, probably like the coolest teacher I ever had. She had a doctorate, . . . and she taught chemistry in French to people living in these poor regions of Africa and I wanted to do that because I thought she was the coolest person ever. And honestly that is kind of the route I am heading in now because I want to join the peace corp and I want to do it with my Physics degree and I want it to be in Africa. So, I never realized it but I think I am trying to do everything she did because I thought she was so cool. And yeah, she is everything she did, she is just so cool. I felt so bad for her, people made fun of her all the time. I wish they would have appreciated how cool she was”

(Angie, interview 2).

I did have this one teacher in 8th grade, . . . [W]hen 9/11 happened, . . . my school didn't tell us what happened. . . . [T]hat teacher was the only one to tell us and he was another one that was very open minded, very culturally aware . . . worldly. . . . [M]aybe that made an impression, because that was very hard to come by in my town. . . . [N]obody travels outside of America, but this guy was very open minded. . . . [H]e was one of my favorite teachers. . . . [A] year later he died. . . . [W]e actually went to his funeral. I didn't go to my own grandparent's funeral. (Interview 2)

In the military, Angie seemed to have finally found a female role model to provide the guidance she has been seeking. She is a senior level personal, who works in the same office as Angie and has been in the military for 15 years. “She is the one I go to by default. I would go to her before I would go to any of my bosses. Sadly, they haven't put her in a management position” (Interview 3). Angie described the support:

She was awesome she was, like, you are really great, and I am going to help you and even when I got discouraged she was, like, you keep looking; you need to do

this. She is the reason I actually followed through, and it was nice to have a woman who is very successful, and she was promoted first try every time and is very strong. She is kind of in charge of me, a lot of influence on my career always talking me up, and I hope I can do that for others one day, look up to like a mother. (Interview 1)

Everything about her is good . . . she does her job when she is supposed to, she genuinely cares, everything, about her is good, super successful. I want to be like her. I would want to do everything just like her to make sure I end up like her. . . . I have been discouraged by the way things work. She has kind of stepped in at those times and put her power into play and helped me out. . . . I would love to be that kind of figure for other people. (Interview 3)

Angie remembered her favorite teachers in high school:

My coolest teachers were a woman mathematics teacher and chemistry teacher so maybe I always thought teachers were the coolest and I thought it would be pretty cool to be one. That chemistry teacher gave me the idea of being in the Peace Corp. . . . [I]t doesn't seem impossible at all. (Interview 3)

When thinking about her future, uncertainty crept into her voice as she recalled a story about her aunt:

Everybody says I am like my dad's sister. She is really intelligent but never used it. She has a master's degree in microbiology. Instead of using it, she has always been a manager at Shoprite. My family has always ragged on her, but she has said, "I just want to get it." I don't really know what I want to do, but I don't know if I want to apply the physics. I am not sure I want to do that honestly. I don't know if I can get a PhD in physics. I just can't believe that I can actually be doing that. (Interview 1)

Angie's mother repeatedly told her she could definitely do whatever she wanted.

"She always wanted me to do what she didn't do" (Interview 1). When it came time to decide where to attend college Angie recalls,

So my mom didn't know much about it (college), but she was always very encouraging which I am really thankful for because without that, I probably would just, I don't even know, I probably would have just left and never come back, . . . but she was there to encourage me, but then at same time, like I really hated my dad; he told me he would disown me if I went to a third world country for college. (Interview 2)



Angie's accomplishments resulted in teachers giving her extra attention. "Um but it kind of my success kind of caused the teachers to give me extra attention and push me to do better" (Interview 2). As I listened to Angie describe her memories of being a student in her younger years I could relate to being the "teacher's pet" and the student who always got the extra work and extra push. I remembered being the one to always score the highest in the class on the standardized tests and my friends too joking and teasing me about being a brain. To this day, when I get together with my closest childhood friends those are the stories that they bring up. Like Angie, I remember feeling a sense of pride when hearing those words of encouragement and support. I wonder if those words stayed somewhere in the back of our minds and were part of our resilience and ability to push on when everything around us seemed to be crumbling down.

Angie vividly recalls a lack of any guidance from her guidance counselor, "Oh we had them. We had two. I don't think they knew who I was until my last year and I didn't have any interaction with them" (Interview 2). "I kind of just decided on my own I was in that program right from the beginning so obviously you will take AP English so I guess when choosing so I will take AP" (interview 1).

After earning failing grades in the latter part of her high school she told herself, "you know that I am still going to graduate" (Interview 1). As Angie made this assertion, it brought back to the forefront the question that I keeping asking myself. Why do some people have a resilience to overcome the barriers life places in their way while others don't?

Angie shares the following story about her decision to study abroad.

Yeah, so nobody was ever helpful in terms of helping me decide. When I did finally decide I wanted to go, . . . my family members were like, "Oh, well,

alright.” . . . [B]asically I think they were too uneducated about it to really be able to form a positive opinion or think that it would be a good career path for me to follow. . . . [T]he more I talked about that with any people even friends people were like you are crazy you will get kidnapped why would you ever do that, they are all terrorists and so it was actually really discouraging and it made me that much more excited to leave. It was a really depressing last year of high school. (Interview 2)

I was struck by her ability to persevere with her decision when everyone around her was discouraging her.

Angie vividly recalled the effect the physical and verbal abuse by her father had on her. “I was out of the house as much as possible just always out of the house. I didn’t sleep much those days. It started around 5th grade. My dad was an angry person. He still is. He would come home and open a beer . . . it affected grades a lot in high school. It was my demotivator after divorce” (interview 1). Like Angie, I had a difficult family life growing up. My brother and I were a source of strength and support for one another. I imagined how difficult it must have been for Angie to feel like she not only had to be strong for herself but for her brother as well.

The stress of needing to help financially support her family affected her accomplishments both within her academic and musical world. It wasn’t until high school, when she was holding down three jobs and skipping classes, that Angie felt at all academically challenged. “I think it was later in my high school years when I had three part time jobs and I stopped going to school as much as I should have. . . . I was missing school more and more so I wasn’t getting enough in school to kind of solidify all this so I should have been studying at home but instead working and things got challenging” (interview 2).

As Angie tells the story of when she started playing the classical piano at the age of 5 I begin to see how music filled a void within her. She vividly recalls her love of

playing and disappointment when, at the age of 15 her dreams of being a classical pianist were sidelined because of working three jobs. Regret creeps into her voice as she states, “To still play that was one of my goals and I miss that kind of community, I miss that. I play as relaxation. I guess my dad’s family convinced me there was no future in being a pianist. They said there is too much competition so you need to do something other than piano and I wanted to go to Juilliard. I didn’t even apply. The last two years of high school I stopped because I couldn’t afford it and I started working all these jobs to make money for college. I am disappointed in myself” (Interview 1). I am struck by how passionate she still feels about playing and that her having to give that up is still brings such emotions to the surface.

Memories of my high school years came forward as I listened to Angie share the burden she carried trying to balance her family life, three jobs and school. The obstacles I had to overcome suddenly didn’t seem so big and I began to develop a new perspective on my own life experiences. Angie described the result:

missed 50% of last year of high school, got 50s and 60s. I got to that point where I was mad at the world. I didn’t care anymore. This is dumb; this is stupid; this is hopeless. Maybe nothing would help it, so I gave up there, and whenever teachers gave me a hard time, a couple of them wanted to punish me and thought I was a bad person. (Interview 1)

While studying abroad Angie became involved with an abusive boyfriend who didn’t let her have friends which led to her feeling further isolated and alone. As she recounted her story I could still hear the fear in her voice. In her timeline she uses the following words to describe that period of her life, “frightened” “anxious” “discouraged”. I am struck by how completely different Angie’s husband is from the boyfriend she had while studying abroad.

Reflecting about trying to balance school and work brings the following feelings to the surface, “It is very stressful. It is good to have my husband take away the stress. It reminds me what I want to do with my life” (Interview 3). Beyond her husband, she sees a lack of support around her. “Other than pay for it we don’t get any support from the military. Otherwise I still work 12 hr. days. I still work on weekends, not many people are taking college courses . . . My husband is great support, now he is deployed so I can e-mail him. My husband is my support. I have not connected with other physics students” (Interview 1).

I was a little nervous when I thought back to how tired I always was because I was always behind on my work and trying to catch up, but that concern was definitely overshadowed by the feeling that I’d be a student again and I’d get to spend time for myself working to widen my horizons and expand my knowledge. (Journal 1)

The schedule was clearly taking a toll on Angie, and she had added exercise to her routine as a way to make her feel physically and emotionally better:

During the weekdays, I don’t have time, so my weekends are spent entirely doing homework . . . a little worn down this week, very busy; it is kind of tough. I haven’t had 8 hours of time to sit and relax even during my workout I didn’t want to do. So actually I have noticed a difference. The working out, I still do it on Monday and Wednesday. I think it actually helps; it makes me feel better. It helps me get through the stress. This is the busiest term, taking four classes right now, work ahead in case I get busy. (Interview 3)

Angie described making lists and writing everything down as a key to her success and alleviating stress:

Like a week ago when the term just started, and I am so glad to have started ahead of time, when everything started, and I have two math classes and, looking at the course schedule, I thought this is too much; I can’t do it. Everything has culminated into this week, and after this weekend, I want to have a weekend to relax. I put it on the whiteboard and crossed it off, make a list of things and feel better when cross off. I first complained to my husband, and then that is what I do: I write everything down on a whiteboard, and now I have a desk, and I will be ok; I needed to make that list; it is something I had to do because I really have a bad memory. I could be sitting reading, and I will be like, “What was I just

reading?” It is so strange. I used to carry around assignments. I need to write down all homework. I get stressed out when I have to remember, writing it down takes away the stress. (Interview 1)

Angie offered the following advice to other girls and women:

I just hope that honestly people need to stop thinking of things based on gender. It has no impact on being able to do things. Even the military prevents people from doing certain things. I hope that eventually whoever gets into powerful roles they do whatever they can to prevent things, any kind of bias. Even if the government says it is fair I hope that other women don't think it is legit. Of course you can do what you want. (Interview 3)

### **Jeanie**

“My husband says I just plow if I have my eyes set on something I will plow through as far as I could” (Interview 2).

Jeanie was a 28 year old married woman with no children. After reading the first draft of her portrait, Jeanie wrote,

I am so flattered! Unfortunately, after being denied so many times by medical schools and currently on a wait list for that Physician Assistant (PA) school I mentioned previously, I guess that I still can't help but have negative thoughts on my academic life despite how I don't regret the choices I have made to get where I am . . . I DO love who I have become. (E-mail, March 14, 2012)

Before our first interview, Jeanie and I e-mailed about setting up a time. Because of the distance, we agreed to do her interview over Skype rather than face-to-face. On January 8, she e-mailed me: “I will talk with my husband and make arrangements. He has Skype on his computer and I will need to ask him about using it, as I have never used it before”. My first thought was one of surprise. I had incorrectly assumed that Jeanie, as an online student, would be familiar with Skype, yet she showed no apprehension or concern about using this technology with which she was not familiar.

Although I didn't have the opportunity to see Jeanie's neighborhood or home, over the course of several e-mails, she described it for me in detail and even offered to

take pictures so I could “see” everything. I was struck by her desire to share as much as possible with me. Jeanie and her husband shared a house with her parents and sister, who lived upstairs. They had many farm animals, including eight horses; three cats; a large rabbit; and two dogs, once of which they had been caring for while her cousin was in Kuwait for 2 years with the military, so they seemed to have inadvertently adopted it! Jeanie and her family lived in the country in a small town with a population of roughly 1500. The road she lived on was barely one lane wide, in a rural farming community.

Jeanie was not a matriculated student at the college, so she did not have a mentor. She took this course as part of the needed prerequisites for physician’s assistant school.

**A lifelong passion for medicine.** Jeanie saw her mathematics skills as being inherited from her father: “My dad, like I said, wanted to be a surgeon but became a senior VP of finance. So you can see where I got the puzzle-like mind from, my dad” (Interview 1). She described her passion for mathematics as something that was always there. When describing her love of mathematics, Jeanie said, “I want the puzzle; let me work it out; I don’t want to sit there and wonder what is your interpretation of this” (Interview 1). “I loved math; I loved math. Science was good. I did the worst in art, geography, and history. Oh, I hated art” (Interview 1). “My science courses had no problem. Went to class, got good grades . . . I tutored people in physics . . . a math tutor and aid. So my math skills were good” (Interview 2).

She compared her abilities with those of her twin sister:

I like science, solving puzzles, and mathematics and reading/writing or playing the violin. My sister can draw a PERFECT 12x16 character from The Lion King in 2 minutes flat from memory. (I can’t draw a straight line, especially without a computer/ruler/guide. I ALWAYS traded classes to get out of art, I HATE IT!) She sings in perfect pitch, can’t play an instrument no matter how long she takes

courses, compiles creative homemade comic books, and still has problems working with fractions and decimals. (Module 8 discussion post)

Like several of the other women in this study, Jeanie mentioned several times not being good in history or art.

Thinking back to high school conjured up the following image of who Jeanie remembers wanting to be:

Going back to high school, I did struggle with (the traditional family plan). I knew I wanted kids, and according to our family traditional background, the women either worked around kids or got to the point where she didn't work. I liked to be active, and I wondered, I can't just ask someone to stay home and I don't care for daycare. This is just something I will have to deal with when it comes down to it. Then I found my perfect match. (Interview 1)

Jeanie questioned how she could have children and a career: "I always struggled with the how do I work and have kids" (Interview 1). She told her husband (boyfriend at the time), "These are my plans for the next 10 years. Either be okay with it, or let's stop this now. My husband, boyfriend at the time, said, 'So you go to work, and I will stay home with kids'" (Interview 1).

Her family had a history of college education and working in the medical field going back to Jeanie's grandmother, who was a nurse. She took pride in the fact that she was the third in her family to attend college and chose to include an image of her alma mater in her collage.

Jeanie was surrounded by doctors throughout her childhood and remembers, "I tended to feel very comfortable talking to them. I saw a couple outside of work. We did socialize a bit and got to be good friends" (Interview 2). From as far back as Jeanie could remember, there was a strong connection to the medical field because of both her sisters' and her own medical struggles. Jeanie's struggle with health-related issues prohibited her from participating in college activities as much as she would have liked and caused her

grades to go down in high school. “In high school, I started with the illnesses so where I was usually an *A* student I became an *A, B, C* student” (Interview 1). “When I started to get ill, . . . my class grades started to suffer” (Collage essay). In her collage, for which she was asked to think back to her image of herself as a mathematics student, she included a picture of a person having surgery with a note indicating *me*. Jeanie perceived her health issues as a reason she didn’t get accepted into medical school. “My advisor didn’t like my MCAT pre-tests and my GPA and my extra-curricular activities” (Interview 3).

Jeanie saw herself as having an inner strength and drive. “The fact that I have never liked to give up or give in and the fact that I fight tooth and nail but not going outside of rules and I will push and push and push” (Interview 3).

I know that I don’t like being told I can’t do something. . . . I didn’t like my college advisor, and I said, “I am still doing premed whether you think it is worth it or not.” . . . The back of mind, I was screaming, “Oh, I will show you.” (Interview 3)

When struggling in a recent course she was taking as part of her PA program, she stated, “I WOULD NOT give up” (Journal 3).

**A translator I will be.** Jeanie and her sister were born prematurely. Her twin sister struggled with illness throughout her life, and in our first interview, Jeanie described how she spent a significant portion of her childhood in a doctor’s office: “I was constantly being ferried to a doctor’s office, so I became accustomed to the doctor’s office. We were there one to two times a week” (Interview 1).

Jeanie grew up in the country in a two-parent family with her twin sister. Jeanie’s parents provided a strong support system with respect to both the emotional and financial support. Thinking back to her childhood, Jeanie recalled, “My dad was big on making



me think. So if I wanted to learn something, he encouraged me to ask questions and think about it” (Interview 2). Jeanie talked extensively of the support she received from both parents, who “encouraged me to be my own person and do what I wanted to do” (Interview 1). Jeanie included a picture in her collage of four Disney characters smiling and hugging each other as a representation of her, her sister, and her parents. She described both parents as a source of support when it came to homework time, each having their own strengths. “I would go to my mom for any sort of art or geography or sociology. They both had their own areas and were very patient if I needed help” (Interview 1).

Thinking back to a time when she struggled with a particularly hard course, Jeanie remembered her mom taking her to the library every week to help her find the answers. She often asked her father for homework help, and he was the one who discovered she needed glasses. She vividly described a memory of sitting on her dad’s lap doing reading homework:

I remember being curled up in his lap, and he was explaining it to me. The big thing I remember about that is that was when I realized I needed glasses. I kept pulling the book up, and he said you can’t see that? (interview 1)

She remembered both her parents helping her with mathematics homework.

A legal issue involving Jeanie and another classmate created an environment in her middle school that Jeanie perceived as a barrier. She felt she needed to change schools. Jeanie’s parents owned land that was in two different school districts, which enabled her to easily switch to a high school in a different district. Jeanie perceived the opportunity and support at her new high school to be high because it gave her a chance to “figure out what I wanted to be. Everyone didn’t know every little thing about me. I got

to figure it out first” (Interview 2). In the essay she wrote to accompany her collage, she stated,

I loved it. . . . I have to say I am so grateful to have had a happy high school experience. Even when I had to have surgery for a tumor on my back, . . . everyone was supportive. . . . [W]hen I started to get ill, . . . my class grades started to suffer, . . . but support from my classmates didn't!

Images she includes in her collage included groups of children hugging each other, on a seesaw together, and helping one another.

Unlike other participants in this study, when Jeanie thought back to high school, she remembered her teachers as a source of support and frequently sought out extra help in mathematics:

In mathematics I loved algebra and pre-algebra. The teachers, they were really good. If I had a problem, they were right there if I needed it. In high school, the teachers had extra office hours after school, so they would say, “I am going to be here two hours after school,” and I said, “Yes, I want to stay.” In calculus, I stayed, and pre-calculus. I stayed a lot more in pre-calculus for extra help. (Interview 2)

Although Jeanie didn't express any gender-related issues that shaped her learning experiences, she did perceive gender as limiting opportunities for women:

Societies views are the women are caregivers and the stereotype is that a nurse is female. You've got the hierarchy of doctors which are mostly males. No I don't see women treated equally. . . . It is still the male thinks they are better. . . . The administration doctors are the males whether that is because of a hierarchy or not, it is who has more authority. (Interview 3)

Money had been a barrier for Jeanie. At one point, she wanted to take a biochemistry course online, but the school didn't offer financial aid or payment plan, and they simply couldn't afford the cost.

I turned to him [her husband] and said, “Financially, this can't happen, and I need your advice and input here, please.” We both looked at each other, and I said, “We can't afford it. I think I am too stressed to do it, but I think I need it.” But he said, “No, because we are strapped right now.” He asked is it something you can get done in the future, and I said, “Yes.” (Interview 3)

Jeanie's exposure to the medical field through Spanish enabled her to see opportunity where others might not. In both high school and college, Jeanie took Spanish classes as an elective. The end of her sophomore year, Jeanie began part-time work at a local hospital. She worked about 32-35 hours a week, primarily 12-hour shifts over the weekend. One day, the translation system was broken, and Jeanie was asked to do some translating. At this point, she thought, "This is a really good thing" (Interview 1) and switched from pre-med to Spanish as her major. Although she switched majors, her long-term goal remained medical school. "I realized that Spanish was getting me into areas I couldn't access before, just the sheer knowledge of Spanish. They knew I could do it, so I was easily able to access sections of the ER and OR" (Interview 2).

Jeanie perceived entry into the medical field as difficult because of the large number of students applying. She included two references to paint a picture for me of just how many students took the MCATs. I was surprised to see that, in 2005, about 66,000 and, in 2006, just over 70,000 people took them, whereas each year only about 17,000 applicants were accepted to medical school (Journal 1).

Jeanie perceived having opportunities that successfully enabled her to balance work and school. Her employer was not enthusiastic about her changing her schedule around to fit school but allowed her to do so. She described online distance courses as making it possible.

Jeanie described the move she and her husband made about a year ago from a suburban apartment,

When I sent myself back on the path (to return to school), this time last year I was crying to him (her husband) because we had to move to save money and help my family. I remember crying and saying we can't do this, we won't have privacy. Before, we had an apartment with a roommate who paid. I don't know how we

can afford this. I won't have my own space. He just came in and said here is what we can do, we can do it. He rearranged the living area just to make sure I had a spot for everything (moving the desk away from the basement living area and stairwell), where I didn't get any traffic from anyone, so I had my spot to do what I needed to. I thank him every day and I thank god every day. (Interview 2)

Prior to our first interview Jeanie e-mailed me she was waiting for her husband's help with getting set up on Skype. After not hearing back from Jeanie for a few days, I e-mailed her just to check in. I got the following response from her:

I am so very sorry it is taking so long. My husband works nights and goes to bed when I wake up, and I go to bed when he wakes up. It has been really difficult to talk to him about ANYTHING over the past few weeks due to family constraints/obligations in our time off. . . . My parents have been having financial crisis and so we have taken on many responsibilities with them and my sister, who is learning disabled.

Add to that a tremendously taxing week on my part and I am just exhausted. I haven't even been able to do your timeline thing that I have been wanting to do! I feel so horrible about it and making you wait.

I will remind him to show me tonight before I go to bed, and I will e-mail you tomorrow. (E-mail, January 19, 2012)

Through this e-mail, I gained insight into the numerous obstacles Jeanie faced as she was trying to balance school, work, and life. I also gained a deeper appreciation for the time constraints she had and how difficult it was for her to fit this one extra thing into her schedule. I was beginning to understand the physiological toll it was taking on her and the role her husband played. Despite working opposite shifts and balancing numerous duties, her husband took the time to support her. Jeanie wrote me in an e-mail on January 21, 2012, "My husband promised me that he would wake early tonight to show me how to use his Skype." As I read Jeanie's e-mail, I could hear in her voice not only how much she appreciated her husband's support but how much she needed it. I found myself anxious to hear more about her husband, their relationship, and how it fit in her journey.

I found myself initially disappointed when, at our first interview, Jeanie’s camera was not working, and I was only able to hear her voice. However, I was amazed how, with only a voice, I was able to feel a connection and a sense of trust on her part. Jeanie’s enthusiasm, sunny outlook, and sense of humor could be heard in every intonation of her voice. Jeanie sounded very at ease using this new technology. I did not hear any nervousness in her voice, and she didn’t mention a single concern or show any apprehension. If anything, I heard a sense of pride in her voice.

**Medicine keeps calling.** The very first thing one sees when opening the learning contract is a picture of a woman racing to catch a subway train. It is not a “scientific” picture; she is not in a lab coat. I wondered whether this picture was chosen in order to have a picture nontraditional female students could relate to. The image this picture brought to my mind was just a regular woman like me, pressed for time and trying to balance everything. The course had a fairly heavy workload. Each week, there was a chapter to read and a discussion. Every two weeks, there were a lab, quiz, and written assignment. The course culminated with a team project, final concepts assessment, and a student experience survey. In the discussions and the team project, students were asked to peer review the work of others. In the learning contract, the discussion expectations were outlined, requiring an original post and at least three responses. Postings were graded on quantity and quality: “Highest scores will be given to students who write substantive informative entries with links to further information” (Course learning contract).

Jeanie’s instructor strove to create a learning experience in which students could be successful by clearly stating expectations and suggestions for managing time. Jeanie’s

instructor posted course announcements once a week, and in each one, she summarized the written assignments, quizzes, web reviews, and discussions or lab assignments due that week. Dr. V clearly stated her expectations for assignments, her grading policy, and when students could expect to see feedback. She also provided tips on time management: “The coming weeks will go very quickly, so it is important to submit any past due assignments before it becomes too late. Just a reminder” (Course announcement, November 18, 2011). “Week 15 only runs for five days. . . . please keep this in mind when planning your workload” (Course announcement, December 16, 2011). In the learning contract, students are told to allow time for the labs and learning how to use the software: “Some of these labs will require a fair amount of time up front to learn how to use them. Be patient and persevere and you should be rewarded by being able to learn by hands-on manipulation of simulated data” (Course learning contract).

Jeanie received words of encouragement from her instructor throughout the course, such as “Great!”, “Yes!”, “Excellent, Jeanie!”, and “Excellent response to this question, Jeanie!” Her instructor also took the time to respond to her questions and explain in detail when needed. She finished a reply with “Hope this helps!” (M04). “Correct! Great response to this summary question!” When Jeanie asked the question “I am not sure how else to determine . . . is it merely because of the values on the table?” (M04). Her instructor’s response was “Good questions, Jeanie”.

Jeanie both sought and provided words of encouragement. When working on their team project, Jeanie frequently posted feedback to her team members: “I say you did a fine job. . . . Everyone took a lot of time . . . Congrats! . . . Thanks for making this as

stress-free as possible” (December 20, 2011). In her end of course reflection, Jeanie summarized her experience in the course:

Thanks for everyone in the course, you have been so very helpful and supportive of each other! It would not have been the same experience if there wasn't such a caring group and it couldn't be as supportive as this group was towards each others' endeavors! And most importantly . . . for this learning experience . . . thank you Dr. V!

In the icebreaker discussion, she offered words of encouragement to a fellow classmate who was stressed about her wedding: “School and work are stressful enough without planning a wedding . . .be strong! And don't sweat the strong stuff.” She then went on to give an example of how she delegated many wedding-related tasks as a way to reduce her own stress when planning her wedding.

In the icebreaker discussion, Jeanie let her classmates know if she needed help she would be asking:

I am also very new to Angel. . . . Don't be surprised if I pick your brains now and then about it! Feel free to pick mine. . . . I'll always give the best answer I possibly can-just please don't hurt me if it's the wrong one. HA!

This ability to reach out and ask for help could also be heard during her high school years, when she described how she quizzed her friends about which teacher was best when selecting courses. Jeanie included a picture in her collage showing a student raising her hand to ask a question.

I could hear Jeanie's enthusiasm and caring attitude in each of her posts. Jeanie also took the time to write thoughtful meaningful posts. In a reply to a classmate in the opening icebreaker discussion, Jeanie showed interest in her classmates by asking specific questions about what they posted and then connecting it to a personal story.

How many rabbits do you have? How long does it take them to breed, really?  
What types of things do you look for in a rabbit?

My sister has one and he's so funny! He lives in her bedroom and only goes to the bathroom in a specific spot in the corner that is like a wooden litter box with wood (cedar?) shavings. He's the silliest thing. Whenever she comes into the room he actually kicks up his heels in the air and gets excited and runs to her. To see those feet kick out into the air at his side as he runs to her, like something out of a Gene Kelley movie or some other classic, makes me laugh every time!  
(Reply to female classmate, September 7, 2011)

Jeanie earned a 100% on each of her assignments in the course she was taking. In her homework assignments, Jeanie used such wording as "Yes. They are exactly as I predicted" and "according to my hypothesis, . . . it can be concluded" (Module 4, statistical analysis). Her instructor took the time to respond to her questions and explain in detail when needed. She finished a reply with, "Hope this helps!" (M04). "Correct! Great response to this summary question!" (M07). Jeanie earned 100% on every assignment.

**The road in between.** Jeanie recalled earning "As all the way" (Interview 1) during her K-8 years: "I got honors and awards in everything in elementary school and in middle school I received an award for excellence" (Interview 1). She shared a story about receiving a reward in first grade as an example of when she first realized she had an ability others didn't:

In first grade I got an award...we all got to go, students from our entire county. It was catered. . . . I don't think I understood; it was after the award and after the speech the guy gave. I don't think it was until after I realized that it is not something everyone gets. I did a good job. (Interview 2)

Jeanie's passion for the subject emerged when she discussed how she chose her classes in high school as well as in her collage. Given a choice between a mathematics course and a free elective, Jeanie always chose the mathematics course. In her collage, she included several pictures representing her love of school and even one that said, "I love math".



The pictures she selected included students with smiling faces in a classroom as well as pictures of happy students studying.

Jeanie described a college freshman biology class as having six teaching assistants (TA) who all “thought their thing they taught needed to be on the exam and it was too much” (Interview 1). She ended up withdrawing from the course, which left her scared and “as far as the W, I hated it . . . it discouraged me for a while” (Interview 1).

Jeanie was enrolled in PA school at the time of this study.

When I began PA school in May, I knew what I was getting into. . . . About a month into my scholastics, I found myself doubting my abilities in the courses I was taking, even though I had worked in similar environments and had a good basis for my knowledge prior to the course. . . . I strove to improve a single grade that was below my standard, even despite mentor faculty explaining that it was acceptable and my grades *would* be lower than when in undergraduate courses. (Journal 3)

She chose to volunteer at a clinic as a break from the grueling academic environment:

I left exhilarated and confident in my abilities again, assuring myself that I was EXACTLY where I both needed *and* wanted to be. Suffice it to say that I brought my grade up an entire letter grade, and have been improving all of my courses little by little ever since! (Journal 3)

Jeanie’s passion for medicine can be traced all the way back to her childhood. “I liked marine biology; I liked anything with the ocean. My dad had a dream of becoming a surgeon but has a motor dyslexia” (Interview 1). “I think he felt remorse and regret” (Interview 3).

With him it is all or nothing. He sort of told me of his interest in medicine, so I guess I followed and decided I wanted to be a doctor. I just knew I didn’t want to be a nurse. I had a constant drive of wanting to do that [become a doctor]. (Interview 2)

Jeanie did recall her intelligence as helping her navigate the difficulties she had socially.

“I was socially inept. I was very frequently picked for group work because of

intelligence” (Interview 2). When comparing herself to her peers, Jeanie perceived herself as more intelligent.

Jeanie held herself up to extremely high standards academically and explained that, when she didn’t meet those standards, she felt sick physically and emotionally. She included a picture in her collage of a girl with her head laying on top of her homework on a desk and an image of a girl with her head in the toilet. “If I got too frustrated over it, if I didn’t get those questions right, I got a stomach ache. I hated not being able to finish a question” (Interview 1). On one occasion, she had to come home with a *D* grade and described how she was sweating and discouraged, wondering, “If I can’t do this, how am I going to be good at anything else?” (Interview 1). She described an experience in a junior high geography class in which not knowing the answers left her in tears.

She also vividly recounted a story in which a pale-looking girl came in for a checkup. Jeanie, realizing she needed immediate help, got her to the ER, where they said she was about to have a heart attack with severe cardiac failure/damage because of a prescribed treatment the patient had recently engaged in. She reflected on the work she did at the hospital while attending college:

I did basically certified nursing, only I didn’t have certification. Decontamination of rooms, changing bandages, preparing for surgery . . . it was really cool. . . . I got to ask questions like, “That is really a gallbladder?” I got to learn the names of the machines, set up tubing, and abate a patient. (Interview 2)

Jeanie recalled leaving that job because “I got bored. . . . I didn’t feel challenged. . . . I asked for new things, but nothing new came my way. . . . I was ready for something different” (Interview 2). Jeanie moved on to a local plasma donation center for a year and moved to a doctor specialty office, where she continued to work at the time of this

study. As Jeanie talked about this experience, I saw her eyes light up, and her voice had an enthusiastic, excited tone. I could hear and feel her passion for medicine.

By chance, Jeanie met someone who was a physician's assistant, and a spark of interest grew. After some research, she thought, "This fits my lifestyle tons better. . . . [P]hysician assistant is not my second choice" (Interview 1). When introducing herself to her classmates in the icebreaker discussion, she said,

So after several happy (and still ongoing) years with my husband (my continuous partner for 11 years now) I decided I would go to Physician Assistant school. It suits my lifestyle and I cannot be happier with my decisions that I have made for myself in my life - I wish this for everyone! (September 7, 2011)

This interest can also be heard in her first journal entry:

I met a coworker who was a Physician Assistant. I had never heard of PAs. I loved how he worked, his rapport with patients, and I could see myself in that position. After reading up on the PA profession, I realized that it fit my lifestyle so much better than ever being an MD would. So, I decided I was ready to try again. (Journal 1)

She described how those around her questioned her choice because there were other, lucrative things she could be doing, but she stated, "I don't see this as valid for me" (Interview 1).

Balance in her family life came to the forefront. Jeanie went on to research the profession and came to realize it would be a perfect fit with her personal desires and lifestyle. When describing her desire to do something more than translate, Jeanie stated in her first journal entry, "I felt like I had so much potential that I couldn't let it go to waste. I just had this strong sense that I wanted to be 'more' than my job history allowed. I could find no other way to describe it than that - just wanting to be more than I was" (Journal 1).

I was struck by the story of her advisor telling her she didn't have what it takes to make it in medical school. Rather than these words discouraging her, they provided a source of inspiration for her. "[I]n college my advisor told me you can't major in medicine. I found something else that helped me learn medicine. I was told you can't be a doctor; you are not good enough to do this" (Interview 3). As I listened to this story, I recalled a similar experience in college when I was told I would never make it as an engineer.

Jeanie recalled a time when she was feeling overwhelmed:

He [her husband] would remind me of all the personal things we had accomplished together, the life we had built up together, and of all the things that would NEVER have been possible if I had accomplished my original plan of diving straight into medical school. For all we knew, we might not have gotten married at all due to where we were in our lives . . . and THAT was a scary thought in and of itself. It worked out, as far as we both are concerned, for the best for US. (Journal 1)

Thinking back to her childhood school experiences, it was the social memories, not academic, that emerged as low points in her life:

I had more feelings socially than I did anything else. I felt, like, when I did things in a social group, like if you went to a sleepover, I felt like the mousy one in the corner. I didn't speak up much. (Interview 2)

I found myself in awe of the social difficulties Jeanie had in school. "I was constantly ridiculed. Either someone got offended by something I said or I would get someone in trouble from what I said. I was constantly made fun of" (Interview 2). "I did get beaten up. I had scars. I had a legal battle for something outside of school. I had instances where I didn't want to go to school no matter what, but I always went" (Interview 2). Jeanie included two pictures in her collage showing a girl singled out and crying while a larger group of girls stands together appearing to tease her. In her collage essay, she recalled getting beaten up on the bus: "I didn't cry out during, only wept a SINGLE

tear . . . as I took each whipping . . . as the whip sounded slight cracks and I barely flinched”. In her collage, she included a picture of a closed eye with a single tear. I am struck by the paradox between the strong, confident woman I see and the mousy, quiet child Jeanie described.

In her first journal entry, Jeanie described the time after college graduation before she decided to return to school.

I took some time from courses after college graduation. I felt like my brain was tied up in knots, even if I did know that I wanted a career in medicine. I was tired of classes, burnt out on academia, and I put myself under tremendous pressure to boot.

The pressure that she placed on herself could be heard in the following story, which Jeanie described as her husband’s favorite:

My junior year of college, I finally had a surgery that was going to help me alleviate my symptoms [for an issue she had had since high school]. I was in between finals. (We had a week where the course could be sped along to the final, so you could end it sooner.) I had this one course finished so he [her husband] took me and drove me one afternoon, over 2 hours away from home and took me to a theme park. I had so much fun! [During editing, Jeanie added the exclamation point after the word *fun*, making me realize just how fondly she remembers this event.] I realized at that point I had not gone out and done anything that was truly just to be fun (while attending school). When we left, I actually started crying, and he couldn’t understand why I was crying, and it took that for me to realize I was way too serious about the whole school thing. (Interview 1)

Being a nontraditional student was a source of anxiety for Jeanie:

My outlook, even though tinged with apprehension and fears regarding the prospect of failure, was mostly positive. I feel like, I went into it differently than before - with a clearer mind. I guess that is especially strange considering the responsibilities of an adult differ greatly from those of a young student. (Journal 1)

I would have to say that it [returning to school] felt really odd. I mean, only 3 years or so had passed since I had taken a class, but I knew I had to get back into the groove of doing homework and tests and reading . . . And it took sooo loooong! Before, I was a full time student who worked a little part time. Suddenly I was a full-time worker who now only dabbled in classes and school! It was a freaky feeling and, because it took so long to gain the credits of each

class to my transcripts due to being only part time, I thought, “I’ll never get to where I can have kids!” Haha. I keep remembering telling my husband, “I can’t believe I have to do this,” or “Why couldn’t it have worked out the way I wanted to initially and I could have just gone to school and would be working in my dream profession by now?!!” I had an image of me much MUCH fatter (because I was gaining weight thanks to less time to cook and exercise!) and with gray streaks in my hair - trying to read a silly lecture book for class. Worse yet, was the image of myself older, working, but crying to my husband when I tell him it’s too late to have kids! I was petrified! (Journal 1)

Jeanie offered the following advice to other women: “There are many moments when you feel like there is nothing else in this world you can do, but if you take a moment and look at everything around you there is somewhere else to go. It has been a hell of a ride” (Interview 3).

### **Luisa**

“Don’t accept the no; there is always a maybe; problem solve for the yes”

(Interview 3).

Luisa, like me, is 44 years old, divorced, and the mother of three children. Also like me, her return to school was prompted by a divorce, and she was attending school while working and trying to find balance in her life. This commonality between us created an immediate connection and feeling of “you understand”.

Luisa and I e-mailed only enough to set a date, time, and location for our first interview. I remember arriving at the interview without any perception of who she was because of our limited interactions. Luisa lived close enough that we could meet face-to-face. When she arrived, she greeted me with what became a familiar smile and her self-described contagious laugh. There was immediately a sense of easiness between us, and after the first question, her story quickly unfolded.

In between interviews, Luisa shared what was going on in her life. The process of sharing her story caused her to reflect upon her experiences even when we weren’t

together. When things she felt were important came to mind, she would share them with me via e-mail. Occasionally, she simply shared a funny story or photo. As we completed our time together, we agreed a relationship had formed and planned to get together in the future as two friends meeting for coffee.

**Sunshine on a rainy day.** Luisa described herself as a logical thinker who always loved mathematics:

I really enjoyed math in HS. It seemed very chronological; it seemed logical. It seemed like everything had a formula, and it fell into place. I loved proofs. I loved proofs. It was just a stepping stone of knowledge. Most people can do macroeconomics, I can't. I am just totally wired differently that way. (Interview 2)

In Luisa's story, her inner motivation, strength, and optimistic attitude emerge. She described what it was like, at the age of 12, to share a bedroom with a newborn baby.

I slept with a pillow over my head, but my routine, even though the chaos was going on, the routine wasn't interrupted. And even in life now, you know, the routine isn't interrupted with whatever chaos goes on, and I think it is just a character trait. (Interview 1)

As she described this experience, I thought about my own ability to filter out chaos and how that may stem from the chaos that surrounded me growing up. I wondered whether it is a learned or genetic trait. Why is it that some of us can filter out the chaos in our world and stay focused while others get lost in it?

Luisa shared that her sister described her as someone who "doesn't need the trinket at the end," and in her own words, "I like the ride. Getting from point A to B, I enjoy the ride. It doesn't matter what is at the end; it doesn't matter where I start the ride; the ride is fun" (Interview 1). "I didn't need acknowledgment because that wasn't my character" (Interview 2).

Luisa described her inner motivation as a desire to please teachers and not make waves:

I didn't do it for myself; it came easy for me; it is just the reaction from the teacher; if I didn't have confrontation with teacher the better off . . . I just found it easier; this is what you are told to do; just do it, and then you can play. You know, and then nobody bugs you. (Interview 1)

“A very rough teacher (to others), to me was a very easy teacher because I wanted the teacher's reaction. So, if I did the homework I didn't get a negative reaction” (Interview 1).

I again heard Luisa's inner motivation, optimism, and strength as she described the time just before she returned to school. She was recently unemployed and interviewing for a new job. She was involved in a car accident that left her wearing a neck collar:

I was out of work, injured, and I said, “You know what? I don't want to be a secretary rest of my life. I don't want to answer the phone the rest of my life. How am I going to get out of this?” So I went back to school. (Interview 1)

I wondered whether some women have a greater ability to take a risk to achieve something greater? I reflected on my own decision to pursue my PhD and remembered having a similar thought: “How do I get out of this situation?” I wondered whether a trait I shared with the women in my study is an ability to think analytically rather than emotionally when faced with a problem. Like Luisa, I am able to compartmentalize the different parts of my life. We have a home drawer, school drawer, and work drawer. “Our problem solving at our BEST : )” (Luisa, review of final draft).

I again heard her inner motivation, optimism, and strength again as she described her current experiences as a student.

But man is very strong when he/she wants something. I like the peer mentor program the college has begun and I work study in. I feel this piece is such an asset to offering adult learners a support system outside family and friends. I am just not wired like others that my drive routinely comes from within and I don't need too much. (Journal 1)



At the end of our first interview, I again heard her optimism and strength:

I am going to enjoy the ride. It is not going to be a short ride, and it's not going to be a long ride, but I need to enjoy the ride for me to be, and I need to look at it like that. So, when I look back, at the intro to web design, I said, "You know what, that wasn't a u-turn; it was just a bump in that road." (Interview 1)

Her eyes lit up as she told me this story.

When I asked her what her current image of who she should be was, she responded,

Well of course, after the divorce you go through that, [lots of laughing] and I always felt like I was never who I could be. So, I always felt like, and I am a spiritual person, so I always felt like it was a better drive to make a world change. That I wasn't able to do because I didn't have the degree. So, that was my major drive, to finish what I started. (Interview 1)

"Obviously you have been through a lot of changes. I didn't really have an image young" (Interview 1).

**Divorce is the springboard to fulfilling a dream.** Luisa grew up in a two-parent family in a town where the population is almost 100% White, and about 60% of the people had a HS diploma and 25% a college degree. The average age was between 40 and 60, with half the population currently earning an income between \$30,000–\$75,000 and almost 40% earning less than \$30,000. Education, health, manufacturing, and retail are the largest employment industries, with 75% of the population employed in the civilian work force and almost 25% unemployed. She attended a small school and was in a graduating class of 70.

During our first interview, when I asked about the dynamics of her family growing up, she responded,

My father was a non-degree engineer so to speak; he was always like the project manager; he built bridges and dams. When, um, I was 4, we moved, and we stayed in the same house, well until I got married. After I got married, they sold it, that kind of thing, and retired to Florida. So there was stability there. My father

went to Korea, and he was self-medicating at the American legion. . . . So, he would go to work and come home, go to work, go to the Legion, and come home. Wake up and do the same thing. I think we did something as a family, just my brother and I, my sisters are like 11 and 13 years older, so it's like two different families. . . . My sisters were pretty much out of the house by the time I was old enough. The one sister got married at 18 and went to Germany, and the other one was waitressing in the area until she became a beautician. (Interview 1)

Luisa's perception of her mother and father are traditional: "If you think about it as far as being a wage earner, cleaning, childcare, helping out. My dad was the wage earner, my mom was the caregiver" (Interview 1). As a child, Luisa's image of a woman was "I guess working part-time was okay. Working full-time really wasn't done in my nucleus. Anybody I knew, their mom didn't work full time" (Interview 1).

When asked about what guidance she received in her high school years, Luisa remembered a void in this area:

Our guidance counselor sucked; he was good for nothing. I don't know what he suggested I be, and maybe that is where the teacher thing came into play. I thought, "Are you listening to yourself? Because that is not what I want to be. (Interview 1)

Luisa couldn't recall any experiences in which a friend or family member influenced her perception of who she wanted to be, and this is the only time I heard regret creep into her voice:

I just walked the walk; I was never goal oriented, which I kind of wish somebody had taught me that along the way because it is a skill set. I don't think it is anything that is a character trait that says, "Oh, I'm goal oriented. I want this and this and this." Something usually happens that you don't get the candy, and you're like, "Next time, I am getting this. (Interview 1)

When we were discussing college, I must have been undecided obviously, and my mother kind of guided me to say, "Well, you know you were good in math and science. You should probably pursue that. (Interview 2)

I thought about this statement and how it relates to the theory I selected to guide my study. Maybe what needs to be taught is not a skill set related to being goal oriented but more guidance related to potential career paths and expected outcomes.

In relating the following story of getting her driver's license, Luisa described the unguided path she took to college:

I remember even getting my driver's license because I had to drive to school to take the college class . . . And I was thinking, the other two students are driving, why do I have to drive? [lots of laughing] . . . [I]t was expected; it was expected, and I was the first one in my family to go college. . . . My other sister got married right out of high school. . . . So, um, it's not that I didn't have a choice; nobody pressured me to do it; it was just expected that this was the way you were supposed to go. Just like taking the license, it was the progression. (Interview 1)

When I got my license, I didn't think I was ready to drive. It was the same thing for going to college: "What do you mean I'm ready for this?" But it was just kind of expected, and that was the flow of what to do when you were a good student. (Interview 2)

Luisa attended her last year of high school at the local community college with three other students from her high school. Her choice to study engineering seemed odd to her friends. Because she was good in mathematics and science and her father was a non-degreed engineer, it just seemed the natural choice to her. Once at college, Luisa found herself one of eight women in the engineering program. The eight women quickly dwindled down to three. Luisa said, it "shook my world because the calculus really wasn't hitting so I thought maybe I was in the wrong place . . . then I got bored" (Interview 2).

With no direction, Luisa thought about what skills she would need in life. The answer was insurance and taxes. That led to a job as a processor for a health insurance company. Later, when she had small children and was looking for balance, she took a part-time job as a tax preparer. At the time, she lived in an urban city in Pennsylvania.

She described her neighborhood as rough, and related a story in which, one morning, she found a bullet hole in their car. It was motivation to move into a better neighborhood that led her to take a position as an assistant district manager in a new city.

In her journal, Luisa vividly described the support system she had and what it took for her to stay motivated and persist:

My support system followed me. I had a book open everywhere I went. I read in the car at sporting events for the kids. I read when the kids were at school. Acknowledgement is different than support for most, but for me, it was consistent in comment by my cheering group. This acknowledgement came from the kid's guidance counselor, church members, my psychologist, . . . and my boss today. I chose to look for healthy relationships, and sought guidance from those who were very grounded. The kids curling coaches family offered support by keeping a teen occupied for a weekend bonspeil [game] so I could have one less and increase homework time. . . . I stayed away from those who complained or could distract me. (Journal 1)

Luisa did not remember noticing any gender-related connotations until her adult life. She hesitated when telling people her major because she was concerned with the perceptions people have about engineers. Luisa's perception was that people think those in STEM careers have no social skills. "Most of the women I do hang out with, if their husbands are engineers, . . . their first comment is . . . 'you know, my husband, he has no social skills'" (Interview 3). When I asked her what people's reactions were to her major, she said, "They don't know what to say" (Interview 3). She imagined they were thinking, "What's an operating system? Do I want to ask? I don't really care" (Interview 3).

Luisa was not deterred by such comments. "They categorize you, but you know what I do for a living? I help people. That gets them. You help everybody who crawls to your desk, and that gets them" (Interview 3). She also perceived operating systems as an environment that would enable her to combine her social and STEM skills. "Because I have people skills and math skills. It has always made me unique" (Interview 3). When

thinking about the work environment, Luisa said, “The environment, people don’t laugh; it is all guys, and I was like, ‘Gosh, would I really like that environment?’ Then again, I think, I always change the environment. I’m told I have an infectious laugh” (Interview 3).

**Someone tell me which way to go.** Luisa remembered it being difficult to acclimate to the college schedule and progression of the curriculum:

[O]ne course builds upon another. Where in high school you really didn’t do that. You didn’t learn a component in geometry and it flowed over into geology. . . . [I]n college, . . . I learned the Calculus I, you’re reusing it in engineering mechanics I. . . . because it had been a year ago since I learned that, . . . I felt that was the disconnect. That I didn’t have the data fresh at the time it was being used in the other subjects. (Interview 2)

Luisa described how she felt as a student returning to school:

As an adult the unknown is a lot more real than that perspective as a youth. So man versus self was my biggest challenge. I took a deep breath and reminded myself I was going to enjoy this journey no matter what it would bring and not rush the experience of learning. Of course there was the no one else is going to take care of me and I needed to succeed. Differential equations made me face the old time fear. I whined and carried on throughout the course and it brought back some distasteful emotions but I made it through and gained some confidence out of it. (Journal 2)

During our first interview, I asked Luisa what led her to return to school to study operating systems. “Basically I wanted to finish what I started. I wanted the shortest distance between two points for the degree” (Interview 1). When Luisa first enrolled at the college, she wasn’t sure exactly what she wanted to study. When she first enrolled in the college she researched what she wanted to do and discovered the opportunities in the technology field:

Because of the math piece not falling into place, I chose not to do math subject. I had already had the sciences in the core classes of engineering so the only thing I had to take was computers. . . . It was a natural progression to a degree. (Interview 2)

At the time, her goal was to be making \$100,000 within five years.

And in coming from \$0 after the divorce or during the divorce, however, you want to put it. I'm at about \$40,000 now. And it's been, this is year 8. And I have been going to the college, I think this is my 5th year. (Interview 1)

The course that Luisa was taking required written assignments using software, e-portfolio, wiki, and peer review. The instructor included the wiki and e-portfolio as a

means to show that you are able to take what you have read in the module to another level. That is, internalize and analyze the information and use it in a different way. Consider Bloom's new Taxonomy pyramid. . . . Traditional assignments such as readings and homework hit only the bottom three levels of learning. (Course announcement, October 10, 2011)

The purpose of the wiki was described in the learning contract as

help current and future students taking this course. The Wiki contains many files and links that were placed there either by your instructor or past students in the course. It is highly advisable to check the Wiki often for helpful hints on the software and assignments. Students who access the Wiki often generally are more successful in this course.

The instructor posted in the course announcements every 1-2 weeks and included short reminders of when assignments were due and her expectations:

USING . . . "QUICK COMMANDS OR TOOLS (ASSISTANTS & TUTORS) **DOES NOT** SUBSTITUTE FOR SHOWING THAT YOU KNOW HOW TO APPLY THE ALGORITHM (PROCEDURE) IN THE TEXT. YOU MUST SHOW THAT FIRST! . . . YOU MUST DO THE WORK. (Course announcement, October 9, 2011)

When Luisa reflected on her experience in the course, it was the difficulties with the software, not the content that surfaced:

Courses that require you not to use Microsoft Word for a submission you have to learn the material plus a software product to be graded. The software was like that for me, very challenging and I think I will avoid it at all costs if I have to "show all work" and use a program that does the work for you. This lack of logic I find very frustrating. (Journal 2)

In the following e-mail, written prior to our first interview, Luisa conveyed her frustrations with the required software:

There has been such a negative experience in this course using the software that these tears have rolled for the last time over it. I will switch my major before subjecting myself to this program again. As I mentor I have suggested that they offer a couple hour night class on it because like learning even excel for the first time you need to see and play with it to understand what you are putting in is what the program wants to see. The professor suggested I drop the course with a c- but reluctantly gave me the extension. Also offering, "I don't know what else I could have done for you. (E-mail, January 10, 2012)

In discussion posts between Luisa and her instructor, I could hear not only Luisa's frustrations with the technology, but also her strength, "Software was a previous demise in a course and I will not let it frustrate me 2xs" (Original post, September 30, 2011). In the following week, Luisa asked the instructor questions related to the use of the software on six separate occasions within the discussion area. In her final post, she still had not successfully mastered it: "I am still unable to open successfully. I can always open in a new tab and it is still showing the under construction site" (Reply to instructor, October 9, 2011).

Luisa's instructor did set up a homework discussion area for asking questions. In the homework discussion for Module 3, only two students posted comments; one was Luisa. The response to her question came from her instructor, not a peer. Luisa's instructor always responded to Luisa's questions either on the same day or the next. In the final course reflection, Luisa reiterated her struggles with the software, titling her post "Software Madness" and saying,

In conclusion, . . . the software program is essential to course completion. I have had difficulty with this program and suggest a hands on classroom setting offering. This would be similar to a how to write a final paper for English students. I have been told that it used to be offered and suggest you return it. (January 14, 2012)

Luisa shared her homework grades and the comments she received in the course. Her homework average was 18%. I am struck by the incongruence between how Luisa

described her experience in the course and how the instructor perceived the support she provided:

Just because you don't like something, doesn't mean you shouldn't learn to use it. I gave you many of the commands needed. . . . I created a youtube video that should have helped. . . . I don't know what else I could have done. (Instructor comment, Module 7, December 20, 2011)

Luisa recalled not liking to speak up in class when she was younger. "I wasn't one to raise my hand all the time. I wasn't that student. I would have stayed quiet and stayed after. I don't think I liked to admit that I didn't know something in a group" (Interview 2). She described as one of her keys to success a lesson she learned when she attended community college. She constantly felt frustrated and behind and "seldom could I pull it together, so now I try to identify before I get to that point. That is how I try to parent my daughter" (Interview 2). With college, everything happened so fast. Everything builds. The building blocks build faster. So if you feel like you are falling behind, you have to act on the feeling and not wait for the concrete evidence to show. If you wait for the concrete evidence to show while you are already at mod 3 and you're not getting help until mod 6 and final is mod 8. (Interview 2)

After reading the final draft of her portrait, Luisa added the following comment at this point: "Success will be yours".

**Can anyone tell me why I am here?.** When I asked Luisa about her belief in her academic abilities, she stated without hesitation, "I was very confident . . . I barely read whatever was assigned in class whether it was social studies or whatever, but I would study off of the notes and then get a good grade" (Interview 1). In reference to her mathematical abilities, she stated, "I never understood why people weren't good at them" (Interview 1).

Oh, you know the *A* student. I don't know if I was all *As*, but it was pretty close. I never looked at the grade. The parents never said, "I'll give you a dollar for an *A*." There was no incentive to look at the grade. It just happened. Everybody left you alone, and so you said, "Okay, good." It just happened. (Interview 2)

When I asked her what came to mind when her mother told her she could be anything she wanted to be, she responded, "You know I never did know what I wanted to



do; I was just always good at math and science, but way back, like, in elementary school, I was always a good student” (interview 1). Luisa’s belief in her academic abilities was strong throughout her life, but there was never any clear path she was passionate about or anyone there to guide her.

I was always looking to the next class for what I would learn. I knew if I checked off a list of classes that the countdown approach was not going to work for me. Although everyone liked to ask it that way: “How many classes do you have left?” This angered me sometimes because I didn’t care. I needed the distraction and sense of accomplishment with hard work. (Journal 1)

At the community college, for the first time, Luisa struggled with mathematics. “I thought I was ready because I had done all the regent classes. Because of taking the regents, because of doing well in the math and science, I felt I was” (Interview 2).

Although her fellow classmates chose to retake at the local community college the Calculus I and II they had taken in high school, Luisa chose to start with Calculus III. It seemed the practical thing to do and the natural next step. “I was like I already paid for it. It’s already credited. Why should I do that? And I think I got an *A* and a *B* in those classes” (Interview 1). She credited picking up a boyfriend as the distraction that caused her to earn a *B* in Calculus II in high school. Although she had completed Calculus I and II with good grades, Luisa felt unprepared for the level of mathematics she experienced her freshman year:

It is one of the reasons I left college . . . When I took Calculus III, it was a struggle at the university. I passed it, and then when I went on to discrete, I hit the professor that wrote with the chalk and erased the other hand, and when I sat in that classroom for one day, I said there is no way I can play catch up. (Interview 1)

It was her experience in this classroom that led Luisa to question her choice to study engineering. She began to wonder what she really wanted to study in college.

Years later, after returning to school, Luisa described her mathematical ability as follows:

In this class, because the calculus was taken so many years ago, 25-26, it is like, I have relearned that calc . . . It seems like I keep relearning it. And I relearn it less the older I get. Or don't care to even, you know it's true. It's like, okay, I have been here like a 100 times. Do I really need to know what a vector is and how to do this because the program does it for you. (Interview 1)

I think because of my struggle with calculus from 1986 until now, that I felt I am done with it. That I will find the software that will get it done for me. (Interview 2)

Luisa describes her brother;

It was only until we went as a family to the local zoo, . . . we ran into the math teacher, and she saw my mother, and she's like, "Oh my god, I never knew Pat was your brother." (Interview 1)

I think because my brother did so poorly academically, I knew what not to do. I knew the wrong, so I must be right. (Interview 2)

Luisa had high expectations for herself and compared her current achievements to past ones. She described the following as a time she felt she wasn't meeting the teacher's expectations and how this motivated her:

In 5th grade, it was a little devastating in that I wasn't, my math skills weren't up to advanced level . . . So, I was like, how did we get in this group. [lots of laughing] So then I was like so what I'm not performing like I should; that was the first trigger, that I was like, "Oh, people are watching this." I was just always in that class and next, next, next. So then the next one I was back in the scheme of things. (Interview 1)

When I asked her how that experience made her feel about her abilities, Luisa responded,

It discouraged me at first; . . . just sitting differently was derogatory in feel. . . .But it definitely made me strive and look at math differently as far as any of the other classes because it was the first time I was told no, I couldn't be where I wanted to be. Where I thought I should be. (Interview 1)

It was the first time I was on the outside looking in. I was always in the mainstream. Just being pushed forward . . . That was the first time where I noticed a difference. A physical difference. Where I said, "Oh, I have to work harder to bump my game up. Something is not right." And I wondered, "What's wrong

with me? Why can't I sit in the other classroom?" I remember feeling stressed. (Interview 2)

Luisa remembered not comparing her academic achievements to those of her peers. "I just always did it for the adult. I didn't care what my peers thought. I had enough self-esteem that the peer pressure didn't bother me. Where I have seen girls where the self-esteem is so low" (Interview 2).

While Luisa recalled most of her high school math teachers being female, she did not recall them being role models or influencing her in any way:

What you wanted to be was never a conscious discussion. It will happen somehow, but a goal was never set, and there was no real role model to say, "Oh, I see a girl in that position" or "I see a girl in that position, I wonder what they do." (Interview 1)

Luisa recalled the older woman down the street who owned a flower shop where she went while her mother worked.

So I would hang out with her in the flower shop. It wasn't a neat flower shop at all; the stems on the back side of that counter were ankle high to me; she would sweep maybe once a week. So, I started sweeping; there was a need. And it is not what she said, it was just her presence, being there and seeing her; to me she was like 80, but she was probably in her 60s. She wasn't young, young. And I guess that is when I starting looking; my mother wasn't a role model for a career; she didn't know how to guide me in college or toward a career. She didn't really have that skill set. (Interview 1)

She recalled this experience as causing her to think about what she wanted to do.

I thought that, she [the florist] was a different role model, one to me she worked out of her house. Working in her flower shop in a separate building. It made me see that that was a different lifestyle. She had raised two daughters, no, two sons, and um so it was a different perspective, but it wasn't higher education, so when it came to the choice of higher education, and what you want to be there was a void. (Interview 1)

Even today, Luisa is finding it difficult to find a mentor in her field. "It is a quandary.

Where do I get a mentor in that field?" (Interview 3).

Luisa recalled one woman that she felt a connection to joining her engineering program:

After that first year of engineering and people starting dropping, there was one girl who came to the course, which was very different. She was full-time student, older, and she had tried all these different things, and her parents finally told her, “This is your last choice,” and she chose engineering. I was like, “You got to be kidding me.” She thought it was a great opportunity, and so the yearning to learn rebirthed. To say, “Okay, I am not in it alone.” There is a buddy system going on, and she was an asset to the study group. (Interview 2)

Luisa didn’t feel entirely ready to enter college and recalled thinking, “I guess the self-assurance really wasn’t there. [about 1 minute of silence] Other people believe in me ok, I’ll do it” (Interview 2). Earning an *A* in thermodynamics boosted her. “It wasn’t a struggle; it was the given again. So that was like when I thought “Okay, it is not all hard” (Interview 2).

Luisa’s struggle with her grades made her reassess her choice of major. She began to question her all-male classmates about why they were studying engineering. Money was the response she got each time. “I wasn’t money motivated. I am more so now only because of life experience, but otherwise I wouldn’t be” (Interview 1). Luisa felt isolated and unable to make a connection with the material. “In the engineering community the guys would say it is like a car. I don’t understand a car. It didn’t help . . . ; the teacher was worthless. . . . I was looking for affirmation to stay” (Interview 2).

Luisa recalled a family friend who was an engineer but remembered only the suggestion of being a teacher. The idea of being a teacher didn’t appeal, and her experience as a candy striper led her to decide nursing was not the right career choice.

I chalked off those two right away, so I didn’t really, I wasn’t exposed to different things, so at college, when I was searching, I was vividly searching for an answer

where to go with this. With the math not meeting the rest of the curriculum, I felt like I was losing it. (Interview 1)

Feeling lost, Luisa approached an engineering professor for advice. She asked if he could arrange for her to talk to some engineers in the field to get an idea of what kind of engineer she wanted to be. His response was “No, you can’t do that” (Interview 1).

Luisa followed up with the career counseling center, where she took a career survey that indicated she should go into a service field. Mathematics and science didn’t even come up as an option based on her answers to the survey. Feeling lost and without a clear path, Luisa found herself back home and unemployed.

Luisa shared the following in an e-mail after our first interview:

I enjoyed pulling all these thoughts back as I am near the completion of this degree. Your following questions were the ones I was thinking about when we met while driving home. I left realizing what a difference the visual of a woman in mathematics might have made, whether mentor or not? Would it have been an asset to my educational process? As my girls have grown I remember seeing different literature on that from various programs to promote this. I think for me I pull different characteristic from others and look for similarities while maintaining me as my biggest cheerleader. As I look around my workplace I see the same women role models as I am one of the youngest in this building . . . women in roles of managing programs using reporting but the same skill for running a household but not what keeps me engaged to problem solve. Where to find the atmosphere that will promote this for me is going to be continued self-research and still my biggest challenge. It is hard for me because people will tell me I am talented with the menial and peg me there when I have proven to be successful in whatever I try. (January 20, 2011)

Luisa added when reviewing her final draft saying that she had visited a numerologist who told her, “you can do anything”.

When I asked at our first interview what her image was of who she thought she should be when she grew up, she responded, “My mother was a big advocate to you are beautiful inside and out and you can do whatever you want to do. You are beautiful and smart I think are the two she used”. Throughout our first interview, Luisa brought up

these words of encouragement from her mother, and it seemed clear they were at the core of who she is today. Luisa described a vivid memory in which she was being teased on the playground for being overweight. She went home feeling discouraged, but her mother lifted her up by saying those words.

Luisa did not recall ever receiving any specific guidance or help in creating goals from her mother.

It was never like you're smart enough to be a doctor. I think she probably threw them in there, but she didn't want, she wasn't restrictive; her personality wasn't restrictive. She wanted us to grow the way we wanted to grow. (Interview 1)

When thinking back to her decision to study engineering, she stated,

I don't know; we just never, it was never a topic at the table to say, "You should do this; we expect this of you." It was never discussed. It was just always inferred because these are your talented areas. This is a progression to where you should go. (Interview 1)

I don't know if we ever discussed. I mean I always brought my report card home, and I showed my mother. I think I showed it to her and left. So I don't think there was ever a time when we really discussed it. (Interview 2)

Luisa recalled her high school friends thinking her choice of an engineering major as odd. "Some thought it was odd . . . because I was a girl" (Interview 2). When I asked Luisa about the reactions she got from others about her return to school, she said, "I had all the support I needed to succeed just by people saying I don't know how you do it" (Journal 1). As I read Luisa's words, I thought of how many times people had said those very same words to me. When it came to friends and other parents she knew, Luisa remembered,

They basically were acquaintances talking. It was more like, "Yeah that is a good idea. Did you see the baseball over there that went into the foul line?" It just wasn't authentic to me. . . . [M]y close circle of friends were walking me through the divorce after effects. I don't think I told my parents until I knew I was going back. I don't think I asked them or was looking for affirmation from them

because I knew I would get it. I was looking for it from somewhere else.  
(Interview 2)

She said when she told people she was going to study operating systems, they “looked at me with four eyes” (Interview 2). “They don’t know what to say . . . I used to feel special; now I feel can we get over this. I am not hanging out with the right people? . . . They categorize you” (Interview 3). “My aunt said, ‘Luisa that is what you were good at.’ I think I had forgotten I was good at it” (Interview 2).

She recalled a coworker from a previous job:

Through the chaos she would be, “Luisa just come on up.” Her husband would go and take my car and fill it with gas, so I didn’t have to spend money to come back. They were like “Luisa, don’t you need any food? Don’t you need any groceries?” I’m like, “No. I am really all right.” Then filled a vacuum cleaner box and put it in my trunk disguised. Filled with stuff to come back. So, she was really a godsend to reconnect to. She always praised me for going back to school.  
(Interview 2)

When it was time for college visits, Luisa found herself without transportation because of her brother totaling the family car. Luisa’s sister let her borrow her car. She reflected on how, at the time, she didn’t see the significance of her sister’s words: “Don’t worry: we’ll get you there no matter what.” Luisa encouraged her sister to finish up her studies at the same college. Her sister graduated first and is her biggest cheerleader, constantly returning the words of encouragement she received from Luisa.

One of the first courses Luisa took at the college was an introductory computer programming course. Reflecting on this experience, she said it was

the first time I think I felt like a failure in a class, and I couldn’t believe it was an intro class, and I didn’t catch on . . . It was terrible. I wanted to just stomp my feet, and feel like I was five years old. I pleaded to the school, talked to the professor, and I had a tutor session set up. (Interview1)

The tutor was able to say exactly what Luisa needed to hear to persist and earn a *B* in the course. Luisa shared the words of another instructor, “Maybe you are just not cut out for computational math” (Interview 2).

Luisa also described the inspiration she received from her old boss:

She’ll be the one to stretch me. What it is about her is she is very down to earth. She tells it like it is. There is integrity to what she is saying. She walked the walk of single parenthood and career growth, and she does have this knack to make you feel special in that moment. (Interview 3)

While she doesn’t see her old boss on a regular basis, I could hear in her voice how much it meant to know she was only a phone call away. It made me think that support comes in all sorts of forms, and sometimes just knowing it is there is enough of a safety net. Luisa shared in the final review of her portrait that her old coworker at the paving company had called and said she had been laid off and was returning to school. She told Luisa she was her role model.

In college, Luisa recalled the number of women in her engineering program as being small and that it was the first time she felt it might be an unfriendly place for women:

It wasn’t until orientation at college, and there was a guy there who said, “Oh, you’re the one.” I said, “What do you mean?” He says, “Oh, well I was accepted in the engineering program, but a girl got accepted, so you bumped me out.” In that second class of engineering mechanics, the girls of eight dropped to three, and I was like, “Oh, there is something to this.” I just thought it was because I didn’t go to an engineering school. (Interview 2)

Luisa recalled, “It shook my world because the calc really wasn’t hitting, so I thought maybe I was in the wrong place. What are they seeing that I don’t?” (Interview 2).

Luisa initially worked and had her children in daycare. During a discussion with a neighbor, Luisa learned that one child in daycare was documented as having bitten other children 650 times. That was all it took for her to decide, “I am not putting my



other ones through that. So, I was just in poverty and stayed home” (Interview 1). I thought about how many women are forced to make these difficult choices and remembered my own decision to quit my job and stay home. I remembered the number of times I had to call in sick because my son was sick or had to leave work early because of a day-care issue. The stress of day care was greater than the additional amount of money I was bringing in. Like Luisa, many mothers define quality of life not by money but by a work-life balance.

Luisa saw women today in a rift:

I see where women today feel they need the career. The guilt of leaving somebody else to do the raising is something I am glad I never had to face up front. Even I think now that I look at people working from home, “It’s still work from home.” But I think the ideal situation is if you can do it part-time and get the best of both worlds. (Interview 1)

Her words hit home, and I thought of my own struggle to balance working from home.

Early in her career, Luisa was forced to choose between work and her family.

While working at a tax preparing firm, she made a choice to meet the needs of her family during the peak week of tax season. She soon found herself unemployed and alone because her husband was activated after 9/11.

I had financial loss, spousal loss; I knew unemployment was good. I inherited a camper the size of this table. . . . [M]y husband never came back. I had no education to fall back on. . . . I don’t want to be like other women, no looks and no mind. As I was climbing out of the pit, I was looking around me for a goal, and there were a lot of people I didn’t want to be, and people knew I was above the pit. . . . I never understood why people didn’t want to get out of the pit. . . . I was terrified. (Interview 3)

During our first interview, I asked about a time she had to make a choice between school and family, and without a moment’s hesitation, she responded, “School will always be last; mother is first” (Interview 1).

During our second interview, Luisa described a recent discussion with her daughter during her visit home over the Christmas break. Luisa had a homework assignment due. Because they would be driving back to her daughter's school on Wednesday, she planned to work on the assignment on Tuesday. On Tuesday, her daughter came to her frustrated, almost in tears, and in desperate need of her mother's attention. "It wasn't that I didn't prioritize or could have done things differently. It just was what it was" (Interview 2). She explained the situation to her instructor and was granted an extension on the assignment. As she told this story, I could hear how instructor support and understanding of what she was trying to balance had been critical to her success.

During our first interview, Luisa described her situation before returning to college: "I was working as a receptionist at a paving company. I needed to get through the divorce, answering the phone, that was the only thing I could really do. And then I got bored" (Interview 1).

Before our first interview, Luisa and I exchanged several e-mails. At the time, she was just finishing up her course and apologized for taking so long to reply, but "I am finishing this math class from hell today the final is due with my requested extension. I did receive your email sent to personal address. I was just trying to alleviate all distractions. (January 10, 2012)" About 3 hours later, she sent the following e-mail: "I give up . . . on this final . . . your distraction this moment is welcomed" (January 10, 2012).

I could feel the physical and emotional toll this experience had on her as she described the following:

Any other distractions, . . . I would sit and think I could empty the dishwasher and that is how I tolerated this class. It was my last math class, and I really thought I could pull it together, . . . but as far as the emotional, there were tears. It would just get too frustrating. . . . I don't know what I could have done differently.  
(Interview 2)

Luisa summarizes her experience in the course: "I never received a final grade and am too tired to fight while purchasing a house on top of the usual routines. I will have to follow up when I am moved in" (Journal 2). At the time of data collection, Luisa still had not received her final grade. "I think I have more senioritis now and my drive at the last 3-4 courses is shallow. I have decided with this house purchase and maxing out the APT grant I am not enrolling in the March class and will wait until May to gain some zest for learning back" (Journal 1).

When I asked her if she had any advice for young girls, she responded, "Don't accept the no; there is always a maybe; problem solve for the yes" (Interview 3).

### **Rosa**

"Work hard and you can do literally anything" (Interview 3)

Rosa was a 41-year-old, married woman with no children. A typical day for Rosa included waking up around 8 AM to do her homework before heading to work just after lunch. She typically got home from work around midnight. In her current household, Rosa was the primary income earner. Her husband was an actor, and they shared household chores equally. At the time of our first interview, Rosa was looking for a new job with hours that would allow her to have more balance in her life.

My first impression of Rosa was that she was an energetic, excited, and passionate person. We exchanged several e-mails and text messages prior to our first meeting. Because Rosa only lived a few hours from me, we agreed to meet face-to-face. I eagerly anticipated her story and wondered what experiences she would share. It was

like a breath of fresh air to see and feel her passion and excitement when she talked about mathematics and science.

Between our interviews, Rosa updated me on what was going on in her life. She was job hunting at the time and shared with me how the search was going. After she started her new job, we were unable to find a time to meet face-to-face and held our final interview over Skype. I had the opportunity to meet her cat and she met mine.

**Who should I be?.** Rosa saw herself as a people pleaser. Rosa's image of who she wanted to be centered around making a difference and being there for the people in her life:

Oh it is such a work in progress. You know the first thing I want to be and I guess this reverts back to being a people pleaser, I want to be good to the people in my life, be a good friend to my friends, a good wife to my husband, a good mommy to my two cats, and a good daughter to my parents. (Interview 1)

Rosa's studies always came easily to her, and she remembered always being good in mathematics and science. Rosa's passion for mathematics and belief in her ability to finish emerged in our interviews, her collage, and her journal entries.

In our third interview, she said,

I guess I want to make it clear that math is fun for me. It's like solving a puzzle or playing detective. I feel good about math. . . . I swear I had little or no concerns. I was just jazzed to have the opportunity. . . . I feel capable. And I feel like I will definitely get the science degree. . . . It's a fun ride. (Interview 3)

In her collage, Rosa included three pictures of puzzles and one of a girl smiling while working on mathematics. When asked about her choice of major, Rosa said:

I like the whole 'life science' thing. Math and science come so much more naturally to me. The truth is, science as a major hasn't caused me any worries yet. I promise if it does, I will inform you :-). (Journal 2)

**Where is my North Star?** Rosa and her three brothers grew up in a single-parent family in which she was the youngest. She split her time evenly between her mother and

father. Rosa was 5 when her parents divorced, and she did not really have any memories of them being married. Rosa's resilience came through even at a young age as she described how she remembered experiencing the divorce.

I was too little to understand what the splitting up meant, and I remember fighting, so I think the divorce to me, as a kid, I just kept playing. I was like, okay. I just knew we were going to have two houses now. (Interview 1)

In our first interview Rosa talked extensively of the strong, but different, influence each of her parents had on her. Their influence resulted in a strong interest both in the arts and mathematics and science.

While she described her dad as more lenient, it seemed he also gave her the inner strength she later needed to overcome the obstacles she would face in life.

I think there was the sense that my mom was responsible. She was the stick, and my dad was the carrot even though I spent equal time. My dad was a lot more lenient with me. Sort of let me fall down and make mistakes and, you know, when I would cry, he would be like, "Wipe yourself on the butt and get up," whereas my mother was very protective and didn't want anything bad to happen to me and she was definitely more the nurturer and he was sort of more into me taking chances. (Interview 1)

Rosa's mother taught autistic children and taught teachers who teach autistic children. She described her mother as "like such a missionary, she's do good, she's always, she's lemonade, make lemonade; she's great. . . . [S]he teaches autistic children; what can I say; it doesn't get more selfless than that" (Interview 1). Her feelings for her parents seemed very equal, and she seemed to have a good relationship with them both and respected and appreciated that they were different. "My dad is also great. My dad is more, he is definitely not a missionary, more like keeping up with Jones, having nice things, um his rewards are more material" (Interview 1). "They are both great people" (Interview 1). Rosa's father exposed her to a life of glamour in which she crossed paths with famous people and made connections with people in the fashion business. As I

listened to Rosa speak so highly of both her parents and describe what a strong relationship she had with both, I wondered how those relationships affected her success in college. For Rosa, family was not one more obstacle to overcome but a constant source of support. After Rosa lost her college scholarship and had to return home, both her parents offered their support.

When I asked Rosa about the value her parents placed on education, she responded,

My dad was a dentist, and my mom was a school teacher, so I think that even though she wasn't special education yet, I think I always felt like I should be a good student because they had both done so much school. Both of my parents, it wasn't like they worried about me struggling in school just I was going to do well in school and that is just sort of what it was. (Interview 1)

Rosa vividly describes how different her parents' expectations were. If it were her mother asking, she would say,

I want to be President of the United States, and I want to achieve, achieve, achieve because I can be anything in the world that I can set my mind to. And I think if it was my dad, I was going to be a movie star and, um, a great beauty adored by the world. (Interview 1)

I heard slight regret in her voice when she stated, "Obviously none of these things have turned out to be true."

Rosa's struggle with her identity came through again when I asked about her image of who a woman should be.

Strong women, like the Margaret Thatchers and Hillary Clintons, is in my brain. That is what a woman should be. I also knew that wasn't what I was. So then I would also look to the Audrey Hepburns and Grace Kellys, but that is also not who I was. (Interview 1)

Rosa described the difference in support she perceived receiving during middle school as opposed to the school she switched to in high school:

I think just having friends, feeling like I had a support system, where if I didn't understand something, I could be like, "I don't get this." Whereas at the junior high school even if I didn't understand something, it would be like, "What? Are you stupid, poor girl?" So, I think just feeling good about myself came naturally when I had some self-worth back. Poor young Rosa, I am trying to think what I would tell that little 6th grade girl who had like no friends what I would tell her now. (Interview 2)

Rosa remembered receiving little to no guidance when it came to selecting colleges and choosing a major.

I had those books that you could look up all the different colleges and the majors. I talked to my dad more about it. I wanted a college that was going to be a good social fit for me. . . . Our college guidance counselor was horrible. She never really said much. (Interview 2)

Rosa described the path to college as something that was just expected. Her choice to study art over mathematics and science, in the end, was largely because of being accepted at a top art university and wait listed at MIT.

When asked about the support system she currently had that enabled her to persist, Rosa said,

I like my coursework. That is why I persist. My support system includes my husband (who is AWESOME!) and my mom, dad, and step-mom. Not necessarily in relation to school per se, but in relation to feeling overwhelmed. . . . Beyond that . . . Dr. V (her mentor) is amazing. She has total faith in me and believes in my work. If I could add any, it might be fellow students who are experiencing the same course I am. But in this e-world, that doesn't really exist. I have had the pleasure of doing group projects, but even then we are focused on getting a job done but there is really no camaraderie. (Journal 2)

**Life in the fast lane.** Rosa reflected on her feelings about returning to school.

I felt pretty good about going back to school. I had no set expectations because I had no idea what online learning might be like. I did have concerns, not about my ability necessarily, but about my drive to succeed. I was scared that I might get complacent like I had in high school. I didn't want to be that lazy student. I wanted to be a good student. I wanted to take the work ethic I had in my professional life and apply it to my schoolwork as well, and I wasn't sure there was enough of me to go around. I wasn't sure how to address the issue of "not feeling like it" when it came to schoolwork. But I guess with age comes resolve because my drive to be a straight *A* student has overcome my drive to sit on the

couch and watch *Family Guy*. For me that came with maturity. As a kid the choices I made would have been different I think. (Journal 1)

When describing how she fit it all in, Rosa said

All reading gets done on subway so that it doesn't take time away; if I have five minutes of down time, I read. When it comes to actually sitting down and writing a paper, if I feel good about [it], I can't wait; otherwise, I have to force myself to start on Tuesday if it is due on Sunday. I was a crammer who would wait until 2 AM previously. Now I prioritize . . . One class I felt so panicked and had put off and put off and came up with system of highlighting. When I finished, I printed the syllabus. I never want to feel that overwhelmed. If I am going to balance, I can't feel overwhelmed. (Interview 3)

The first year was encouraging. I was studying something for the first time with no expectations. It was great. The only time I really felt discouraged was with this one professor that I had difficulty communicating with. He was a nice enough man, but he was so wordy that when I finished reading his feedback I had no idea what I had just read. I approached Dr. V (mentor) and emailed her some of the commentary I had received and I was relieved to know she was as lost as I was. (Journal 2)

Rosa posted often and gave careful thought to her posts. I could hear her excitement and passion for the subject in such comments as "This article is truly fascinating. It amazes me" (Reply to classmate, November 19, 2011); "I am really interested in learning more. . . . [I]t touches me. . . . I am excited to be working with everyone" (Original post, November 30, 2011). In her journal, Rosa described her classroom experience:

The class . . . with Dr. T who is an amazing teacher. I didn't prepare at all. Beyond trying to read ahead a little, I never do. I feel like if I let go of expectations I will be better prepared for what I find. I have to say (humbly of course) I ACED this course. I loved it! The challenge for me was the virtual labs. Not the problem solving, but understanding how use them. Once I had that understanding, I was feeling great! (Journal 2)

I heard her desire to reach out, connect with her classmates, and offer support in the following posts: "I believe you will achieve your goals of being a science teacher.

We need good educators out there. Best of luck" (Reply to classmate, September 10,



2011). In another post directed to the entire class, Rosa wrote, “I just wanted to say how impressed I am by how many of you are studying to be PAs and how strong your scientific backgrounds are. I hoping I can keep up with all of you and learn from your experience. Best of luck to everyone” (September 15, 2011).

Rosa frequently provided words of encouragement to her classmates in the discussion posts. “I think we will be able to help each other navigate this course” (Icebreaker, September 10, 2011). “I believe you will achieve your goals of being a biology teacher” (Icebreaker, September 10, 2011). “Just a quick thank you to our team leader for the final project. Awesome job” (Team project discussion post, December 10, 2011). When responding to the articles her classmates posted, she let them know what they had to say was of interest to her: “This article was of particular interest to me” (Discussion post November 19, 2011). “This article is so interesting” (Discussion post, November 19, 2011).

In the final course reflection, Rosa summarized her experience: “I really enjoyed this class. It was challenging, but not overwhelming. And I learned a lot about a myriad of topics. . . . Thank you Dr. T!!! Thank you classmates!!!!” (Discussion post, December 22, 2011).

**From actress to research scientist.** Rosa describes her image of herself during her k-5 years.

I was always, through 5th grade, I was really good in school. I went to Montessori school all the way through 5th grade. I think the creativity of it really allowed me to flourish and I had a really great self-confidence about my ability to learn. (Interview 1)

In addition to academics, gymnastics was a source of accomplishment for Rosa.

Her parent’s decision to enroll Rosa in a private middle school was detrimental to both

her academic and emotional health and resulted in her losing belief in herself. Feeling isolated and alone, she escaped by practicing gymnastics 5 days a week, which ultimately led to her receiving a college scholarship. She described the effect this experience had on her belief in her academic abilities and self-confidence:

I knew in grade school I was good in science and math, and then when I got to junior high, I didn't feel so much about that. Like they put me into a computer class and I had never been in front of a computer in my life because in Montessori school they don't do that . . . all the sudden I said maybe I am bad at this. (Interview 1)

Rosa's parents pulled her out of the school and sent her to a Waldorf high school, where

all the sudden I could start making decisions, and I could take drama or calculus. And I think I was taking calculus, and I was like, "Okay, I got it. This is something I can do". Math makes sense to me. And I like beakers. I like the whole experiment thing. And making smoke. (Interview 2)

Rosa's passion and belief in her abilities came through whenever she started to talk about mathematics and science. During our interview, Rosa's eyes lit up, she had a smile from ear to ear, and I could just feel the passion bursting out of her. When thinking of mathematics Rosa remembered doing well even when she was failing everything else.

Math was the one area of study that never faltered for me, even at the school where everything else went haywire . . . to me math is like a series of puzzles and you figure it out or you don't, you know it is like doing a crossword puzzle . . . So that was just the one area I managed to maintain my confidence. (Interview 2)

When it came to selecting classes, Rosa said she always wanted to challenge herself.

In college, she wasn't required to take a science course, but she chose to take a class called Earthquakes. "It was a cool class because they drove you up the fault lines and stuff. It was really hard. I remember it was just really hard. But a good hard, not an, 'I want to shoot myself' hard" (Interview 2). Even while studying acting, her interest in science drove her to take a class that wasn't required and was not easy. Rosa went to

college with a strong belief in her academic abilities, although she questioned whether she would have felt equally prepared had she been a mathematics major.

I think if I had been a math major, because I came from a Waldorf school, I probably would have had a really different experience. But because I came from the Waldorf School and I walked into the school into this artsy program, I think I was very well prepared. I think if I had been a life science major, I would have been *what?* (Interview 2)

When asked about what she found challenging in her current course, Rosa responded,

I didn't prepare at all. Beyond trying to read ahead a little, I never do. I feel like if I let go of expectations I will be better prepared for what I find. I have to say (humbly of course) I ACED this course. I loved it! The challenge for me was the software. Not the problem solving, but understanding how use them (the software). Once I had that understanding, I was feeling great! (Journal 2)

Rosa's mentor described her first impression of Rosa: "Initially, when Rosa came into the environment, I felt whatever Rosa decided to do, whatever path she took, she is going to be successful" (Mentor interview). When describing Rosa, Dr. V used descriptions such as "she is very acute; she is dedicated; she is disciplined; . . . she is paying for this out of pocket on top of that, you know" (Mentor interview). After Rosa completed the advanced-level science course, Dr. V. said, "She just loved it. She said she loved it. She loved the instructor, and she was involved with the material" (Mentor interview). Dr. V described it as her "aha" moment. Prior to this course, Rosa might have described a course as a "good course" or say "it was okay," but with this course, "She was in love" (Mentor interview). Dr. T described Rosa and Jeanie, who was a classmate of Rosa, as "very diligent, keep in close contact . . . very strong . . . diligent about keeping up with assignments . . . reach out" (Mentor interview).

In our first interview, I asked Rosa about her image of who she thought she should be when she grew up. Her response was "Okay, that is a weird question; I am a

weird person to ask that to.” Rosa struggled to find her identity growing up with what she described as very different expectations from her mother and father.

My parents divorced when I was very, very young, and they are, like, down to their very cores two very different people. Like, I am surprised they even created me. So, the expectations of what I should be were very different on both sides, so up until, about, I was 22 or 23, and I was really kind of on my own. I was a people pleaser. It was very hard to see past that because I had so many different sets of expectations coming from both sides. I was, like, I never really thought about, I was good at gymnastics, and that was good on both sides. I was a good student, and that was good on both sides, and I got into college and that was good on both sides . . . I really don’t think there was, like, a clear image of that for me as a kid. I never, it depended on who was asking me the question. (Interview 1)

Rosa’s expectations for herself were a source of comparison for her. The first time Rosa failed a test was a vivid memory for her. It was 7th grade biology:

It was a biology test, and that was what really freaked me out and I failed it. I had to come home and tell my mother, who was just irate, and I was trying to explain everything, and I was trying to, and I’m just dumb and whatever explosive, idiotic thing came out of my mouth. (Interview 1)

While Rosa passed biology, she received her one and only *F* in computer science.

These other things that should make sense to me and just didn’t, just, I was tearing my hair out and doing things like failing tests; I actually got an *F* in computer science. It’s the only *F* I have ever gotten in my life . . . I felt like a failure because I failed. . . . I was hysterical, and I was like I never want to go back and I was horrified. (Interview 1)

In college, the social adjustment was easy for Rosa, but academically, she “fell down a few times and realized it is better to be careful” (Interview 2). Rosa realized that she needed to find a balance between her academics, sports, and social life if she was going to continue to meet the expectations she had for herself:

It is different in college because you have to self-discipline. You are coming from an environment, at least in my case, where I had my parents on my ass all the time about my grades. So now I can stay out and drink until 4 AM every night if I want to, and nobody can tell me no. So how do I navigate that and the fact that I have to go to school and I want to be social and the fact that I joined a sorority and I am on a sports team? How do I mesh all that? I think that was

more the challenge than getting good grades. Learning how to be a grown up. (Interview 2)

I thought of my own freshman year and struggling to figure out some of the same things. Like Rosa, I remember knowing I needed to figure it out because flunking out was just not an option. I found myself considering what experiences we had in common that may have led us each to share believe finishing was the only acceptable outcome.

Rosa recalled the following conversation:

So I applied to the college first, because she [her mom] knew somebody who got a master's in, I want to say psychology, and they loved it, they loved the whole experience, and I thought let me go see what I can do, and they accepted me and I started right away. (Interview 2)

It was a friend who worked in the pharmaceutical business who eventually gave Rosa direction. She suggested Rosa get her BS in nursing and work in the pharmaceutical field. They used to bartend together, and she explained to Rosa the steps she would need to take and the financial stability she would gain.

When I asked Rosa about her image of a woman today, she responded,

Now, well, I guess, I would look to my friends to that and my step-mom is pretty awesome. To me that question is to a woman; to a man, it's like, I think a person should be true to themselves, and I think as long as you do that, people may or may not agree with what you are doing or how you are doing it, but that would probably be key to who anybody should be. I guess I don't have a clear cut image of who a woman should be because there have been so many different types of women in my life, and they are all so different and great just the way they are. (Interview 3)

She remembered a different image when she was younger, "Women should be pretty, skinny and no runs in stocking, a lot of stock in appearance, I got that from my dad. I wanted to be those pretty girls" (Interview 1).

Rosa remembered all of her doctors being men, and her dad was her dentist.

Although her mother was not in a mathematics or science field, she credited her with

instilling the belief that women can be scientists. “I don’t think I really saw women in science. But for some reason (my mother most likely), I never questioned the fact that women could be scientists. I just knew they could” (Interview 3, Skype). When I asked her about the role her father played in this belief, she responded:

He just hung around with those types. We always had directors and celebs about. It’s very important to be fabulous, you know! His wife is in fashion so we had designers and stuff around too. . . . He hated dentistry; that’s why he hung around with the glam squad. . . . I didn’t know how much he hated it until I was an adult. (Interview 3, Skype)

Rosa had a friend who was a pharmaceutical researcher. One day they were having lunch, and her friend shared with her what she did, how much money she made, and why she thought it would be a good fit for Rosa. Rosa described how her friend’s words connected with her:

My friend really got to me when she discussed the possibility. I have this fantasy about not having to think so much about money all the time. . . . [W]hen she talks about work, she really talks about the work itself. She gets excited when a drug is approved and disappointed when it doesn’t, . . . I know I am not alone. (Interview 3, Skype)

Rosa frequently turned to her mother for advice. At a point in her life when she was feeling dissatisfied with her career, it was the words of her mother that motivated her to make a change: “She always told me I could be anything I wanted to be” (Interview 1). When Rosa first thought about returning to college, the person she turned to for advice was her mother.

I was putting all this work and effort into doing something that, I was like, “If I am going to put all this work and effort into something, shouldn’t it be something that is going to help me grow?” And just sort of like a light bulb went off. And I called my mom, and I asked her what she thought about it, and she said, “I think that is awesome; you should totally do it.” (Interview 1)

“My parents sent me to an all-girls academy, like a very snooty, hard to get into, children of celebrities kind of place” (Interview 1). The transition from the open, creative

learning environment of the Montessori to a typical classroom was difficult for Rosa. “I started to not do so well, and on top of that, I was on scholarship, so these kids were not the nicest to me. I went from having friends to having no friends” (Interview 1).

Rosa described the stress and frustration she felt in middle school:

Oh, god, that was awful. And it was so frustrating because I was thrown into this environment where I didn't know this at the time but where I was kind of set up to fail, and I couldn't understand that; all I knew was that I was failing. And was like you know, I thought there was something wrong with me. (Interview 1)

I heard regret in Rosa's voice when she stated, “I was like frustrated and angry and I was especially angry at my parents for not getting me out of there” (Interview 1). I thought about what it must have been like for Rosa in this environment and tried to imagine what it must have felt like, reaching out for help and nobody there to save her. I think of the resilience she had to persevere and come out the other side unscathed.

Rosa spent several years seeing various therapists:

I would come home crying, so of course, they would send me to a shrink, thinking it was something about me that which, you know, I guess if you are a parent you want your kid to be able to succeed in any environment, and in their head, there was no way I was stupid, so what was the problem? There was no way I was unlovable, so what was the problem? And it took a series of bad shrinks; she sent me to a shrink at the school, and of course, their job is to say everything about the school is wonderful and their daughter is defective. (Interview 2)

Eventually Rosa went to an adolescent doctor who was a psychiatrist and a general practitioner who specialized in ages 11-21. He told her parents, “Look you are sending her there every week, and she is miserable. She is not going to thrive. Get her out of that school. Like these kids are terrible to her. She doesn't know how to deal with it” (Interview 2). Rosa fondly remembered the doctor, who she still kept in touch with: “To this day I still love him. I still keep in touch with that guy” (Interview 2). As Rosa was telling me this story, I heard in her voice how fortunate she felt, to this day, that she

finally connected with a doctor who could help her. I wonder what would have happened if she hadn't.

Rosa switched to a Waldorf school, where, on the first day of school, the most popular girl in the school said to her, "Hey, we're all going to go out for burgers; do you want to come?" (Interview 2). I could hear in Rosa's voice the difference being accepted by her peers made to her, and I found myself considering what effect this support had during those critical years.

The negative relationships and verbal interactions from Rosa's junior high ultimately influenced her college choice, and I could hear in her voice the pain she still felt: "I thought if I went nearby, I was going to bump into all those girls I went to junior high with. . . . So, I was just like, no" (Interview 2). Once in college, Rosa did not recall any stressful experiences.

After middle school, Rosa didn't have any academically stressful or difficult experiences. Although she carried a heavy load of courses, the strongest college memories related to her social life rather than any feelings of stress related to academics.

I dropped a class once or twice. I think when I would do that it was because it was either something that was so time consuming and I was in a time-consuming major, plus a sports team and a sorority, and I was like, "I can't balance this." And then, of course, my mom got very angry because I had dropped a class. I always tried to carry 16-18 credits. I wasn't the 12-credit kid. I didn't have the option of a 5th year. You know, so it was just one of those things. I am trying to think of a specific overwhelmed feeling, but I think I was having so much fun that, even when I was overwhelmed, I sort of had something to look forward to later, whether it was like a sorority party or going to a football game or whatever it was. (Interview 2)

Rosa attended college for 3.5 years. During her junior year, they eliminated the gymnastics team but, because she was a good student, allowed her to keep her scholarship by joining the diving and crew teams. Rosa's resilience was illuminated as



she talked about this experience. During spring term of her senior year, Rosa's scholarship was entirely cut. Her family didn't have the finances to pay for that final term of college out of pocket and she was forced to pack her bags and move back east. "My family just didn't have \$25,000 to fork out. I had already done with what they were helping with and taken out all the loans I could. There was just nowhere else to go" (Interview 2). "It was so fricking unfair. But good things happened. I came back home, which I am glad I did. I never would have pursued anything in science which I am glad I am doing" (Interview 2).

Rosa's path back to college was primarily because of wanting better balance in her life and more financial stability.

I was literally working like 80 hours a week, getting phone calls on my day off. When he (her boss) had a bad cup of coffee at one of the restaurants, I had to run down and yell at one of the managers, so it was like one of those, like, I was standing in the wine store one day, and it was just dead, and I was like, you know, what I am writing that essay right now, and I did it. (Interview 1)

In her first journal entry, Rosa wrote,

My decision to return to school was I think based on feeling stagnant. I wanted new challenges and I wanted a career with more financial opportunities. I am 41 years old and since I still don't really know what I want to be when I grow up at least let me be financially stable.

Rosa had had a very positive experience since her return to school, although she had recently needed to take a break from course work because of financial constraints from being unemployed.

Financial concerns permeated Rosa's world, and she commented on money in our interviews as well as her journal. Her mentor also mentioned that it was a struggle because Rosa was paying for all her courses herself. When I asked Rosa about school and how it had affected her emotionally, she responded,

Not the mental ability. Just the financial ability. . . . I am actually in a much better financial position now than I was before, so I guess getting laid off was a blessing in disguise. But still not quite where I want to be. . . . I'm not worried about rent or have to budget like crazy to buy a nice dinner. But school is still CRAZY expensive.

(Interview 3, Skype)

Rosa had the following advice for girls: “Work hard and you can do literally anything” (Interview 3). At the end of our last interview, Rosa said, “I can't wait to Skype in 5 years from my lab! White coats are fetching!”

## Chapter 5:

### Themes: Factors that Contribute to or Inhibit College Completion

This chapter focuses on the results from the thematic analyses of the portraits and ways in which this study has informed a particularized theory of development in nontraditional women. As discussed in Chapter 4, portraiture methodology was used to gain a deeper understanding of how the women experienced their path to STEM within the context of the world in which each lives. Throughout the data-collection process and analysis process, the participants and I worked together to co-construct meaning, gaining deeper insights into the particular factors that brought each to this moment. Data analysis was guided by SCCT (Lent et al., 1994). After each portrait was complete I carried out a second analysis, this time of the portraits looking for overarching themes across them. Findings resulted in the convergence of three major themes that emerged in all five portraits: supports, barriers, and harmony.

Using portraiture, I wove a tapestry of the lived experiences of each of the women in the study and their perceptions of barriers and needed supports. By using rich examples, I strove to help the reader develop a relationship with the participant and, through their own perceptions, make meaning of the participants' human experiences (Lawrence-Lightfoot & Davis, 1997). It is my goal that the reader, whether it be a woman who is thinking of returning to school, an educator looking to increase persistence or enrollments of women in STEM, or a policy maker wondering how he or she can provide support, will find meaning they can relate to in their own life.

The richness of the data led me to identify the three overarching themes that capture sociocognitive features that contribute to their very different stories. These

themes are informed by features described in Figure 2, yet go beyond to encompass the superordinate factors that capture their development

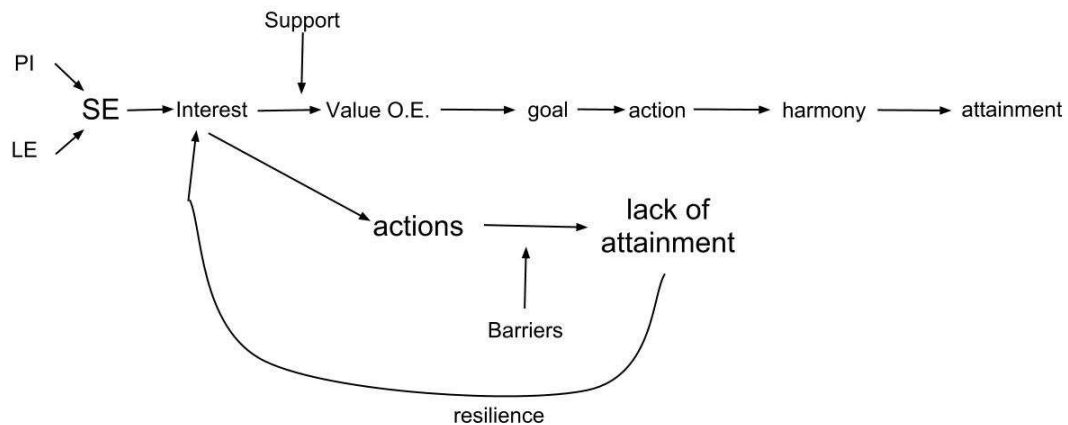


Figure 8. Proposed path to goal attainment. Personal inputs (PI). Self-efficacy (SE). Value outcome (VO). Learning experience (LE).

All the participants in my study had a high math and science self-efficacy and a high interest in these subjects independent of whether they had goals that were aligned with their personal values. In my model, instead of outcome expectations, I used values outcomes. The expected outcome grows from a personal value.

Self-efficacy and contextual factors informed their goals, which led to their actions immediately after high school for all the participants in my study. Self-efficacy also informed interest, but without any value outcome, they seemed not to know what to do with that interest and just went with the “flow.” They chose to pursue a STEM major and career simply because they were good at math and science and they knew someone, such as a father, who worked in a STEM-related field.

The first commonality I found was that not all the women coming to the college were there to complete a degree for the first time or even to complete an entire degree.

My other prior expectation was that the women would have struggled with mathematics growing up and, therefore, lacked an interest in the subject as well as a belief they could be successful. I expected that some life experience had enabled them to connect with mathematics and that through life experiences they gained a belief in their ability to succeed. All the women in this study had always been good in mathematics and science. Even when they struggled in all other aspects of their lives, they remained strong in mathematics and science. After high school, Alice and Luisa pursued computer science and engineering, respectively, while Rosa pursued acting, Angie declared business as her major and Jeanie pursued and completed a BS in Spanish.

## **Barriers**

**Personal problems.** Although a review of literature by Lent et al. (2002) found negative social or family influences and negative school or work experiences to be minimal barriers for traditional students in their studies, findings from my thematic analysis identified these as primary barriers perceived by all women in this study (Table 5). The perceived barriers left these women without direction and, in some cases, attending school or living in an environment in which they could not successfully function. Lent et al. suggest differences in perceived barriers may be due to methodological issues such as how the researcher defines barriers, context and temporal specifications.

Alice, Luisa, and Angie did not complete college the first time they attended, and each struggled with a family problem during their K-12 years. Alice had an abusive mother with whom she cut ties at the age of 13 and a father who was either afraid or just didn't know how to reach out his hand and save her as she was drowning. Luisa and

Angie both had alcoholic fathers and mothers who clearly cared and supported them but didn't have the background or skills to provide the guidance and direction each needed. In addition, all the women, except Rosa and Jeanie, had some type of academic failure that was a result of family problems. Each of the women described how she perceived her family problem ultimately affected her academics.

Table 5

*Barriers*

Barrier	Cause	Example
Personal problems	Alcoholic parent, abusive parent, health	"Coming home with my report card. It had three 100s, two 99s and a 98 and a 97, and she beat me and said, 'What happened to the other points?' And I said, 'If she is going to do that, I am going to give her a reason to,' and I stopped doing homework. I just stopped" (Alice, Interview 1).
Money	Loss of financial aid, loss of job, not enough money to pay tuition	"I wanted to take biochemistry, but they didn't offer any type of financial aid. . . . Financially this can't happen. . . . We are strapped right now" (Jeanie, Interview 3).
Work-life balance	Working extremely long hours, balance between work, family, and friends	"I was literally working, like, 80 hours a week, getting phone calls on my day off" (Rosa, Interview 1).

For example, the strain of living with an abusive mother and expectations she simply could never live up to resulted in Alice not going to school, not caring, and finding herself in a peer group that did not value education. She simply stopped attending high school. Throughout this time, Alice explained that, although she was failing everything else, she continued to be a strong math student. It was this realization, an inner resiliency, that resulted in Alice getting back on track and attending community college her senior year of high school. Alice chose to pursue a STEM major after high

school but failed most of her classes and ended up dropping out. She ultimately had to attend summer school to earn her high school diploma. Alice repeatedly stated that she wished somebody had reached out to her and provided her with the support and guidance she so badly needed.

Another example is Angie, who described the strain of living with an abusive father and what she perceived as a hostile school environment in which she felt she never quite fit. Like Alice, this experience resulted in her not going to school, not caring, and being academically poor. Also like Alice, she explained that she continued to do well in math and had the inner resilience to overcome the personal and academic barriers to complete high school and go on to college. The relationship with her father and peers resulted in her wanting to get as far away as possible and choosing to attend school in a developing country. She also expressed the desire that somebody had reached out and rescued her.

The strain of going from a Montessori school to a prep school on the “rich” side of town resulted in Rosa feeling unprepared for the academics and isolated in what she perceived as a hostile classroom environment. She began failing classes. Once her parents understood she was in a negative environment, they moved her to a school environment that she could and did thrive in. For Rosa, it was the support of her parents that ultimately enabled her to regain her self-efficacy. In a new environment, Rosa was no longer plagued by physiological issues and was able to achieve academically. For example, Rosa described the lack of support she received as she struggled in junior high school:

There was nobody to go to. There was no, like, the teacher wasn't helping me. My mother was angry with me; the director of the middle school couldn't give a

rat's ass if I was there or not, so it was like, where do I go? So it just became, I don't remember how, I got it to a C. I just remember studying and crying and studying. That is what I did for 3 years. Study, tumble, and cry. (Interview 2)

Luisa didn't face academic issues until college. She was successful in high school and her first year at the community college. It was during her sophomore year, when she transferred to a 4-year college, that she felt academically unprepared, isolated from her peers, and unable to find meaning in her choice of major. Ultimately, her academic failure led to her dropping out of college. While she reached out to her advisor, instructor, and peers, she was unable to find the support she needed in any of these relationships.

Jeanie faced academic issues because of health problems. These health problems resulted in her taking longer to complete her college studies, but she did ultimately complete them. However, she was unable to enter medical school after college as she had initially planned.

**Money.** All of the participants at some point interrupted their academic studies because of a lack of money. The college Rosa was attending withdrew funding of her scholarship during her senior year. She was forced to drop out of college because her family didn't have enough money to pay full tuition. Luisa used up all of her financial aid and was trying to figure out where she would get the money to finish after buying a new home: I have decided with this house purchase and maxing out the APT grant I am not enrolling in the March class" (Journal 2).

Alice's studies were interrupted because of a mix-up with her mailing address. Because she didn't receive a notice about her student loan, she was unable to secure another one when she attempted to return to school. Her initial plans to go right on for her master's degree had been interrupted because of the amount of student loans she was carrying. She and her husband felt they could not afford to take on any more debt: "I got



a new master promissory note, and they sent it to my old address, and I didn't return it, so they canceled my loan and sent it to collections. I couldn't afford to pay the whole thing off, so I could go back to school" (Alice, Interview 1).

During the time of data collection Rosa was unemployed, so she could not take any courses. She was paying full tuition, and because there was not enough time to apply and receive aid, she could not afford to attend.

**Work-life balance.** All the women indicated an issue of trying to balance work and their lives. None of them had one consistent job but found themselves in and out of work, frequently working long hours just trying to make ends meet. For example,

I am not happy in my current job. . . . I want to be there for my family. . . . My job . . . is that familiar safe area which I am terrified to leave, . . . except it isn't really. . . . I am currently applying for new jobs. . . so I can continue to be employed . . . when my job ends. (Alice, Journal 3)

Other than pay for it, we don't get any support from the military. Otherwise, I still work 12-hour days. I still work on weekends; not many people are taking college courses. (Angie, Interview 1)

Luisa described what it was like to balance becoming a newly single mother with a promotion at work:

It was crazy and chaotic and it was a terrible experience. It was terrible. Then he [her husband] got activated with 9/11, and I was a single parent, and it was horrendous. I mean, luckily everybody was in school; I can't imagine trying to do it with daycare. . . . I chose parenting first during peak week. . . . [A]fter that, they decided already I wasn't going to be invited back for another contract. (Interview 3)

Rosa describes what she was balancing in her life:

I wanted a career with more financial opportunities. I am 41 years old . . . let me be financially stable . . . back and forth wine/gymnastics jobs. There were times where I was in the gym wondering if in 10 years I'd still have the mental desire or physical strength to keep this up. There were times in the restaurants, wine shops and wholesale jobs where I realized that my passion for food and wine put me in a position to never be home for dinner to share these things with my husband. . . . I

was positive that I had reached the apex of what I could do in the industry. There was nowhere to go. (Rosa, Journal 1)

## **Supports**

During their pre-college and college years, all the women except Jeanie perceived having little support or guidance. A lack of someone being there to guide them or support them echoed throughout the stories of each of the participants. I heard from these women such an incredible disappointment in the adults around them. They were screaming out for help as they were drowning, but nobody heard them. The people who were supposed to be their lifeguards—teachers, guidance counselors, and parents—either didn't hear their cries for help or didn't care enough to respond. Each of the women in my study described a situation in which she lacked relationships that provided the needed support and encouragement.

Yet, findings from my thematic analysis indicated that although they perceived having little to no support systems, as their stories unfolded, it became clear that there were people who reached out to them and provided a meaningful level of support. They were just unable to recognize it at the time. Each woman shared a story of a teacher or someone outside of her immediate family who reached out to her in some way. Each of the women persisted in math and science throughout their K-12 years.

As nontraditional students, they found the support that had been missing from their lives through new relationships that included spouses, peers at work, and their teachers and mentors at the college (see Table 6). Each of the women shared a story in which, as a nontraditional student, she sought out or received support from someone other than family. All the women in my study described the college mentors as a

significant source of support and a mix of instructors who were incredibly supportive and helped them, providing support even after they had finished their course.

Table 6

*Supports*

Source	Type	Example
Family	Words of encouragement, financial help	“So my mom didn’t know much about it [college]. but she was always very encouraging which I am really thankful for” (Angie, Interview 2).
Advisor/mentor	Guidance, help with academic issues, words of encouragement	,
Teacher	Understanding of adult needs, presence in online course, clear expectations and feedback	“Wow, those hours are horrendous. You deserve applause for keeping up with your schoolwork so well” (Instructor e-mail, 9/19/11).
Peer	Student network, helping hand when needed	“Having Shelly—who is not only a fellow student, but is on the same path in terms of major and career—has been extremely helpful. Nobody can truly understand what you are going through unless they are going through it or have gone through it. The fact that she and I can call each other and complain or cry or scream or do whatever we need to do when we are stressed is a huge plus” (Alice, Journal 2).

**Family relationships.** Prior research has indicated the educational background of parents may influence success in college. Both of Rosa’s parents were college educated, Alice’s mother was college educated, and Jeanie’s father was college educated. Neither Angie nor Luisa had college-educated parents. It may be that college-educated parents have a higher SES, which leads to better learning experiences, and are better able to model and support their children’s education. It was clear Rosa’s parents placed a high priority on the type of education she received. During her K-5 years, they sent her to a

Montessori school and then, in middle school, moved her to a prep school in hopes she would receive a better education. Jeanie recollected numerous times that her parents supported her school work. Alice's father was extremely active in the school board, working to ensure Alice's school provided the best possible learning experiences. Alice also participated in numerous camps during her summer vacation to provide her with vicarious experiences.

Byars-Winston and Fouad (2008) found that contextual variables such as parental involvement directly predicted math and science self-efficacy and outcome expectations. Results of this study indicate there is a direct path between parental support and attainment.

Results of this study support the influence of parental involvement on self-efficacy through its influence on choice goals. None of the women in the study indicated that their parents expected them to study STEM or even encouraged them to do so, except Jeanie. She is the only participant who actively pursued medicine and was in some way involved with the medical field. For Rosa, Alice, and Jeanie, their fathers had an indirect influence by way of being a role model. Each of the women pursued college directly after high school, and all indicated it was an expectation of at least one of their parents. Bandura's (1997) social cognitive theory indicates that, when others believe in one's ability to be successful at a given task, it increases one's own self-efficacy belief. Although only Jeanie completed her 4-year degree on the first attempt, each participant held onto the belief that she would one day return to college and complete her education.

Luisa, Alice, and Angie had a supportive relationship with one parent and a destructive relationship with the other. All of their parents were divorced. None of these

women completed more than the sophomore year of college the first time. Jeanie and Rosa had supportive relationships with both of their parents.

Jeanie was the only participant who grew up in a two-parent family with a strong relationship with both parents. Rosa's parents were divorced, but she maintained a strong relationship with both of them and would have finished college if not for the loss of her scholarship in her final year. Luisa, Angie, and Alice all had one parent from whom they were estranged: Alice and Angie because of abusive relationships and Luisa because of alcoholism. None of these three participants attended college beyond her first year during the first attempt.

In her second journal, when asked about what support she needed to persist, Rosa responded:

I like my coursework. That is why I persist. My support system includes my husband (who is AWESOME!) and my mom, dad and step mom. Not necessarily in relation to school per se, but in relation to feeling overwhelmed. I'm lucky in that I was born with two, the third my dad smartly dragged into my life and the most important one found me! (Journal 2)

The stories of Rosa and Jeanie reinforced the importance of family relationships in their lives. Although Rosa's parents were divorced, she maintained a strong, positive relationship with both parents. Jeanie was the only participant in the study who grew up with both parents. Previous studies have indicated that a strong family system leads to success in college. Rosa almost certainly would have been successful in college the first time if she hadn't lost her scholarship. Despite numerous health issues, Jeanie completed her BS degree on the first attempt.

She explained that with her husband's (then boyfriend) support, she was able to continue working toward medical school by taking courses and reattempting to take the MCATs. Her parents provided financial support during her college years. Throughout

her life, Jeanie had a strong support system from her mother and father and boyfriend, who is now her husband: “My dad paid for my undergraduate, my mom sent care packages all the time . . . my dad wanted to pay more . . . if they had the funds they would still support me as far as school is concerned” (Jeanie, Journal 3).

Alice described the support she was receiving from family at the time of this study as primarily words of encouragement and occasionally math help from her brother in-law. Angie and Jeanie see their husbands as their primary sources of support while Luisa maintained she was an island and did not need anyone. However, she frequently mentions her sister and parents when talking of family support: “My parents were very supportive. I would always read my grades to them so we could enjoy the journey together” (Luisa, Journal 2). In addition, Luisa described her sister: “I think she is my cheerleader” (Interview 3).

**Mentor.** When reflecting on the support Angie received from her mentor, she shared a story about the difficulty she had in finding a physics instructor after the only one employed by the college passed away. She described the level of effort her mentor made to find her someone. Alice explained that her mentor helped to guide her when selecting the needed courses, guidance she had never had previously.

Thankfully, I was able to rely on my mentor to work with a lot of people from the school to fix the situation. Things worked out and the school was able to find someone to work with me, so I was able to continue my studies. (Angie, Journal 2)

Rosa credits her mentor with providing the needed words of encouragement to overcome her initial nervousness when returning to school. “Beyond that . . . Dr. V is amazing. She has total faith in me and believes in my work” (Journal 2).

**Teacher.** During their K-12 years, each of the women mentioned a teacher that in some way reached out to them or provided support. For Angie, it was her band teacher

and an “eccentric” teacher who taught in Africa and left a lasting impression on her. For Alice it was a teacher who reached out and helped her get her ADD diagnosed and a mathematics teacher who made math fun:

I did have this one teacher. . . . She was my chemistry teacher but she had lived in Africa. She used to be in the Peace Corps, and she was like so eccentric but so cool . . . because she just seemed so cool, probably like the coolest teacher I ever had. She had a doctorate . . . and she taught chemistry in French to people living in these poor regions of Africa and I wanted to do that because I thought she was the coolest person ever. And honestly, that is kind of the route I am heading in now because I want to join the Peace Corps, and I want to do it with my physics degree, and I want it to be in Africa. So, I never realized it, but I think I am trying to do everything she did because I thought she was so cool. And yeah, she is, everything she did, she is just so cool. I felt so bad for her; people made fun of her all the time. I wish they would have appreciated how cool she was. (Angie, Interview 2)

I had my physics teacher in 10th grade, . . . the only teacher who ever tried. . . . I told her she was the only one who ever asked any questions. . . . [M]y 6th grade math teacher, I wanted to be him. He made it fun. (Alice, Interview 1)

Each of the women had a story as a nontraditional student in which she was struggling with either a personal or academic issue and the support of an instructor helped her overcome this barrier. “Each has told me that I could have extensions on all my work and to take all the time I needed to be with my father” (Alice, Journal 3). “Thank you so much for the extension. I appreciate it” (Rosa, Module 2 homework comment to her instructor).

**Peer.** Alice cited her peers as her greatest support system. She looks to them for support when faced with a difficult class or personal issues. Luisa credited the support she received from other families as making it possible to balance school and her family.

Angie received support and encouragement from a peer at work:

There is a woman in my office. . . . [E]verything about her is good. . . . I want to be like her. . . . [T]here have been times I have been discouraged. . . . [S]he has kind of stepped in . . . and helped me out. . . . I would love to be that kind of figure for other people. (Angie, Interview 3)

When asked about her support system in her second journal, Luisa said,

My support came from anybody who knew me and what I was going through - abrupt single parenthood and no money. The girl's softball coach was affiliated with CSE, other alumni graduates I met along the kid's activities, other adult learners working on their master's. (Journal 2)

What struck me about all posts that I read—something I had experienced as an online instructor—was the intimacy and connectedness that develops in an online course. I could hear caring, frustrations, words of encouragement and occasional anger. Each of the women in my study provided support to their classmates in the discussion area and reached out for help when needed.

I heard mixed feelings as to whether online learning left them feeling isolated. Alice didn't see online learning as isolated although the mathematics group was small. She felt that, because they tended to take classes together, they got to know one another and form a close supportive bond. Luisa, who was studying operating systems and taking a math course, found herself feeling isolated and alone. Because of the small number of students in Angie's concentration, she found herself alone and did mention she missed the interactions in a face-to-face class. She was quick to add that face-to-face courses would not be a possibility and that she wouldn't be able to complete her studies if not for online courses. Neither Rosa nor Jeanie mentioned feeling a connection to other students or being part of any type of support network.

If I could add any, it might be fellow students are experiencing the same course I am. But in this e-world that doesn't really exist. I have had the pleasure of doing group projects, but even then we are focused on getting a job done but there is really no camaraderie" (Rosa, journal 2).



**Summary of supports and barriers.** The women in my study mentioned barriers more than any other theme and still held strong feelings of regret related to their circumstances and the choices they made, and—for Rosa, Angie, Alice, and Luisa—the lack of anyone there to rescue them.

The resulting academic issues permeated the stories of the women in my study throughout their pre-college, college, and nontraditional college years. What was noticeable was their ability to overcome these issues and persist as nontraditional students in a way they couldn't during their pre-college and college years. It seems the difference was the development of supportive relationships.

During their post college years, the women shared stories of support that in some way led to choosing and persisting in STEM. The importance of relationships as a source of persistence came through in each of the women's stories. What they lacked in their pre-college years they found as nontraditional learners. These supports have been critical to their ability to persist and overcome barriers that inhibited them during their pre-college years. Each of the women described the support they received from mentors and instructors as what makes it possible to succeed.

All of the students mentioned the critical role their mentor played in the academic choices they made and their ability to persist. Luisa, Rosa, and Alice all recalled a situation in which they had an issue with an instructor and turned to their mentor for assistance. Analysis of the data suggests traditional colleges may want to look at the role advisors play and think about how they can reshape this role into being more of a mentor. This relationship may better provide the guidance and support female students need in order to persist.

## Harmony

Traditionally, a discord has been associated with women in STEM areas. The cultural stereotypes associated with STEM conjure images of a “leaky pipeline,” a “chilly environment,” isolation, hard sciences, nerdy, geeky, and men. Many studies have addressed why women are absent from these fields and why they don’t persist. Studies have examined the effect of early outreach efforts, special programs that take place over summer vacation to inspire interest or at the college level to increase persistence, the effect of role models, and whether women just don’t have a math brain. Many opinions have been expressed about the need for more STEM majors so our country will stay competitive and, more specifically, the need for more women in STEM fields. This topic is receiving a good bit of attention within the political arena, at the state and federal levels and even in the literature.

Girls’ spirits, values, interests, beliefs, and goals are first born at home. Parents are the first ones to have an influence on these attributes. They are the first who can break a girl’s spirit or not provide the right environment for her values, interests, beliefs, and goals to blossom. Then, girls go off to school, the second place where values are developed. They have the opportunity to “rebuild” a broken spirit and create an environment that would nurture and feed the spirit and allow her values, interests, beliefs, and goals to grow. Previous studies have examined the factors that lead women to choosing STEM fields and why some girls persist while others don’t. However, thematic analyses in this study identify support systems and, more specifically, relevant supports and a strong mathematical background and ability as critical elements that contributed to college completion (Table 7).

Table 7

*Harmony*

Element	Cause	Example
Environment	Exposure to STEM experiences as adults that led them to find meaning	“I met a coworker who was a Physician Assistant. I had never heard of PA’s” (Jeanie, Journal 1).
Academics	Lasting effect of childhood academic experiences into adulthood	“I really missed being a student. . . . The most exciting time is the very beginning of the term. . . . I used to really love the first week of school, . . . and that definitely hasn't changed. I was a little nervous when I thought back to how tired I always was. . . . I was always behind on my work . . . that concern was definitely overshadowed by the feeling that I'd be a student again” (Angie, Journal 1).
Passion	Love of mathematics and science	And it was just that I loved it. I understood it. It clicked for me” (Alice, Interview 1).
Meaning	A career that was aligned with their values	“I already have great potential as a translator, but it is not fulfilling. It is not as fulfilling as practicing medicine” (Jeanie, Interview 1).

The women in my study told story after story about their strong mathematical and science abilities during their K-12 years and their passion for the subjects. All the women but Jeanie voiced feelings of just going with the flow, following a natural progression, and taking classes because that was what was on their schedule. There was no meaning for them.

Each of the women, except Jeanie, voiced regret that there was nobody there for them. There was nobody to guide them or save them from themselves. Their memories of always being good in mathematics and science immediately emerged when I asked about their beliefs they were capable of successfully pursuing a STEM major and career.

Stories of academic achievement were immediately followed with stories of regret and disappointment that they didn't have the support they needed to fulfill their dreams.

How did these women who were full of talent and a burning empty void within them find harmony? How did the themes of their lives converge to form an aesthetic whole? Each of the women made multiple references to her mathematical and science skills during her K-12 years, her passion for the subjects, and the personal struggles she faced. These constituted a “driving current that flows through each life journey” (Lawrence-Lightfoot & Davis, 1997, p. 197). In all but Jeanie's stories, I heard repeatedly about the lack of guidance and support they received. Ability, passion, and struggle were the “life litanies” of the women in my study (p. 197).

Lawrence-Lightfoot (2003) referred to the traumas that parents experienced as children resurfacing during parent teacher conferences as “ghosts in the classroom” and “ancient echoes” (p. 218). A ghost has evil connotations, whereas a spirit connotes goodness, a guiding light, encouragement, and disposition. For each of these women their mathematical and science achievements were with them in spirit throughout their lives. Unfulfilled dreams were the ghosts that haunted them. Throughout their K-12 years, there was a missing piece.

**Strong Mathematics Background.** SCCT (Lent et al., 1994) posits that occupationally relevant self-efficacy will relate positively to choice goals and actions. Each of the women had stories related to successful achievements in mathematics and science and each had a STEM-related goal when planning for college. Jeanie was the only one who saw any value or meaning in her STEM goal. Angie, Luisa, Rosa, and Alice had an interest but hadn't yet found meaning. They had a destination that was void

of any values to them. Jeanie had the interest; she knew from a young age that she wanted to study medicine and that having a work-life balance and helping others were important values to her. It wasn't until adulthood when she had an experience that resulted in all these things converging for her.

Jeanie held on to her dream of one day attending medical school and continued to take medical-related course work while applying to medical schools. "I still want to keep going for this. I still have a knack for this type of job" (Interview 1). This can also be heard in her first journal entry: "I felt like I had so much potential that I couldn't let it go to waste. I just had this strong sense that I wanted to be 'more' than my job history allowed. I could find no other way to describe it than that - just wanting to be more than I was" (Journal 1).

All the women were nontraditional students who had returned to the university to study STEM fields. Rosa was pursuing a life science degree so she could go on to become a pharmaceutical researcher, a job she saw as enabling her to be able to support her family, have a work-life balance, and "do important work." Jeanie was taking a class so she could go on to physician's assistant school (to which she was accepted and began just after data collection was completed) and fulfill a lifelong dream of working in the health-care field. Jeanie saw this occupation as enabling her to have a work-life balance and help others. Angie was pursuing a physics degree and fulfilling her dream of completing her BS. She planned to go on to earn her PhD and would like to teach. Alice was majoring in mathematics and would like to teach. Both Alice and Angie saw teaching as a way to provide to others the guidance and support they were missing. Alice also saw teaching as enabling her to have a work-life balance. SCCT (Lent et al., 1994)

hypothesizes that outcome expectations affect choice goals and actions both directly and indirectly. Lent et al. described outcome expectations as being able to answer the question, “If I do this what will happen?” As nontraditional students, outcome expectations that had a value to them led to persistence in attaining their goals. The answer to that question needed to be more than earn money or have a career.

The theory posited that people will attempt to enter occupations or academic fields that are consistent with their choice goals, provided that they are committed to their goal and their goal is stated in clear terms (Lent et al., 1994). After high school, they attempted to enter college whether they were committed or not. I found that value outcome led to commitment and persistence.

After high school graduation, Jeanie went to college pre-med and worked in a hospital as a translator. She chose to work full-time as a translator at the local hospital she worked at during college. Each job she chose was in some way related to medicine. Analysis of the data provided evidence of numerous times when Jeanie expressed commitment to her goals:

So when I hit that 8 year mark, medical school or not, we were married. . . . [M]y goal of practicing medicine became the back burner, FOR ONCE. I said to myself that practicing medicine wasn't something that I “can't do,” rather it was something that I “can't do right now.” So I went on and set up a nice little life with my husband (still retaining my plans of having children after I get my medical degree). (Journal 1)

Angie had a clear vision of what she hoped for the future. “I wish women would stand up for themselves. They believe they are not allowed. They can get an education. Going over to the Middle East, putting up an institute, I think about it” (Interview 1). When thinking about her image of who she would be after graduation, Angie said,

“Eventually I would like to be a professor at a university; that would be fun. We [she and her husband] will be the fun teachers. So some work for the Peace Corps” (Interview 3).

All of the women expressed a passion for math and science. I repeatedly heard them say, “I love math.” Lent et al. (1994) hypothesized that people will aspire to enter occupations or academic fields that are consistent with their primary interest.

Throughout her interviews, in her journals, in her collage and in her timeline Angie talks of her belief in her mathematics and science abilities and describes the reason she chose Physics as it was a way for her to combine her love of mathematics and science. Analysis of the data supports Jeanie’s lifelong interest in a career in the medical field.

When Rosa first enrolled at the college, she was thinking about physical therapy for sports medicine, but after a few classes, she found that was not what she wanted. She went back and forth, knowing only that she wanted to do something scientific. “I just think science is cool. I am doing it because I want to” (Interview 3).

The theory posits that self-efficacy beliefs regarding particular career or academic activities (Lent et al., 1994) will be positively related to the perceived amount of four sources of self-efficacy. Direct personal experience will account for more variance in self-efficacy beliefs than vicarious experience. Successes achieved under challenging conditions will be more strongly related to self-efficacy. I heard from the women the lasting effect of getting good grades even when not trying had on their self-efficacy.

“Even with not trying I still managed to get phenomenal grades in math” (Alice, Interview 1).

“I missed 50% of last year of high school. . . . I was able to keep up fine in math and science. . . . I still got 80s and 90s. I got a 31 on ACT and SAT . . . 2100” (Angie, Interview 1).

**Relevant Supports.** The theory posits that outcome expectations are generated through direct and vicarious experiences with educationally and occupationally relevant activities (Lent et al., 1994). I heard the effect the direct personal experiences the women in my study had with teachers, parents, mentors, and peers had on them. Alice and Angie still talked of the lasting effect a teacher had had on them, yet it was the personal experience they had as adults that ultimately led them to where they were at the time of this study. Alice worked in a job that led to her teaching classes; Jeanie worked in hospitals. Luisa worked in jobs that involved computers.

These experiences were limited for Angie and left her with no real outcome expectations with respect to choice of major or future career aspirations after high school. “It was like all over the place and then I was like maybe I will just be a math teacher, so many things I would like to do” (Interview 2). She had come full circle and returned to school to study physics and eventually be a mathematics teacher. As a nontraditional student, her own experience drives her outcome expectations.

Jeanie had numerous experiences that informed her value outcomes. These included her own experiences with doctors because of both her and her sister’s illnesses, as well as her work in the medical field during and after college. “I already have great potential as a translator, but it is not fulfilling. It is not as fulfilling as practicing medicine” (Interview 1).

Rosa talked of working in her future career:



I am under the impression that there is a lot of alone time. I don't mind that at all. It is just a new experience, I think. I am guessing it will be much less social than now. I won't have customers. . . . [S]he (her friend) says it can be boring and lonely, but validating. (Interview 3)

I could hear in her voice how important the meaning in her work was to her perseverance. In her collage, Rosa included two pictures with keys. One was a picture of a key lying on top of the word *success*, and the other a key lying on top of a puzzle.

I found the importance of value to be a missing piece in SCCT. For the women to feel committed to their goals, they needed to be in harmony with their personal values. When they asked the question "If I do this, what will happen?" the answer needed to be "I will have work-life balance, be able to support my family, and help others." For example, Angie could hardly contain her excitement when thinking about becoming a teacher:

I want to learn it well. I really look forward to it. I have these pictures. I will go to the lab and prepare lessons and perhaps plan field trips. I will be the eccentric teacher everybody will love . . . awesome trips to physics related places across the globe. Summer break trips or something cool. (Interview 3)

Analysis of the data indicated each participant's interest in helping others. This desire permeated the stories shared in e-mails, interviews, and journals, as well as in course discussion posts. Jeanie recalled,

I just always wanted to do something. I always helped my mother and sister. . . . I was always helping somebody. It didn't have to be somebody I knew, . . . helping the lady bring in packages, . . . the desire to just truly help started that. (Interview 2)

Jeanie, Angie and Rosa describe their future career,

the person in the white coat when you go to the doctor. A typical day will be a nice stack of charts for sick or medicine or reviews primary care stuff. I see a lot of fulfillment in that it is very fulfilling thinking I can help these people in a way I haven't been able to before and to finally be able to be that person. It is just very satisfying. I am more elated now than before. . . . [T]o make someone happy makes me happy. (Jeanie, Interview 3)

So, it took me really until an adult to be like a woman is whoever she is. Just having friends who spanned different careers, some being moms, some not, some getting married, some not, gay, straight, transgender; it's like I think my peers taught me more than my elders did because I was afraid to form an opinion. (Rosa, Interview 1)

I really like being in school, so that may just never stop. I may just wind up some crazy PhD in like I don't know why the sky is blue. I just really enjoyed the whole process of being back in school; that would be fun for me, if I could be a scholar for the rest of my life . . . Right now I am just working on getting a class in and making ends meet and keeping a roof over our head and all those good things. (Angie, Interview 3)

I think I will be doing it like now for the money but unlike what I do now it is important work" (Rosa, interview 3).

**Harmony summary.** All the women in my study were always good in mathematics and science but, for various reasons, either dropped out or didn't pursue the path to a STEM degree. Now as adults, they were returning but with a new perspective. It was not just about the career or money, although both are important, but about a life-work balance and wanting to make a difference. An interesting outcome is the careers these women are returning to pursue. That they are not returning to pursue "typical" STEM careers is in itself enlightening. As young adults, they were unaware of such careers as a physician's assistant or pharmaceutical research. As adults, they were able to look back and see the world from a different perspective. Alice and Angie lived with regret for the academic choices and paths they followed and wanted to prevent other women from taking that same path. They were pursuing teaching as a way to provide that safety net and be the role model they didn't have. Because my study was about the women returning to study STEM studies, their goals for what they wanted to do after completing a degree was not a selection criteria but rather an outcome I discovered.

I reflected upon my own journey from working as a mechanical engineer to teaching at the college level and pursuing my PhD. I remembered having similar experiences in high school in which mathematics and science always came easy to me and just being placed in the advanced-level classes with no real direction. Unlike the women in this study, I do recall receiving guidance, support, and words of encouragement from teachers, family, and my guidance counselor. Ultimately, for me, it was my brother who had the greatest influence on my path to college and beyond. It was he who suggested I major in engineering and guided me through the college application process. I followed him in earning an MBA. It was my brother who provided the encouragement and support I needed to believe I could successfully pursue and earn a PhD.

While I left the STEM world in search of a better work-life balance, the women in this study were returning to school to pursue those fields in search of a better-work life balance. After giving birth to my son, I returned to engineering for a year, balancing being a part-time employee, part-time student (working toward my MBA), a part-time wife, and a part-time mother. At the time, my place of employment allowed for only one year of part-time work. I chose to take a leave of absence and complete my MBA as a full-time student. Three children later, a chance meeting resulted in my teaching for the college. I found it interesting that, for Jeanie and Rosa, it too was a chance encounter that ultimately set them on their current paths. The combination of the engineering degree and the MBA got me that job. I had sufficient self-efficacy to be willing to try the unplanned and unexpected opportunity, and Jeanie and Rosa were open to such chances

as well. Years later, I found myself divorced and thankful I had the educational background that enabled me to have my job.

For each of the women, all the pieces are finally in harmony. The goals they are heading for are in alignment with their values. They did not take the traditional path, but they are right where they want to be. I remember those same words when asked, if I wasn't doing what I am doing, now what would I do. My response was "There is nothing else I would rather be doing than what I am doing right now. This is where I am supposed to be."

## Chapter 6:

### What Does This Research Mean for Nontraditional Education?

SCCT (Lent et al., 1994) posits that self-efficacy and outcome expectations jointly give rise to interest. The interest then informs choice goals (aspirations, plans, and intentions), such as declaring a major. This action then leads to success or failure at attaining the goal and feeds back to self-efficacy. Contextual factors are hypothesized as directly affecting goals and actions.

The question driving this study was why some women choose to study STEM and hold a belief they can be successful when others don't. I found myself wondering what it was within some women that, no matter what obstacle they faced, they were able to persevere. What experiences did they have in their lives that gave them that inner strength and drive? After a review of the literature, I found SCCT (Lent et al., 1994) to be a useful theory to guide my data collection and analysis. This theory helped me to create a data-collection plan that would enable me to collect the pertinent data to answer my research questions, guide my initial coding of the data, and think about how all the pieces fit together. It helped me to think about how the lived experiences and contextual factors of the five women in my study influenced their self-efficacy, interests, goals, and expected outcomes in their pursuit of their STEM majors and careers.

#### A Lasting Imprint

All the participants in my study had a high math and science self-efficacy and a high interest in these subjects, independent of whether they had high outcome expectations. In high school, only Jeanie had a meaningful answer to the question "If I

do this, what will happen?” (Lent et al., 1994). The others spoke of a natural progression, indicating that the academic choices they made just seemed the thing to do.

Each of the women had stories of multiple mastery experiences in mathematics and sciences that led to high self-efficacy and interest in mathematics and science. These mastery experiences caused Luisa and Alice to have an interest in these subjects, but without the supports to provide vicarious experiences and verbal persuasion, they didn't develop clear choice goals. Each indicated the actions she took related to academic choices were more a natural progression rather than a choice she made based on clearly defined goals. The study conducted by Ozyurek (2005) found that a high mathematics self-efficacy and high mathematics interest do not predict a preference for a STEM major. SCCT (Lent et al., 1994) predicts a direct path from self-efficacy to interest and interest to choice. It also explains how contextual factors may inform the path from self-efficacy to interest to choice as seen in Figure 2.

Bandura (1995) suggested vicarious learning experiences have the second greatest influence on self-efficacy. When asked about role models, none of the women in my study immediately thought of anyone. When discussing the pre-college years and the role of their families, four of the women in some way identified their passion for learning and pursuit of mathematics and science with their parents.

Self-efficacy, interest, and contextual factors informed their goals, which led to their actions immediately after high school. However, they lacked any value outcome. Alice was always good in math and science, and her dad was technical. She chose to major in computers. Luisa was always good in math and science, and her dad was a non-degreed engineer; she chose engineering. Rosa was always good in math and science,

and her dad was a dentist. She applied to MIT as an engineering major. Jeanie was always good in math and science and pursued medical school. None of these women had any career-specific intentions, plans, or aspirations that held value to them except Jeanie.

The path between actions and attainment is where barriers come into play. All the women faced academic issues that prevented them from attaining their goals. Rosa was wait-listed at MIT, Jeanie didn't have good enough MCAT scores and had health issues that affected her grades, and Luisa and Alice had poor grades. Angie had a high math and science self-efficacy and a goal of being a teacher in high school, but in her case, the negative contextual factors resulted in her goal changing to going to school as far away as possible. Doing so led to her action of choosing business purely because it was the only major available to her. She too did not reach her goal because of an academic barrier. These women didn't have the support system they needed to overcome the barriers

SCCT (Lent et al., 1994) indicates an indirect pathway from self-efficacy to choice through interest and outcome expectations. Previous research has supported the importance of personal accomplishment and vicarious experiences in predicting the choice to study STEM. I discovered that, for the women in my study, their belief in their ability to be successful was still driven by childhood accomplishments in STEM subjects. Analysis of the data showed that the choice to study or not to study STEM was driven by vicarious experiences in childhood and adulthood, but four of the women lacked the experiences needed to develop goals that had meaning to them the first time they went to college. Alice and Luisa chose to study STEM the first time they attended college largely because of their personal accomplishments in STEM and the influence of their fathers. It

was the only thing they knew, and they made the choice, not because they identified with STEM as a career, but because it just seemed to be the next logical thing to do.

The theory posits that, the more highly valued the outcome expectation, the more likely a person is to adopt the goal and action (Lent et al., 1994). The women in my study adopted their goals and actions independent of having a value outcome. I did see that, when they had a value outcome expectation, they were highly committed to their goal.

All the women in my study mentioned successful childhood mathematics and science experiences as a source of belief in their ability to be successful in a STEM major and career. What they were lacking was the guidance of a role model and STEM experiences that would have resulted in their development of meaningful STEM-related goals based on value outcomes. None of the women in my study remembered a mathematics or science teacher reaching out to them or suggesting they pursue STEM. However, memories of teachers who made mathematics and science fun and interesting did emerge. Angie and Alice recalled a mathematics teacher who always made class fun, and each mentioned a desire to emulate this teacher and the type of classroom environment that teacher created. Rosa recalled science class as being fun and vividly recalled several positive classroom experiences. Even as adults with years of lived experiences, it was these childhood memories that emerged to the surface when discussing their current choice to study in STEM fields.

None of the participants recalled a negative classroom environment or being treated any differently because of their gender. They also did not voice any concerns during their K-12 years about being considered “nerdy” and didn’t recall having any



negative, preconceived notions about what it would be like to work in a STEM career. Rather, a general lack of knowledge about what STEM careers were and a lack of STEM identity seemed to deter an earlier choice. Luisa and Alice recalled their choice to pursue STEM when they first entered college as just a natural choice. They had always been good in mathematics and science, so studying engineering and computers, respectively, seemed the next logical step. Angie, Luisa, Rosa, and Alice lacked the role models and experiences to open them up to the wide range of possibilities in the field that may have created meaningful goals and outcome expectations related to studying STEM.

All the participants in the study voiced a need to have a work-life balance as a priority. Thus, schools should look at educating women in terms of what companies are doing to enable women to have this balance. STEM companies should look at what they are doing to help women have this balance and what they need to do to “sell” a STEM career to women. Rosa had never thought about pharmaceutical research, and Jeanie never knew how well being a physician’s assistant fit with her values.

All the participants mentioned what they perceived as a lack of direction, advice, or guidance from their high school counseling offices. None of the participants remembered getting any advice from teachers or their counseling office as to what courses they should select or future career plans. They recalled doing well in mathematics and science and therefore being “automatically” placed in the advanced-level courses. Alice and Luisa were both advised to do their last year of high school at the local community college. However, both felt they were not academically or emotionally ready. They perceived this decision as the reason they were not successful in college the first time. Thus, schools should more carefully assess the process of selecting

and recommending students to attend college their senior year. Schools should also look at spending more time talking with students and getting to know them, their interests, goals, family life, supports available to them, and obstacles they may face. If the counselors are better informed they will be in a better position to guide students.

The role of GPA in first-year college persistence was supported in this study (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008; Montgomery, 2009; Wang & Pascarella, 2012). Both Luisa and Alice had failed attempts to enter college as high school seniors. Although they always had had good grades in high school, they felt unprepared for college and ended up dropping out. Rosa told of how a first term of bad grades “woke her up.” All the women in the study had had a high GPA since returning to school and had persisted. This finding supports the discussion of Usher and Pajares (2009) concerning the greater effect a *B* can have on an *A* student’s self-efficacy as oppose to that of a *C* student.

Luisa started out studying engineering but felt isolated, academically unprepared for the demanding engineering classes and unable to connect with peers or role models. Poor grades and doubts as to whether engineering was what she really wanted resulted in Luisa dropping out of college. Although Luisa did reach out to faculty and her peers, she was unable to find a role model or any feeling of connection. Studies have supported the benefits of STEM support groups in relation to persistence of female students. Had Luisa been able to speak with a woman who worked in STEM, as she had asked, or found a peer support group, she may have persisted. Thus, colleges should identify and provide support to students who do poorly early in their first semester. There should be some type of early warning system set up and support systems in place to address the specific

needs of female students. Luisa mentioned feeling alone, overwhelmed, and suffering from a loss of belief in her academic abilities. None of the participants mentioned any gender-related issues or a negative classroom environment.

### **The Tipping Point**

The women in my study were motivated to return to school for financial reasons and personal fulfillment. This finding supports prior research (Dey & Hill, 2007; Kramarae, 2001, 2003; Muller, 2008). The women in my study cited such barriers as money, poor instructors, and balancing the care of family members. Studies by Kramarae (2001, 2003) and Muller (2008) of nontraditional female online students cited the same barriers. A difference is that the women in my study were trying to balance the care of elderly parents and not small children as in Kramarae and Muller.

For each of the women, there was some contextual factor that resulted in their creating a new goal based on their value outcome. A contextual factor led to their new career choice goal, but it was their value outcome that directly informed their action. Alice received an e-mail about being a teacher when she was about to lose her job. If she majored in mathematics she could become a mathematics teacher and help students in a way she wasn't at the time. Rather than interest increasing the likelihood of a choice, I believe resilience is an important part of who these women are. Instances of actions and characteristics associated with resilience repeatedly emerged in the data. I looked for a theory to help me understand how resilience fits. As I reviewed literature, I came across the following quote by Ernest Hemingway: "The world breaks everyone and afterwards many are strong at the broken places" (quoted in Meichenbaum, 2006). As I read this

quote, I thought it was the perfect description of the resilience I saw in each of the participants in my study.

Whereas the theory takes into account supports and barriers, for these women, I believe overcoming the barriers is what gave them the resilience to persevere. That resilience was a significant part of what drove their beliefs in their ability to successfully return to the university to study STEM and pursue a career in this field. For Alice and Angie, family experiences negatively influenced their personal accomplishments. For Alice, an abusive relationship with her mother and, for Angie, with her father resulted in their just giving up and not caring about academics. However, even though they were not trying, they did well in mathematics and science, leading to strong beliefs in their academic abilities beyond their K-12 years. This finding indicates further studies are warranted on the connection between overcoming barriers, resilience, and the influence on self-efficacy.

According to Brafman (2011) and Meichenbaum (2006), those who are resilient

- Have the tools to overcome obstacles,
- Persevere and adapt to whatever situation they find themselves in,
- Are even tempered.

Meichenbaum (2006) described *resilience* as something that “turns victims into survivors and allows survivors to thrive” (p. 3). He described ways children can practice resilience (p. 4):

- Have a friend be a friend.
- Take charge of behavior.
- Set goals and have a plan to reach them.

- Look at the bright side.
- Have hope.
- Believe in yourself.
- Ask for help if you need it.

I saw instances of this behavior in all five of the participants. When observing the participants in their online classroom, each very clearly laid out her plans and actively participated in her future. I continuously heard optimism in each of the participants. As they recalled their stories, they were always able to find that “silver” lining and make that connection between the obstacle they faced and the inner strength it gave them. Each one had an unwavering belief in herself.

The following characteristics of resilient children were also found in the women in my study (Meichenbaum, 2006):

- Easy going
- High IQ, abstract thinking
- Easily getting along with others
- High self-efficacy
- Goal oriented
- Optimistic
- Academic success.

I heard instances of each of the above characteristics in all my participants’ stories. They each struggled socially when they were younger, but in my interactions with them and observations of them in their online classrooms, it was evident they easily got along with others. Angie reflected upon her resilience:

I was nervous my life would end. I was married off to an Islamic man. I did not think I would get out. I was pretty nervous. I held that hope. I don't know why I held that hope. I don't know, maybe it is that experience that makes me sure I can do what I want. . . . I did everything they told me and got to the point where they trusted me. . . . [W]hen my passport, was ready I caught a bus . . . and a taxi, . . . waited for my mom to get money for my plane ticket home; it was an adventure. (Interview 3)

Each participant described a never ending commitment to completing her education. They each stated it was never a matter of "if" but "when." They demonstrated they could adapt to whatever situation came their way and persevere. As nontraditional students returning to school, they each had clearly defined goals and a plan. They continued to demonstrate they had the tools to overcome whatever obstacle was placed in their way.

### **Coming Full Circle**

SCCT predicts that failure at attainment would have a negative effect on self-efficacy (Lent et al., 1994). This was not the case with all the women in my study. Their resilience kept them going until they found the path to harmony. They never lost the belief that they were capable of completing their college educations. It was never a matter of if, but when. Luisa spoke several times of her college failure at mathematics and that her choice not to major in mathematics when she returned to school was because she didn't know she would be successful at it. However, she chose to major in operating systems, an area of computer science.

Furthermore, they all had a strong need to have meaning in their lives and help others. Previous research has supported the idea that success in mathematics and science leads to an interest in those subjects and a belief in one's ability to be successful in those careers. For the women in my study, this connection was true, but the additional piece driving their interest was the need for meaning in what they were doing.

A contextual factor enabled them to answer the question “if I do this what, will happen?” (Lent et al., 1994). Their development of a value outcome led to a clearly defined goal to which they felt committed. Alice received an e-mail about being a teacher when she was about to lose her job. If she majored in mathematics, she could become a mathematics teacher and help students in a way she wasn’t at that time. Rather than interest increasing the likelihood of a choice action, such as declaring a major, what I observed was a value outcome increasing the likelihood of persistence.

As nontraditional female students returning to the university, the women’s independent mastery experiences of childhood were at the core of their beliefs they are capable of successfully pursuing STEM majors and careers. The responses of these women echo the findings of Zeldin (2000) with respect to men. In her study, men made comments similar to the women in this study concerning math and science coming easily to them. Also similar is that the women in this study spoke of their motivation coming from within and gave very little credit to any outside influences.

As adults, Jeanie and Rosa each had a vicarious experience that led them toward a STEM career to which they felt a strong connection. That is, they found a career that connected with their interest in STEM and their need for meaning and helping others. Analysis of the data supported the importance of childhood personal accomplishment in a nontraditional female student’s choice to study STEM. However, further research on this population using SCCT as the theoretical framework is needed. All the women in my study had a strong interest in STEM and a goal to find a career that would have meaning and allow them to have a work-life balance. Further research is needed on the role of wanting work-life balance and meaning in a woman’s choice to study STEM. Because

none of the women in my study had small children, further research is needed on populations of married and single women with small children.

All the women mentioned the critical roles their mentors played in the academic choices they made and their ability to persist. A mentor's role is different from that of a traditional advisor. A mentor sees his or her role as more than giving advice on selecting courses. A mentor works closely with the students, discussing personal and professional goals and learning about their personal lives, the support system they have, and the barriers they may face. A mentor guides the student through the process, taking all these factors into account. Mentors have an in-depth understanding of their mentees and what they need to be successful. Thus, traditional colleges may want to consider the role advisors play and think about how they can reshape this role into being more that of a mentor. This relationship may better provide the guidance and support female students need. Luisa, Rosa, and Alice all recalled a situation in which they had an issue with an instructor and turned to their mentor for assistance. This finding again supports the critical role of the mentor in their persistence.

Rosa mentioned the connection she made with her science instructor as being critical to her decision to pursue studies in the life sciences. Rosa and Jeanie mentioned that the online labs enabled them to make meaningful connections to the content. Jeanie and Alice recalled situations in which they faced personal obstacles during their courses and reached out to their instructors for support. Both recalled the understanding and support they received from their instructors as being critical in their ability to meet the needs of their family and complete their coursework. Thus, colleges need to be sensitive



to the unique needs of nontraditional students and provide professional development for instructors.

Alice and Luisa both recounted negative instructor experiences that almost resulted in their dropping out and positive instructor experiences that kept them persisting. Both mentioned difficulties with the mathematics software they were required to use and felt it was more of a barrier than the content. They each felt that the student feedback surveys were inadequate and that no one at the college read them or listened to their complaints. Analysis of the data suggests the critical role instructor support plays in student persistence and the importance of instructional design. Colleges should assess their student feedback surveys to ensure they are meaningful. They should follow up with students when a complaint has been lodged so that the student knows his or her voice is being heard.

None of the women in my study identified gender as a barrier in the classroom, although Luisa, Angie and Jeanie identified areas within their professional lives in which they felt gender was a barrier or in which the idea of women in STEM fields had a negative connotation. As in my study, Zeldin (2000) discovered men highlighted mastery experiences that were personal attributes, such as independent achievements as sources of self-efficacy, and viewed relationships as sources of career information. This finding differed from that of the study by Zeldin and Parjares (2000) that discovered vicarious experiences and verbal persuasion had the greatest effect on the self-efficacy of the women in their study.

In addition, Hughes (2010) conducted a study that compared women who persisted STEM during their college years with those who did not. She discovered that

the stayers saw gender as a biological, not cultural difference. The leavers struggled with gender stereotypes. She suggested that current feminist theories discussed in Harding (1997) and Lemke (2001) supported the idea that for women to be successful in STEM, they need to take on masculine gender behaviors. Although the women in my study stressed the need to find meaning and make a difference, they never considered this tendency as being a female trait. Parts of their personalities closely matched what normally might be associated as masculine, but they did not see themselves this way. Is there a biological difference between men and women who are successful in STEM and those who are not? Although it seems more common to hear women talk of STEM not being for them, there are men who are not successful in STEM. Further research is warranted in exploring what leads some women to see gender only as a biological, not cultural, difference. Further studies into whether there are biological similarities between men and women who choose or who don't choose to pursue STEM are also warranted.

Each of the women in my study cited online learning as what made it possible for her to return to school. Analysis of the data showed that the online learning environment was critical to their success. The women described online learning environments in which they found it difficult to be successful and cited mentors and instructors as critical to their ability to persist. Seventy-five percent of the women in the study by Furst-Bowe and Dillman (2002) chose distance learning for the convenience and flexibility that allowed them to juggle work, family, and educational responsibilities. All women in the Furst et al. study stated the quality and interaction of the teacher was the most important aspect to a good experience whether online or face-to-face.

In a study by Mohny and Anderson (1998), the need for security and to be able to support themselves were seen in women who were in an abusive relationship, single mothers or women whose husbands were ill. Angie, Alice, and Luisa cited these same reasons.

### **Give Me the Puzzle**

The odds were stacked against them yet the women in my study faced each barrier and came out stronger on the other side. No matter how dire their circumstances they managed to thrive and endure. Living in circumstances where the expectation seemed to be certain failure they demonstrated perseverance and resilience. Throughout their lives, when they were knocked down, they got back up to fight. Now they have returned, after unsuccessfully pursuing a STEM degree after high school, to finish what they started. The weaving of each portrait illuminates what it took for each of these women to overcome the barriers they faced and successfully pursue a nontraditional field a second time. By looking at stories of success each portrait focuses on the “pursuit of strength” (Lawrence-Lightfoot & Davis, 1997, p. 141).

To weave a full picture of the women, I explored their shortcomings, how they overcame them, and their histories. I placed each woman in my study in the larger context of the environment that shaped her by learning about her lived experiences during her childhood, both in her home and at school. Doing so enabled me to weave a portrait that illustrated how the realities they experienced were similar and different to the story demographic statistics and prior research.

Each of the women spoke of her desire to solve puzzles. They voiced their desire to be challenged and spoke of being bored when there was no problem to solve. What

they didn't realize was that they were solving the puzzles of their lives and trying to figure out how all the pieces fit together. They had some of the pieces: interest in mathematics and science, the ability to do well in these subjects, someone in their lives who worked in a STEM-related career. Further, they thought they knew what the picture of the puzzle looked like and how to put the pieces together. However, each of these women found herself in a situation in which the table on which she had been building her puzzle was knocked over, leaving the pieces scattered and the picture of how things were supposed to look distorted beyond recognition.

When putting a puzzle together, most people sort the puzzle pieces into two piles: the edges and the inside pieces. The next step is choosing what foundation to build the puzzle on. The frame guides how the inside pieces should fit. The frame is what shapes the puzzle and holds the pieces together, just like a support system holds the pieces of our lives together. The picture serves as an image of what the finished product should look like, just like a mentor or role model serves to provide an image of what things might look like in a certain career. It is this image that was missing for each of the women in my study.

The women had all the pieces of the puzzle. They just needed some guidance as to how to put them together. The time each of the women spent trying to figure out how the pieces of her puzzle fit ranged from a few short years to nearly 20 years, but each of them had a triggering event that motivated her to return to the puzzle. Each knew part of the finished product was education. Through chance meetings, Internet searches, and a friend of a friend, each of these women heard about the college. Along the way, each one had an experience that enabled her finally to see what the puzzle should look like at the

end. Although events threatened repeatedly to destroy their puzzles, this time they built those puzzles on a solid foundation of support and goals meaningful to them.

### **What Does the Future Hold?**

When I began this journey 5 years ago, I was motivated by my perception of how a STEM degree had benefited me and my disappointment in my own daughter's perceptions of mathematics and science. I questioned why my own daughter would say, "I hate mathematics!" "Why do I need to know this anyway?" and "Math just isn't for me." I was driven by the questions of why some women pursue STEM degrees while others do not and why so many women leave STEM careers as I had. I initially viewed this research as my opportunity to answer these questions and change how content is taught in the classroom. I quickly realized there is a vast difference between research, recommendations, and actually implemented change. During the research process, I realized what it meant to "have an open mind" and accept that preconceived notions may be wrong and what we hope or expect to find may not be what is there.

The first thing that I realized was that not all women coming to the college were there to complete a degree for the first time or even to complete a degree. My other prior expectation was that the women would have struggled with mathematics growing up and, therefore, they would lack an interest in the subject as well as a belief they could be successful. I expected that some life experiences had enabled them to connect with mathematics and that, through those life experiences, they gained a belief in their ability to succeed.

One of my goals for this study was to illuminate the experiences the women in my study had throughout their K-12 and college years to better understand how the way

content is taught and the environment of the classroom affect a girl's choice to pursue STEM majors and careers. I hoped that, by understanding why, as nontraditional students, women returned to pursue STEM majors and careers, I would learn two things: (a) what happened to enable them to make a connection to STEM and could these experiences be replicated during the K-12 years and (b) what enabled women to persist when they returned to school. I wanted to provide recommendations to educators and policy makers concerning how they could increase interest and persistence. I quickly realized the problem was comprised of so much more than simply how the content was taught.

During the course of this study, I watched both my daughters go from “math haters” to wanting to major in engineering. My older daughter still does not love math; however, she does love science and now understands the importance of math in reaching her goals. She wants to be a biochemical engineer so she can “research and discover things that will change people's lives.” My younger daughter had a science teacher who changed her world and left a lasting imprint on her. My only hope is that their passion and love for science and math is not diminished by some future experience they may have. For now, I am encouraged when I hear my daughter say, “I love science this year; it is so hands on” or hear my other daughter's teacher say, “My class is hard, but I want them to be prepared for college. They come back and thank me when all their friends fail.”

My study has resulted in a great deal of personal reflection on the choices I have made in my life, how my own lived experiences influenced me, and especially how the lived experiences of my children will influence them. I dropped out of engineering and

am a college mentor and instructor, which enables me to have a life-work balance I otherwise could not have. It also allows me to touch the lives of many women and offer them the support and encouragement described as critical by the participants in my study. I continue to find myself drawn to technology, and it has become an integral part of how I teach.

As I sat down to write my final reflections, I was struck by my own personal dissonance. I began to wonder exactly what message I really wanted to leave the reader with. I feel passionately about women pursuing STEM areas. I tell my children, “Don’t close any doors.” I believe that having a STEM background opens doors. It is better to have that background and the choices it offers than not have them. However, I struggle with the question of whether women can “have it all.” I look at my own life and see harmony. I am able to meet my need to make a difference in the lives of others through my teaching and my research, I am able to incorporate my interest in STEM in my personal and professional life, and most importantly, I have time for my family. I realize this is not the case for many women.

I asked a close friend, someone who has known me since we were freshman students in high school, to read the portraits in this study. Her response was, “They are a montage of you.” A coworker who has known me since I started at the college said the following after reading the portraits: “They have your strength and courage.” Due to the reflexive nature of portraiture, my history, background, experiences and education all shaped my interpretation of the data.

Portraiture methodology enabled me to explore in depth how the lived experiences of the women in my study influenced the path they took to returning to the

university to pursue a STEM major and career. Although it allowed me to dig deeply into the lives of the women in my study, it limited the total number of participants. I traded a larger sample size for deep, intimate relationships built on trust and respect.

It is my intention that these portraits start a conversation that has been needed for a long time. STEM fields have traditionally been male dominated, and the fields continue to bring up images of isolation, “nerdy,” and “geeky.” The path to successfully pursuing a STEM major is an academically challenging one. There has been a great deal of focus on ways to encourage interest and persistence in STEM for girls during their K-12 and traditional college years. However, little research has been focused on the needs of women who are returning to the university. They are an ever-increasing population that has the benefit of experience and perspective. These women may be single mothers trying to support a family or women yet to even think about a family. They know firsthand the issues in need of research because they have lived them. They have overcome insurmountable barriers and have a burning desire to help other young girls and women do the same. These are women shouting, “Notice me.”

Just like many of the women in our society, the women in my study were trying to balance societal expectations, personal expectations, and financial needs. When there was no support, they experienced an imbalance that led to dissonance. As I listened to their stories unfold, I heard the fluidity in their lives and the constant tension between dissonance and consonance. When there is dissonance, there is a natural push to move toward consonance. When there was a combination of support, with role models and professional goals aligning with personal values, there was harmony in their lives.



By looking deeply within the lived experiences of the women in my study, I gained insight into how the notes of their lives intertwined to create chords that were either in consonance or in dissonance. Each of the women had a story related to a poor grade, an extremely difficult course, or a situation in which life seemed to make it impossible for her to complete her coursework. However, each of these women persisted as a nontraditional student where she had not as a traditional student. They voiced an unwavering commitment to overcoming any barrier that might stand in the way of achieving their goals. What was different this time?

As nontraditional students, they found the guidance and support they lacked during their childhoods. All of the women mentioned a range of people—from family to mentors, instructors, peers, and faculty—who had made it possible for them to persist. A strong relationship with at least one person in their lives was critical. Each woman shared a story in which, if not for supportive relationships they currently had, they would not have persisted. The words of encouragement they needed were not related to self-confidence issues but knowing somebody was there, unconditionally. When the balance shifted toward dissonance, they knew they had the support needed to move back toward consonance. The knowledge that all they had to do was reach out their hand and somebody would grab it enabled them to persist.

All the women mentioned having met somebody who enabled them to make a meaningful connection between their interests and their goals. They were the conductors who helped them see the possibilities of a STEM career. The notes in their lives were their interest in STEM, the need for financial stability and a work-life balance, and a

desire to make a difference. The new conductors in their lives gave them the needed direction to see how they could play these notes in harmony.

Lawrence-Lightfoot (1983) described portraiture as a means to creating educational research that would “play a critical role in shaping educational practice and inspiring organizational change” (p. 378). It is my hope that these portraits can be a catalyst not just for organizational change but to inform guidance counselors, teachers, administrators, families, and women themselves concerning the critical need for a connection between their STEM interests, personal values, and professional career goals. Together, they can provide the needed support systems for all women.

### **What Does This Say to Educators?**

**Professional development.** Memories of teachers who made mathematics and science fun and interesting emerged and left a lasting imprint on the self-efficacy, interests, and goals of the women in my study well into adulthood. This finding indicates the importance of professional development for new as well as seasoned teachers. The women in my study voiced regret that none of their teachers had ever reached out to them and encouraged them to pursue a STEM career. It was not until they were adults that they were able to find STEM careers that aligned with their values. Each voiced the importance of there being meaning in their work and making a difference. This finding is in line with studies indicating that girls seek careers that are meaningful and will enable them to help others and make a difference (Modi et al., 2012). It indicates teachers should incorporate content and projects into their curriculum that expose girls to a wide range of experiences that may have meaning to them. Concerns about STEM careers being isolated and antisocial were expressed by some of the participants. This finding

indicates the importance of exposing girls to STEM projects and careers that emulate a social component (Lee, 2002).

**STEM Programs.** The women in my study did not find a mentor or role model with which they could identify until they were adults. This finding indicates the importance of early mentoring and exposure to a wide range of real-life experiences that have meaning to girls. Since the time the women in my study were in school, numerous programs and initiatives have emerged both within schools, during the summer, and through the Internet and social media (*SciGirls*, 2012)

It would be beneficial to increase awareness of the wide range of STEM careers a woman can pursue. Rather than only having female engineers come to talk with students, include representatives of professions women may connect to but be unaware of. Beyond the stereotypical picture that many people have of scientists and engineers, there is a range of opportunities, including creating a safer planet, researching new materials to be used for clothing, or investigating chemicals used in makeup and soaps.

### **What Does This Say to Policy Makers?**

There are currently several policy initiatives related to encouraging more women to study STEM disciplines, and a significant amount of research is currently underway, drawing on funds provided by private, state, and federal initiatives (Altema, 2010; Holdren, 2012; Robelen, 2012; Salmanowitz, 2012). Many policies are directed at the problem of U.S. students being outperformed in STEM and the low numbers of the U.S. population that pursues STEM careers. Although many policies are being put into place to provide monetary incentives to those who study STEM or become STEM teachers, policy makers should consider focusing on improving work-life balance within STEM

careers and highlighting the ways STEM careers can enable women to make a difference and help others. In addition, more policies should be directed at the increasing nontraditional female student population. Most programs directed at women in STEM are seen in middle and high school and on traditional campuses. More of an effort should be made to research the effectiveness of these programs with nontraditional female students.

SUNY recently received a \$2.95 million NSF grant to expand the education pipeline with STEM mentoring across New York (Doyle, 2012). The intent of the grant was to create programs in high-need low-resource areas. One of the key pieces of this grant focuses on mentor training. Results of my study support mentoring as a beneficial thing to do.

The STEM Education Coalition has developed core policy principles in an effort to drive state and federal policy related to STEM and education (Brown, 2012). One of the initiatives it supports is community colleges better preparing students for further STEM education. Indicated by the results of my study, part of this preparation should include addressing early intervention when students are struggling, for example, providing study groups, support networks, and mentors.

### **What Next?**

My study illuminates the importance of supports, vicarious experiences, and meaningful connections between interests and goals. However, further research is warranted to continue the conversation. A more diverse sample would allow for an understanding of how the lived experiences of a single or married mother might influence her choices and ability to persist. Including a comparison to students who returned to

school as non-STEM majors or as STEM majors who later switched majors would provide additional information related to needed supports and barriers encountered by women when they return to the university. The inclusion of men in the study would allow for a deeper understanding about gender differences. Inclusion of each of these populations would enable a greater number of people to identify with the participants and their experiences and provide a more extensive basis for “shaping educational practice and inspiring organizational change” (Lawrence-Lightfoot, 1983, p. 378).

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## **Appendix A: Recruitment Letters**

### **STEM Recipients**

Hello, my name is Patrice Prusko Torcivia. I am a doctoral student in the Educational Theory and Practice department at The University at Albany. I am interested in having you participate in a study that I am currently conducting about the experiences adult women have when they return to school to study a science, technology, and mathematics (SMT) concentration. Participation in this study is both voluntary and confidential—you would receive a pseudonym and your name would not be revealed. If you are selected as a participant your participation would require three 60-90 minute interviews, observation of your online classroom interactions, journal writing, optional art work and sharing of some classroom material (written assignments, quizzes and exams). If you are not selected as a focal student your participation would only require permission to observe you in your online classroom. No personal information concerning you will be released to school personnel, your course instructor, your mentor, classmates or the general public.

I am attaching the consent statement for you to sign and return to me (see contact information below) if you agree to participate. You will receive a \$50 Amazon gift card as fair compensation for the time involved in participating as a focal student. If you are not selected to be a focal student but consent to observation of your online classroom interactions your name will be submitted in a drawing for a \$50 Amazon gift card. If you choose not to participate I will not use any data from your discussion posts or any communications or written work. This study has been approved by the IRB at both University at Albany and State University of New York Empire State College.

Sincerely,

Patrice Prusko Torcivia  
Doctoral Student  
School of Education  
Department of Educational Theory and Practice, ED 122  
1400 Washington Ave.  
Albany, NY 12222  
Phone: (518) 442-5021  
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Email: [patrice.torcivia@gmail.com](mailto:patrice.torcivia@gmail.com)



## **Non-STEM Participants**

Hello, my name is Patrice Prusko Torcivia. I am a doctoral student in the Educational Theory and Practice department at The University at Albany. I am interested in having you participate in a study that I am currently conducting about the experiences adult women who returned to school to study a science, technology, and mathematics (SMT) concentration and chose to switch concentrations. Participation in this study is both voluntary and confidential—you would receive a pseudonym and your name would not be revealed. Your participation would require three 60-90 minute interviews. No personal information concerning you will be released to school personnel, your instructor, your classmates, your mentor or the general public. I am attaching the consent statement for you to sign and return to me (see contact information below) if you agree to participate. As fair compensation for your time you will receive a \$30 Amazon gift card. This study has been approved by the IRB at both University at Albany and State University of New York Empire State College.

Sincerely,

Patrice Prusko Torcivia  
Doctoral Student  
School of Education  
Department of Educational Theory and Practice, ED 122  
1400 Washington Ave.  
Albany, NY 12222  
Phone: (518) 442-5021  
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## **Appendix B: Consent Forms**

### **SMT Participants (Adapted from Ashby-Scott, 2005)**

Adult Women in STEM Majors

#### **ABOUT THIS STUDY**

I am a doctoral study at University at Albany focusing my dissertation on exploring the life experiences of adult women studying a science, technology, engineering and mathematics (STEM) major.

Data collection will include three 60-90 minute interviews, optional art work (you will be given a choice of using online tools or paper and will not be pressured or forced to draw if you are not comfortable), observations of online classroom interactions such as online course discussions, the student lounge, the ask a question area, student-instructor e-mail, and other forms of communication your instructor may use such as Facebook and Twitter (you will be notified when I am observing), a creation of a timeline of your life history, journal writing, and document review (written course work, quizzes, exams, curriculum vitae, and personal history from demographic survey about family and educational history). Topics covered may include significant life experiences with your family, in your professional life and in school.

With your permission I will record the interviews. Each interview will be transcribed with the data being kept secure at all times. You will be given the opportunity to read and comment on the final portraiture prior to it is published.

By giving your consent you are agreeing to allow me to use all data collected in my dissertation and any future publications or presentations. You may not make any financial claims for the materials used in this study.

#### **RISKS**

A foreseeable risk would be if the information shared in confidence was discovered by faculty, peers, classmates or family that may have been discussed in the interviews. I will be the only one with access to the data which will be locked in a drawer in which only I have access.

#### **BENEFITS**

Participation in this study will give you a voice and the opportunity to tell and share your stories with others. Through the telling of your story you enable me to add to the literature on adult women returning to school and adult women and STEM careers. The results of this study will also inform future studies that may influence other women,

teachers, and university administrators. As fair compensation for your time you will receive a \$50 Amazon gift card.

**CONFIDENTIALITY**

You will be assigned a pseudonym and no information concerning your identity will be included in reports.

**CONTACT**

If you have any questions at any time about the study or the procedures, you may contact the researcher, Patrice Prusko Torcivia, at (518) 466-0026 or [patrice.torcivia@gmail.com](mailto:patrice.torcivia@gmail.com) <mailto:patrice.torcivia@gmail.com>, or the faculty advisor for this project, Vicky Kouba at the University at Albany.

If you have any questions concerning your rights as a research participant that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the office of Regulatory Research Compliance at 518-442-9050 or [orrc@uamail.albany.edu](mailto:orrc@uamail.albany.edu) or Lorrie Anthony, Compliance Officer, Empire State College, One Union Avenue, Saratoga Springs, NY 12866-4391; 518 587-2100 ext. 358.

**PARTICIPATION**

Your participation in this study is voluntary; you may refuse to participate without any penalty. If you decide to participate, you may withdraw from the study at any time. If you withdraw from the study before data collection is completed your data will be destroyed.

**CONSENT**

I have read this form and received a copy of it. I had all my questions answered to my satisfaction.

\_\_\_\_\_

Participant's Signature

\_\_\_\_\_

Date

\_\_\_\_\_

Participants' Printed Name

\_\_\_\_\_

Date

## Focal Student Survey

Gender: male \_\_\_\_\_ female \_\_\_\_\_ don't wish to answer \_\_\_\_\_

Age: under 25 \_\_\_\_\_ 25 or older \_\_\_\_\_ don't wish to answer \_\_\_\_\_

Total number of credits completed \_\_\_\_\_

Consent for:

(Please initial your choices below: adapted from Uzner Smith, 2010))

### Interviews

\_\_\_\_\_ I voluntarily agree to participate in the interviews.

\_\_\_\_\_ I do NOT agree to participate in the interviews.

Audio recording of interviews (for students who have agreed to participate in the interviews)

\_\_\_\_\_ I am willing to have the interviews audio recorded

\_\_\_\_\_ I am NOT willing to have the interviews audio recorded (You may still participate in this study if you are not willing to have the interview recorded)

### Online Observations

The Institutional Review Board at University at Albany and SUNY Empire State College requires the investigator to obtain consent from everyone in the class to observe the online course.

\_\_\_\_\_ I agree to the investigator's observation of the online portions of the course.

By choosing this option you are agreeing that the investigator may look at all discussion posts and interactions within the online course in order to use the data for her sample of seven.

\_\_\_\_\_ I do NOT agree to the investigator's observations of interactions in the online course

### E-Mail

\_\_\_\_\_ I agree to the investigator's observation of my e-mail exchanges with the instructor.

By choosing this option you are agreeing that the investigator may look at all e-mail exchanges between you and your instructor. The investigator will NOT look at any exchanges in the private folder

\_\_\_\_\_ I do NOT agree to the investigator's observations of e-mail

### **Document Review**

\_\_\_\_\_ I agree to the investigator's review of written assignments, grades, and feedback received from the instructor or other students.

By choosing this option you are agreeing that the investigator may look at all written assignments\_\_\_\_\_, quizzes\_\_\_\_\_ and exams\_\_\_\_\_.

\_\_\_\_\_ I do NOT agree to the investigator reviewing written work, quizzes or exams

## **Non-SMT Participant Consent (Adapted from Ashby-Scott, 2005)**

### **ABOUT THIS STUDY**

I am a doctoral study at University at Albany focusing my dissertation on exploring the life experiences of adult women studying a science, technology or mathematics (SMT) concentration. I will be interviewing seven SUNY Empire State College students who are currently enrolled in a SMT concentration and five students who enrolled in a SMT concentration and switched to a non-SMT concentration. The data from your interview will be used to create a comparative data set only. The purpose of this study is to gain deeper insight into what the lived experiences of the seven adult women in the study are in their pursuit of a SMT degree. This study will add to the literature on adult women returning to school and inform future studies on adult women and science, technology, engineering and mathematics (STEM).

With your permission I will record the interviews. Each interview will be transcribed with the data being kept secure at all times. By giving your consent you are agreeing to allow me to use all data collected in my dissertation and any future publications or presentations. You may not make any financial claims for the materials used in this study.

### **RISKS**

A foreseeable risk would be if the information shared in confidence was discovered by other faculty, students or other college personnel that may have been discussed in the interviews. I will be the only one with access to the data. The computer used will be password protected and storage of any data will be in a locked drawer in which only I have access.

### **BENEFITS**

Participation in this study will further enable me to give the participants in this study a voice, add to the emerging literature on adult women and science, technology, engineering and mathematics (STEM) careers and inform future studies that may provide results that can be used by other women, families, teachers, and university administrators.

### **CONFIDENTIALITY**

You will be assigned a pseudonym and no information concerning your identity will be included in reports.

### **CONTACT**

If you have any questions at any time about the study or the procedures, you may contact the researcher, Patrice Prusko Torcivia, at (518) 466-0026 or [patrice.torcivia@gmail.com](mailto:patrice.torcivia@gmail.com) or the faculty advisor for this project, Vicky Kouba at the University at Albany.

If you have any questions concerning your rights as a research participant that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the University at Albany office of Regulatory Research Compliance at 518-442-9050 or [orrc@uamail.albany.edu](mailto:orrc@uamail.albany.edu) or Lorrie Anthony, Compliance Officer, Empire State College, One Union Avenue, Saratoga Springs, NY 12866-4391; 518 587-2100 ext. 358.

### **CONSENT**

I have read this form and received a copy of it. I had all my questions answered to my satisfaction.

\_\_\_\_\_  
Participant's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Participants' Printed Name

\_\_\_\_\_  
Date

Consent for:

(Please initial your choices below: adapted from Uzner Smith, 2010))

**Interviews**

\_\_\_\_\_ I voluntarily agree to participate in the interview.

\_\_\_\_\_ I do NOT agree to participate in the interview.

Audio recording of interviews

\_\_\_\_\_ I am willing to have the interviews audio recorded

\_\_\_\_\_ I am NOT willing to have the interviews audio recorded (You may still participate in this study if you are not willing to have the interview recorded)



Instructor Consent (adapted from Ashby-Scott, 2005; Uzner Smith, 2010)

### **ABOUT THIS STUDY**

I am a doctoral study at University at Albany focusing my dissertation on exploring the life experiences of adult women studying a science, technology or mathematics (STM) concentration. I will be inviting seven students from your Fall 2011 online course \_\_\_\_\_ to be focal students in my study. I will also be asking all students in your Fall 2011 online course \_\_\_\_\_ for their consent to allow me to observe their online classroom interactions. The purpose of this study is to gain deeper insight into what the lived experiences of these seven adult women are in their pursuit of a SMT degree. This study will add to the literature on adult women returning to school and inform future studies on adult women and science, technology, engineering and mathematics (STEM).

The research timeframe for this study will be the length of the Fall 2011 semester. During this time I will observe your course but will not participate in any course activities or discussions. I will obtain guest access to the course.

Online classroom observations will include:

- Online discussions, course announcements and bulletins, the student lounge, ask a question area, instructor-student e-mail, and any web 2.0 tools you may use such as Facebook or Twitter.

Document review will include:

- Syllabus, contract evaluations, written assignments, quizzes, exams and instructor feedback

With your permission I will record the interviews. Each interview will be transcribed with the data being kept secure at all times. By giving your consent you are agreeing to allow me to use all data collected in my dissertation and any future publications or presentations. You may not make any financial claims for the materials used in this study.

### **RISKS**

A foreseeable risk would be if the information shared in confidence was discovered by other faculty, students or other college personnel that may have been discussed in the interviews. I will be the only one with access to the data. The computer used will be password protected and storage of any data will be in a locked drawer in which only I have access.

### **BENEFITS**

Participation in this study will further enable me to give the participants in this study a voice, add to the emerging literature on adult women and science, technology, engineering and mathematics (STEM) careers and inform future studies that may provide results that can be used by other women, families, teachers, and university administrators.

### **CONFIDENTIALITY**

You will be assigned a pseudonym and no information concerning your identity will be included in reports.

### **CONTACT**

If you have any questions at any time about the study or the procedures, you may contact the researcher, Patrice Prusko Torcivia, at (518) 466-0026 or [patrice.torcivia@gmail.com](mailto:patrice.torcivia@gmail.com) or <mailto:patrice.torcivia@gmail.com>, or the faculty advisor for this project, Vicky Kouba at the University at Albany.

If you have any questions concerning your rights as a research participant that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the University at Albany office of Regulatory Research Compliance at 518-442-9050 or [orrc@uamail.albany.edu](mailto:orrc@uamail.albany.edu) or Lorrie Anthony, Compliance Officer, Empire State College, One Union Avenue, Saratoga Springs, NY 12866-4391; 518 587-2100 ext. 358.

### **CONSENT**

I have read this form and received a copy of it. I had all my questions answered to my satisfaction.

---

Participant's Signature

---

Date

---

Participants' Printed Name

---

Date

Consent for:

(Please initial your choices below: adapted from Uzner Smith, 2010))

**Interviews**

\_\_\_\_\_ I voluntarily agree to participate in the interview.

\_\_\_\_\_ I do NOT agree to participate in the interview.

Audio recording of interviews

\_\_\_\_\_ I am willing to have the interviews audio recorded

\_\_\_\_\_ I am NOT willing to have the interviews audio recorded (You may still participate in this study if you are not willing to have the interview recorded)

**Online Observations**

The Institutional Review Board at University at Albany and SUNY Empire State College requires the investigator to obtain consent from everyone in the class to observe the online course.

\_\_\_\_\_ I agree to the investigator's observation of my Fall 2011 online course\_\_\_\_\_.

By choosing this option you are agreeing that the investigator may look at all discussion posts and interactions within the online course in order to use the data for her sample of seven.

\_\_\_\_\_ I do NOT agree to the investigator's observations of interactions in the online course

**E-Mail**

\_\_\_\_\_ I agree to the investigator's observation of my e-mail exchanges with the seven students in the study.

By choosing this option you are agreeing that the investigator may look at all e-mail exchanges between you and the seven students in the study. The investigator will NOT look at any exchanges in the private folder

\_\_\_\_\_ I do NOT agree to the investigator's observations of e-mail exchanges

**Document Review**

\_\_\_\_\_ I agree to the investigator's review of written assignments, grades, and feedback provided by the instructor or other students.

By choosing this option you are agreeing that the investigator may look at all written assignments\_\_\_\_\_, quizzes\_\_\_\_\_ and exams\_\_\_\_\_.

\_\_\_\_\_ I do NOT agree to the investigator reviewing written work, quizzes or exams

Mentor Consent (adapted from Ashby-Scott, 2005; Uzner Smith, 2010)

### **ABOUT THIS STUDY**

I am a doctoral study at University at Albany focusing my dissertation on exploring the life experiences of adult women studying a science, technology or mathematics (STM) concentration. I will be inviting seven students from the Fall 2011 SUNY Empire State College online course \_\_\_\_\_ to be focal students in my study. The purpose of this study is to gain deeper insight into what the lived experiences of these seven adult women are in their pursuit of a SMT degree. This study will add to the literature on adult women returning to school and inform future studies on adult women and science, technology, engineering and mathematics (STEM).

The research timeframe for this study will be the length of the Fall 2011 semester. You are the mentor of one or more of the focal students in this study. I am asking your permission to interview you about your experiences both as a mentor at SUNY Empire State College and specifically about your experiences with the student(s) in this study.

With your permission I will record the interviews. Each interview will be transcribed with the data being kept secure at all times. By giving your consent you are agreeing to allow me to use all data collected in my dissertation and any future publications or presentations. You may not make any financial claims for the materials used in this study.

### **RISKS**

A foreseeable risk would be if the information shared in confidence was discovered by other faculty, students or other college personnel that may have been discussed in the interviews. I will be the only one with access to the data. The computer used will be password protected and storage of any data will be in a locked drawer in which only I have access.

### **BENEFITS**

Participation in this study will further enable me to give the participants in this study a voice, add to the emerging literature on adult women and science, technology, engineering and mathematics (STEM) careers and inform future studies that may provide results that can be used by other women, families, teachers, and university administrators.

### **CONFIDENTIALITY**

You will be assigned a pseudonym and no information concerning your identity will be included in reports.

## **CONTACT**

If you have any questions at any time about the study or the procedures, you may contact the researcher, Patrice Prusko Torcivia, at (518) 466-0026 or [patrice.torcivia@gmail.com](mailto:patrice.torcivia@gmail.com) or <mailto:patrice.torcivia@gmail.com>, or the faculty advisor for this project, Vicky Kouba at the University at Albany.

If you have any questions concerning your rights as a research participant that have not been answered by the investigator or if you wish to report any concerns about the study, you may contact the University at Albany office of Regulatory Research Compliance at 518-442-9050 or [orrc@uamail.albany.edu](mailto:orrc@uamail.albany.edu) or Lorrie Anthony, Compliance Officer, Empire State College, One Union Avenue, Saratoga Springs, NY 12866-4391; 518 587-2100 ext. 358.

## **CONSENT**

I have read this form and received a copy of it. I had all my questions answered to my satisfaction.

\_\_\_\_\_  
Participant's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Participants' Printed Name

\_\_\_\_\_  
Date

Consent for:

(Please initial your choices below: adapted from Uzner Smith, 2010))

### **Interviews**

\_\_\_\_\_ I voluntarily agree to participate in the interview.

\_\_\_\_\_ I do NOT agree to participate in the interview.

Audio recording of interviews

\_\_\_\_\_ I am willing to have the interviews audio recorded

\_\_\_\_\_ I am NOT willing to have the interviews audio recorded (You may still participate in this study if you are not willing to have the interview recorded)

## Appendix C: Interview Protocol by Participant

### Interview 1: Personal childhood through adult

1. (PA) Thinking back to your childhood, tell me about your image of who you thought you should be when you grew up. Tell me about the kinds of experiences that contributed to this image.
  - a. Think back to your belief in your academic abilities as a child. Tell me about an experience you had with your family that contributed to this belief. How did this make you feel?
  - b. Think back to your belief in your mathematics abilities. Think back to an experience you had with a member of your family and tell me about how that experience made you feel about your mathematics abilities.
  - c. Sitting here today, as an adult, what is your image of who you think you should be? What experiences contributed to this image?
  - d. Tell me about an experience you have had in your adult life related to your belief that you could be successful at a task that required mathematical skills. Tell me about this experience. How did it make you feel? What experiences contributed to this feeling?
2. VE: Tell me about the dynamics of your family growing up. What role did each member play in your family? Tell me about the messages you received from your immediate family members, close family friends or relatives about a woman's role related to academics, family and a career.
  - a. Think back to an experience you had growing up where a friend or family member in some way affected your perception of who you should be when

- you grew up. Tell me about this experience and who was involved. How did you connect with this person?
- b. Growing up was there a friend or family member you looked up to? Tell me about this person and in what ways you connected with this person. Tell me about an experience you had with this person and how the experience related to your belief in your academic abilities.
- c. Think about a time you had to make a decision related to the types of mathematics courses you would take. Tell about the family member or friend you looked to for advice. Tell me about an experience you had with this person. What type of messages did you receive from this person about the value of mathematics in your life? How did this make you feel?
- d. As an adult tell me about an experience you had where another person that led you to believe STEM was a viable career for you. Tell me about this experience and who was involved in the decision making process. In what ways did you relate to this person and what role did they play? How did they make you feel about your ability to be successful in your chosen career?
3. VP: Think back to the types of verbal messages you received from your family about the value of academics. Tell me about a story about something someone in your family said to you that you feel contributed to your belief in your academic abilities.
- a. Think back to what you wanted to be when you grow up. Tell me about the kinds of things people said to you when you told them what you wanted to be. How did this make you feel?



- b. Think back to your level of interest in mathematics. Tell me a story about a time you told someone in your family or a friend about how you felt about mathematics. What did they say to you? How did this make you feel about yourself and your ability to do math?
  - c. Think about your decision to return to school. Tell me about the kinds of thing people said to you when you told them about your decision. What types of words of encouragement or discouragement did you receive? How did these words make you feel?
  - d. Think about a time when you told someone about your decision to return to school to study a science, technology, engineering, or mathematics major. What did they say? What did your husband and/or children say? How did this make you feel?
4. PH: Think back to what it was like to be a student in your family. Tell me a time you were at home working on homework or talking with your family or a friend about academics. What kind of images come to mind? Tell me about how you felt physically and emotionally. Tell me about the people involved and the experiences that contributed to these images.
- a. Think back to a school related experience where your home environment made you feel stressed or anxious. Tell me about the experiences that contributed to your feelings of stress or anxiety. Tell me about the value your family placed on education, family, and career and how these values contributed to your feelings.

- b. Think back to a time you were a child at home doing mathematics home work. How did you feel when you first began thinking about doing your mathematics homework? How did you feel physically and mentally? When you finished your homework, how did you feel?
- c. Sitting here today, how do you feel about doing your mathematics homework? How do you feel physically and mentally?
- d. Think about the home environment you live in today and a time where it made you feel stressed or anxious about a school related activity. Tell me about the experiences that contributed to your feelings of stress or anxiety. Tell me about the value your current family places on education, family, and career and how these values contributed to your feelings. How did this make you feel?
5. Support family: Think back to a time you faced something academically challenging and needed the support of your family to overcome this challenge. Tell me about this experience, who you went to for support and in what ways they contributed to your success.
- a. Tell me about a time your family provided the support you needed to overcome a challenging experience at school. Tell me about the ways in which your family contributed to your belief you could succeed and overcome this challenge.
- b. Tell me about a time your family provided the support you needed to overcome something that was mathematically challenging at school. Tell me

about the ways in which your family contributed to your belief you could succeed and overcome this challenge.

- c. Think about what it is like being an adult student trying to balance work, school, family and your personal needs. Tell me about the types of support you look to from your family for. What support do you need from them on a daily basis in order to believe you can successfully complete your education?
  - d. Think about what it is like being a science, technology, or mathematics major and how you feel about your academic load. Think about your decision to pursue this major. In what ways do you feel your family's support contributed to your belief that this was a viable option for you? In what ways does your family's support make it possible for you to continue to believe in your mathematics abilities?
6. Support school: Think back to a time you faced something academically challenging and needed the support of others to overcome this challenge. Tell me about this experience, who you went to for support and in what ways they contributed to your success.
- a. Tell me about the time someone at school provided the support you needed to overcome an academic challenge. Tell me about who this person was and the ways in which they contributed to your belief that you could overcome this challenge.
  - b. Tell me about the time someone at school provided the support you needed to overcome a mathematical challenge. Tell me about whom this person was

and the ways in which they contributed to your belief that you could overcome this challenge.

- c. Think about a time as an adult student when it was particularly hard to balance work, school, and your family. Tell me about the experience and the type of support you sought from the school. If you didn't see support, tell me why?
  - d. Think about a time, as an adult student, you faced a challenge related to being a science, technology, or mathematics major. Tell me about the experience and who you sought support from. Tell me about the role they played in supporting you, how you felt about the experience. What images come to mind?
7. Barrier gender: Tell me about a memorable experience that describes the types of messages you received either implicit or explicit about the role of a woman. Where did these messages come from?
- a. Think back to a time you were watching TV, a movie or listening to music. Tell me about the type of message you received about a woman's role with respect to family and academics. How did this make you feel?
  - b. Tell me about a memorable experience that describes the types of social messages you received about a woman's role related to mathematics. How did this make you feel?
  - c. Think back to when you first chose to return to school and were selecting your major. Tell me about how you felt as a woman interested in science, mathematics, and technology. What types of images come to mind? Tell me about the experiences that you feel contributed to these images and how you felt.

- d. Think about how you felt as a woman working in your most recent career.  
Tell me about the images that come to mind and the experiences that you feel contributed to these images. How did you feel about this experience?
8. Barrier family/socioeconomic: Think back to a time when you faced an academic challenge and did not believe you could be successful. What image comes to mind? What experiences contributed to this image? How did this make you feel?
- a. Think back to a time where you faced an academic challenge and did not believe you could succeed due to family related constraints such as your socio-economic status or access to a quality education. What images come to mind? What experiences contributed to this image? How did this experience make you feel?
- b. Think back to a time where you faced a mathematically challenging experience and did not believe you could succeed due to family related constraints such as your socio-economic status or access to a quality education. What images come to mind? What experiences contributed to this image? How did this experience make you feel?
- c. Think back to a time when, as an adult, you had to choose between meeting the needs of your family and work or school. Tell me about this experience and your belief in your ability to successfully be able to balance work, school, and/or family. How did this experience make you feel?
- d. Think back to a time when, as an adult, you wanted to pursue a particular career or educational experience and had to consider whether you believed you could successfully meet the responsibilities of the job due to the needs of

your family. Tell me about your belief in your ability to be successful in this role. Tell me about what your decision was, how you made the decision, and how you felt about it.

9. In my observations of the discussions and document review, I noticed X and interpreted it as Y. Can you tell me about how you experienced this and your interpretation of what was going on? How did you feel about this experience?
10. Artwork: I had you were to draw a timeline of your life. Tell me about what was memorable about some of the experiences. What feelings come to mind? How would you describe the life experiences that ultimately led to your interest in science, technology, engineering, and mathematics (STEM) and choice of major? Is there anything else you would like to share?

### **Interview 2: K-12–Precollege Educational Experience**

1. PA: Thinking back as early as elementary school what kinds of images come to mind when you think about yourself as a student? Tell me about the experiences that contributed to these images.
  - a. Think back to a time when you found something academically challenging. Tell me about your belief in your ability to complete the assignment. How did you feel about this experience?
  - b. Think back to an experience you would describe as your greatest academic failure and tell me about it. How did you feel about this experience? Tell me about the experiences you would contribute to your failure.
  - c. Think back to when you entered college for the first time. Tell me about how confident you were in your academic abilities. How confident were you in

your mathematics abilities? How did you experience being a student in a college level classroom? Tell me about how you felt.

- d. Think back to your decision about what major and career you wanted to pursue. Tell me about the school experiences that contributed to this decision. How did you feel about these experiences?

2. VE: Think back to your academic interests and goals when you were in middle and high school and tell me about them. Tell me about what made it interesting and who was involved.

- a. Think back to a time you had to make a decision related to the type of academic course work you would take. Tell me about any people you looked up to or were involved with and what their role was in your decision process. Tell me about the ways in which the actions of other people contributed to your final decision.
- b. Tell me about any specific actions or characteristics that contributed to your feeling connected to this person or persons and the types of messages you received from them.
- c. Think back to when you were in college and had to make a decision related to your major or future career direction. Tell me about what this experience was, the person involved, and how you felt about the experience. In what ways did you connect with this person?
- d. Thinking back to when you were in college, was there any person you admired or looked up to who connected to a STEM course or field? Tell me about your relationship with this person and how you related to him or her.

Tell me about any experiences you had with this person related to your course selection and career goals.

3. VP: Think back to a time growing up when you told someone at school about your academic interests and goals. Tell me about what images come to mind and the experiences that contributed to this image. Who did you go to, and what did this person say? How did the words of this person make you feel about your interests and goals?
  - a. Think back to a time someone at school said something to you related to either academics or career that in some way was meaningful to you. Tell me about the situation in which this exchange took place and how these words made you feel.
  - b. Think back to a time you received words of either encouragement or discouragement when you sought help from your teacher, a peer, or someone else within the school on a mathematics assignment. Tell me about who this person was, what they said, and how their words made you feel about your ability to complete the assignment.
  - c. Think back to an instructor you had in college whose words stick with you even today. Tell me about this person, the experiences that led you to still remembering these words today and what the words were. How did these words make you feel?
  - d. Think back to a college experience, related to mathematics, where someone said something to you that you feel had a significant impact on future decisions you made related to academic and/or career choices. Tell me about



who this person was, what the experience was, and the words this person said.

How did you feel about what this person said?

4. PH When you think back to yourself as a student and how you felt about school as a child. What image comes to mind when you think about being in a classroom or doing school work? Tell me about what you think contributed to this image of yourself. How did you feel about doing school work?
  - a. Think back to an experience where you had to study for something particularly challenging. Tell me about the experience, how you felt about the amount of time you had to study, and the outcome.
  - b. Think back to a time you felt stressed or anxious in the mathematics classroom. Tell me about the experiences that contributed to these feelings of stress or anxiety.
  - c. Think back to how you felt as a member of your college community in general and the department in which you studied. Tell me about how you experienced being a member of this community. What images come to mind that would describe to me how you felt being a member of this community. What experiences contributed to this image? How did you feel?
  - d. Think back to an experience you had in a mathematics classroom or when you were doing mathematics as a college student. Tell me about the images that come to mind when you think about your ability to do mathematics. What experiences do you feel contributed to these images? Tell me about any feelings of stress or anxiety you experienced. How did you feel physically and emotionally?
5. Support-family: Going back as early as elementary school tell me about a classroom or school experience where you lacked the belief in yourself that you

could be successful. Think about the type of support your family provided. What role did your family play in helping you believe you could be successful? How did you feel about this experience?

- a. Think back to a time where you needed to make decisions related to your course work. How did you feel about selecting courses? What role did your family play in your belief in your abilities? What support did they provide?
  - b. Think back to a time where you needed to make decisions related to the types of mathematics courses you would take in HS. How did you feel about selecting courses? What role did your family play in your belief in your abilities? What support did they provide?
  - c. Think about your decision as to what college you would attend and what your major would be. Tell me about how you experienced this decision making process with your family. What type of support or encouragement did they offer when you told them where you wanted to go and what you wanted to major in?
  - d. Think about a time when you were having difficulty with an academic related issue. Tell me about any type of support you sought from and received from your family. Describe the experience to me, the type of support your family offered, and how you felt about the outcome of the experience.
6. Support-school: Going back as early as elementary school tell me about a classroom or school experience where you lacked the belief in yourself that you could be successful. Think about the type of support someone at school (teacher,

counselor) provided. What role did your this person play in helping you believe you could be successful? How did you feel about this experience?

- a. Think back to a time where you needed to make decisions related to your course work and you either sought the support of someone at school or they provided support without your explicitly asking. What role did this person play in your belief in your abilities? What support did they provide?
- b. Think back to a time where you needed to make decisions related to the types of mathematics courses you would take in HS and you either sought the support of someone at school or they provided support without your explicitly asking. How did you feel about selecting courses? What role did they play in your belief in your abilities? What support did they provide?
- c. Think back to your academic experiences during your during college. Tell me about a time you were in need of some type of academic or financial related support. Tell me about the experiences that contributed to your need for support, the type of services or people that were available to support you and how you went about seeking support.
- d. Think back to the experiences you had in mathematics classes. Thinking about the instructors you had for mathematics what types of images come to mind about the experiences you had? Can you tell me about an experience you had with an instructor you connected with or did an especially good job teaching mathematics?

7. Barrier-gender: Going back as early as elementary school think back to a time you were in the class room and questioned your academic ability. What kinds of

images come to mind? Tell me about the kinds of experiences that contributed to these images. Tell me about the environment of the classroom where this experience took place.

- a. Tell me about an experience where being a woman created an environment where you questioned your academic abilities. What kinds of images come to mind? What types of experiences contributed to this image? How did you feel?
  - b. Tell me about an experience where being a woman created an environment within your classroom that made you question your mathematical abilities. What types of experiences contributed to this feeling?
  - c. Tell me about how you experienced being a woman in your major. Think about an experience where you questioned your ability to be successful in your major. Tell me about the experiences that contributed to this experience, the people involved, how you felt, and the outcome.
8. Barrier-family/socio-economic status: Going back as early as elementary school think about a time you didn't participate in a school related activity that you really were interested in. Tell me about the experiences contributed to your decision not to participate. Tell me about the environment of your school or classroom where this experience took place.
- a. Go back to a time where you wanted to participate in a school related activity but felt you didn't have access due to a family related constraint (such as socio-economic, access to quality school system) what kinds of images come to mind when you think about yourself as a student in this situation? Where

do you think these images come from? What types of experiences contributed to these images?

- b. Go back to a time where you wanted to participate in a school related mathematics activity but felt you didn't have access due to a family related constraint (such as socioeconomic, access to quality school system) what kinds of images come to mind when you think about yourself as a student in this situation? Where do you think these images come from? What types of experiences contributed to these images?
9. In my observations of the discussions/document review I noticed X and interpreted it as Y. Can you tell me about how you experienced this and your interpretation of what was going on? How did you feel about this experience?
10. Artwork: I had you think back to how you felt in a mathematics classroom and draw a picture that emulates that feeling. Tell me about what is happening in this picture. What grade were you in? What mathematics class? Tell me about why this was a memorable moment for you. What feelings come to mind? Is there anything else you would like to share?

### **Interview 3: Professional Life**

1. PA: Think back to your decision to pursue your future career. Tell me about what that career is and your image of yourself working in that career. Tell me about the experiences that contributed to your decision. How did you feel about these experiences?
  - a. Tell me about your belief in your ability to be successful in this career and the experiences that contributed to this belief.

- b. Think about an experience you had as an adult that you feel gave you the confidence to believe you could be successful in a STEM career. Tell me about this experience, who was involved, and how it made you feel.
  - c. Think about an experience you had either in or out of school that created your interest in this career or gave you the confidence that you could be successful in this career.
  - d. If the career you are pursuing is not directly related to a typical STEM field tell me about the experiences that contributed to your not wanting to pursue a traditional STEM career.
2. VE: Think about someone you, as an adult, admire or look up to. Tell me about an experience you had with this person related to either school or your career. How did you feel about this experience?
- a. Tell me about the role your parents, peers, employers, instructors, children or significant other play in your career making decisions.
  - b. Tell me about any other source you would attribute having impacting your career decisions as an adult.
  - c. Tell me how you developed your academic interests and in what ways they relate to your career goals.
  - d. Think about a time you had to make a decision related to the type of career you would pursue after college. Tell me about who you went to for advice. How would you describe this person? How did you feel connected to this person?

3. VP: Think about a time you questioned whether or not you could be successful in your chosen career and went to another adult for advice or support. Tell me about who you went to and what this person said. How did their words make you feel?
  - a. Think about an experience you had where you were discussing with someone your chosen career. What did they say to you when you told them about the career you were pursuing? How did this make you feel?
  - b. Think about the experiences you have had with your mentor. Tell me about any words of encouragement your mentor provided. What were these words and how did you feel about them?
  - c. Think about the types of messages you got from others related to expectations of a woman's role at work and home. Tell me about an experience you had when someone questioned your ability to be successful in your chosen career. What did they say to you? How did this make you feel?
4. PH: Think about your image of a woman or mother working in your chosen career. Tell me about what this image is and the experiences that contributed to this image.
  - a. When you think about working in your chosen career how do you feel emotionally and physically? Does it make you feel stressed or anxious?
  - b. If you are a mother, tell me about how you feel when you think about having to choose between the needs of your family and your new career.
  - c. Think about your perception of the work environment in your chosen career. Tell me about how you feel about working in this type of environment.

5. Barriers: Think about the types of messages you have received, either implicit or explicit, throughout your life about a woman in this career. Tell me about an experience where the message you received made you question whether this was a viable career for you. Describe to me who was involved in this experience, when it took place, how it made you feel, and how you overcame this feeling.
6. Supports: Think about your chosen career and what it will take to balance work, your family, and your personal life. Tell me about what you think you will need in the way of support to believe you can be successful.

**Interview Protocol Mentor** (to be used for triangulation)

1. Think back to a time when student X came to you because they questioned their ability to succeed in their current major. Tell me about the experiences that contributed to the student feeling this way. Tell me about the role you played. What actions did you take or words did you use? Tell me about the outcome of this experience and how you felt about it.
2. Think about the student services available to your students. What services do you most frequently send students to? Are there services that you feel should be available to students? What barriers do you see your female students facing that you feel these services would help them overcome? What barriers have student X faced and how did she overcome them?
3. Think back to when you do degree planning with your students and you discuss their personal goals and objectives. Think about an experience you had with a female student who you felt had the ability to succeed in a STEM major but was pursuing a non-STEM major. What experiences do you think contributed to their



choice of major? What were the characteristics of this student that led you to believe they could be successful in a STEM major? Tell me about any discussions you had with student X related to her pursuing a STEM major.

4. Think back to a time you were helping a new female student select what mathematics courses she would begin with. Tell me about the questions you asked the student and what factual background information you considered. Thinking about student X, how prepared did you think she was to do mathematics when she came to ESC? What were the characteristics of her that led you to feel this way?
5. What are some common things your female students say about their mathematics abilities? Tell me about how you react when a student does not believe in their ability to do math? Tell me about a time you were able to say something to a female student that resulted in her taking a challenging mathematics course when she lacked the belief she could succeed. What words did you say? Tell me about any experience you had with student X where she lacked a belief in her mathematics abilities.
6. Think about a time when a female STEM major talked with you about a role model. Tell me about the experiences they described to you and how that relationship contributed to decisions the student made. Think about student X. Tell me about any role models she has mentioned to you.

**Interview Protocol Instructor (to be used for triangulation)**

1. (PA): Think about when your students first started this course. Tell me about how prepared you felt the students were, what your expectation of the number of

students who would persist was, and what the final grades would be. Tell me about what you find particularly challenging in teaching the course. I have the following students in my study . . . . Can you tell me about one who seemed especially prepared and one who did not?

2. (PH): Think about the course you are currently teaching. Tell me about the course. What is it like being an instructor in this course? Tell me about how you perceive the classroom environment for your female students. Thinking about the female students in my study tell me about anyone you know of that has experienced some type of stressful or anxious situation. Tell me about what you know about the experience.
3. (VP): Think about the experiences you have had with students in this course. Tell me about an experience you feel had an impact on the decision one of your students made with respect to their pursuit of a science, mathematics or technology major (SMT). Tell me about who was involved and the words you used. How did you feel about this experience? Tell me about your philosophy with respect to providing feedback on written work and facilitating discussions. Tell me about a time you provided words of encouragement to one of the students in my study. What were the words you used and what was the outcome?
4. (VE): Thinking about the students in my study tell me about any relationships you have developed where you feel you in some way affected interest, goals or belief in their ability to persist. Tell me about how you see your role as an instructor with respect to being a role model for your students.

5. (Support): Tell me about any college support services you have suggested to any of the students in my study during the course. Tell me about your perception of how your students experienced these services. Did you feel they received the level of support you expected?
6. (Barriers): Think about the environment of the classroom, the academic expectations, and support provided by yourself, as well as the college. Tell me about any experiences you had with a student where they questioned their ability to succeed. What do you perceive as the experiences that contributed to this feeling? Tell me about how you tried to help them overcome this barrier. What was the outcome? Think about the students in my study and any who have had to overcome barriers that you know of. Tell me about what these barriers were and how they overcame them.
7. In the discussions, I noticed you do X which I interpreted as Y. Tell me about your perception of this discussion and how you feel about my interpretation.

## Appendix D: Journal Protocol

### College as an Adult Student

1. (PA): Tell me about your decision to return to school. What experiences contributed to this decision? Tell me about the experiences that led to your decision to attend the college.
2. (PH): Go back to when you were first considering returning to school. Tell me about the images that came to mind when you thought about yourself being a student again. Tell me about the experiences that contributed to these images and about how you felt physically and emotionally.
3. (PA): Think back to how confident felt about your ability to be successful as a student. What did you expect the experience to be like? Tell me about any specific issues or concerns you had about returning to school and how you expected to address these concerns.
4. (VP): Tell me about some of your experiences as a student your first year at the college. How did you feel being a student again? Think back to a time you questioned your ability to persist. Tell me about this experience and what messages you received either implicit or explicit that made you feel this way.
5. (Barrier): Think about a challenging experience you faced related to your major. Tell me about this experience and what specifically made it challenging. Tell me about how you felt about this experience and who or where you turned for support.
6. (Support): Think about what it has taken for you to successfully complete your course work and persist in your studies. Tell me about the support system you have created and the experiences that led to the need for this type of support.

How did you go about creating this support system? Tell me about the people and/or school related services that are a part of your support system. If you could add some additional type of support, what would it be? Thinking about the types of support systems available to you at school, can you tell me about your experiences with them? What is missing or what type of support would you like to see added?

7. (PA): Think about when you first started this course. Tell me about how prepared you felt and what your expected final grade is. Tell me about what you find particularly challenging in this course.
8. (PH): Think about the course you are currently taking. Tell me about the course. What is it like being a student in this course? Tell me about how being in this course is similar or different for you than being in a non-mathematics course.
9. (VP): Think about the experiences you have had in this course. Tell me about an experience that has been especially meaningful to you. Tell me about who was involved and the words they used that were meaningful. How did you feel about this experience? How did you experience the social interactions in this course?
10. (VE): Thinking about other students in the course tell me about any relationships you have developed that have in some way affected your interests, goals or belief in your abilities to persist
11. (Support): Tell me about any college support services you have used during the course. How did you experience these services? Did you receive the level of support you expected?

12. (Barriers): Think about the environment of the classroom, the academic expectations, and support provided by the instructor as well as the college. Tell me about any point during the course where you questioned your ability to succeed. What were the experiences that contributed to this feeling?

## Appendix E: Observation Protocol

1. What types of interactions take place in the online classroom?
  - a. (VP) Does the participant offer advice to other students in the ask a question area or student lounge or replies to questions students post in the discussion area about content.
  - b. (support) Does the participant use the student lounge or ask-a-question area? How frequently, for what, and who replies?
  - c. (PA) How active is the participant in the online classroom?
  - d. (barriers) How frequently and timely is the student in posting to the discussion?
  - g. (VP) How frequently does the instructor reply in the discussion area or e-mail directly about a discussion response? How frequently does the instructor reach out to the participant if the participant is not participating?
  - h. (barriers) How frequently do students seek help with a difficulty related to technology and what are the difficulties?
2. What is the classroom experience of the participant in my study?
  - a. (VE) When the participant needs help who specifically do they turn to and what kind of response do they get?
  - b. (PA) In discussion responses does the participant reflect on content in a way that demonstrates understanding of the readings and other materials? Does the student make reference to outside sources or make connections to previous courses? Is the student able to construct a meaningful post that answers the discussion question? (*meaningful* will be defined by rubric)

- c. (PA) Does the participant challenge what others have said by referencing their post and asking a question about it such as “that is a really interesting idea but have you thought about this . . . ”? Does the student look to others to check or confirm understanding of the material such as “I am not really sure I am understanding this right, could you tell me if you think I did this right”?
- d. (PA) Does the participant confidently state opinions or ideas by using words such as “My opinion or idea is...”, “This is my suggestion” or “This is what I think...” or does the student hedge by using words such as Lexical hedges occur when a student uses words such as “might”, “probably”, “maybe” or “I think” “In my opinion...” “I think...” “Probably...” “Likely...” “Practically...” “Hopefully...” or “As I understand it...” (Hyland, 2000).
- e. (VP) What words of either encouragement or discouragement does the participant receive? Does the instructor use words of encouragement?
- f. (PH) Does the participant discuss feelings online such as frustration, stress, anxiety or health issues that are preventing her from completing course work on time or making it difficult for her to balance everything? Who does she go to for help, what method of communication does she use, and what is the outcome?
- g. (barriers) Does the participant experience any negativity in the responses of other students or reply in a negative way to other students? Does the participant experience any negativity specifically directed at gender, race, ethnicity, or other environmental factor?



- h. (barriers) How frequently does the student express difficulty learning mathematics online? What are the difficulties? Are they related to technology or content? (support) Who does the student go to for help, what is the response and outcome?
5. What are the intentions of the teachers?
- a. (VP) What are examples of words of encouragement I see used? How frequently does the instructor encourage students, where and how? Does the instructor use unsolicited motivational words in the course announcements or bulletin? In the discussion area or on a written assignment when replying to an incorrect response, what words does the instructor use to provide feedback?
  - b. (support) When a student expresses a lack of confidence in his or her ability to complete an assignment or the course, what actions does the instructor take? What words or used or support services suggested?
  - c. (VE) What teaching methods does the instructor use to try and help the students make connections to mathematics?

## Appendix F: Demographic Questionnaire

(Adapted from Shildneck, 2009)

### Part I: Demographics

1. Name: \_\_\_\_\_

2. Address \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. Phone numbers Home: (\_\_\_\_\_) \_\_\_\_\_ Work (\_\_\_\_) \_\_\_\_\_

Cell (\_\_\_\_\_) \_\_\_\_\_

Please indicate preferred number to be contacted at and time of day

4. E-mail address(es): \_\_\_\_\_

5. Pseudonym for reference during the research process: \_\_\_\_\_

6. Current Age: \_\_\_\_\_ 7. Birthdate: \_\_\_\_\_

8. Ethnicity (optional): \_\_\_\_\_

9. Are you currently employed? YES NO

10. If so, describe your current profession and the number of hours a week you work.

\_\_\_\_\_

Please attach a resume if you have one

11. Which living arrangement best describes your current status?

\_\_\_\_\_ Single, never married \_\_\_\_\_ Separated divorced or widowed

\_\_\_\_\_ Married \_\_\_\_\_ Living with a Partner \_\_\_\_\_ Other \_\_\_\_\_

12. Do you have children? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, please list their ages. \_\_\_\_\_

13. Do you have siblings? \_\_\_\_\_ Number of Sisters: \_\_\_\_\_ Number of Brothers: \_\_\_\_\_

Were you the eldest, middle, youngest? \_\_\_\_\_

14. Did you grow up in a single \_\_\_\_\_ or two parent family \_\_\_\_\_?

If a single family did you primarily live with your mother \_\_\_\_\_ father \_\_\_\_\_ 50/50 \_\_\_\_\_

15. Were your parents both alive growing up yes \_\_\_\_\_ no \_\_\_\_\_

16. In your current household who is the primary income earner? \_\_\_\_\_

17. What time of day do you typically do your schoolwork? \_\_\_\_\_

18. Who is primarily responsible for the household chores?

\_\_\_\_\_ Childcare \_\_\_\_\_

19. Make a timeline of a typical day for you

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## Part II: Schooling

1. Were you identified by the school system as “gifted”? Yes \_\_\_\_\_ No \_\_\_\_\_

If yes, please tell what grade you were identified. \_\_\_\_\_

2. What mathematics courses did you take in middle school and high school?

(Please list course, grade year, and grade) (if unsure indicate unknown)

MS \_\_\_\_\_

\_\_\_\_\_ HS \_\_\_\_\_

3. What academic awards and recognitions were you awarded (elementary through high

School; e.g. student of the month, top math student, etc.)?

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4. What honors organizations were you involved in (e.g. NHS (national honor society)?

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5. What extracurricular activities were you involved in (Band, athletics, student government, science or mathematics related, etc.)?

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6. What after-school, summer, and/or mentoring programs did you attend (Boys Club, Girl Scouts, Bridge, etc.)?

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7. What do you recall your class standing when you graduated from high school?  
(Valedictorian, top 10%, etc.) \_\_\_\_\_

8. Overall GPA: \_\_\_\_\_ Math GPA: \_\_\_\_\_ (if unsure indicate unknown)

9. Test Scores from High School: (if unsure indicate unknown or N/A if you didn't take)

AP TESTS: Subject(s): Score(s):

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SAT Verbal: \_\_\_\_\_ Math: \_\_\_\_\_

ACT Verbal: \_\_\_\_\_ Math: \_\_\_\_\_

10. Is there any other information that you feel is important to include about your

kindergarten through twelfth grade schooling experiences?

**Part III: College Information**

1. What college(s)/university(ies) did you attend and when?

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2. How many credits did you complete prior to enrolling at ESC? \_\_\_\_\_

3. What mathematics courses did you take prior to enrolling at ESC?

(Please give course, year, and grade earned.)

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4. What mathematics courses have you taken/are you currently taking at ESC?

(Please give course, year, and grade earned.)

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5. Have you received any awards/citations while attending ESC? If so, please list them.

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6. What is your GPA \_\_\_\_\_ Major GPA \_\_\_\_\_ (is unsure indicate unknown)

7. Do/did you receive any type of financial support (grants, loans, scholarships)?

Yes \_\_\_\_\_ No \_\_\_\_\_ If yes, please list the name of the scholarship and indicate the nature of the scholarship

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8. Approximately how many hours a week do you spend on course work?

\_\_\_\_\_

9. During your time at ESC have you only taken online courses through CDL?

Yes \_\_\_No\_\_\_

10. If you have taken face to face classes were they through cross registration \_\_\_\_\_ or another ESC center \_\_\_\_\_?

11. List what support services you know of that ESC offers

\_\_\_\_\_

12. List what support services you have used, when you used them and how often

\_\_\_\_\_

\_\_\_\_\_

13. Is there any other information that you feel may be pertinent to the study?

\_\_\_\_\_

\_\_\_\_\_

## Appendix G: Path to STEM of the Participants

Table G1

*Rosa*

Life stage	PA	VE	VP	PSY	Interest	Goals	Outcome expectation
K-5	+A	+T, +M, +F	+T, +M, +F	D, +SE			
MS	-A, +ST, - H, +M		-T, -PS, -TS, - M, -F	-SE			
HS	+A, +ST, - H, +M	+T	+T	+SE	STEM; A; M	LOD	
College	+A			-F	STEM; A	BFA	Acting
Life in between	+W			-F			
CSE	+A, +ST	+EX	+T, +S, +M	-F	STEM	BSLS; BSN	M; HO. WL

PA: STEM (ST); Academics (A); History (H); Art (A); GPA; SAT; Awards; Gifted; Work (W)

VE: Teacher (T); Mother (M); Father (F); STEM experience (EX); Mentor (M)

VP: Teacher (T); Mother (M); Father (F); Spouse; faculty support (FS); peer support (PS); Mentor Support (MS)

PSY: School Experience (SE); Family Life (FL); Isolation (I); Finances (F); Gender (G); Health; Frustrations (FR); Anxiety (A); Tragedy (T); Divorce (D); Health Family Member (HF)

Interest: STEM, Art, History, Music; Multiple (M)

Goals: Bachelor of Fine Art (BFA); Bachelor Nursing (BSN); Lack of Direction (LOD)

Outcome Expectation: helping others (HO); Work Life Balance (WL)

**Rosa:** no negative environment or gender

**Pre-college:** positive family; negative MS academics; negative peer MS; lack of clear goals in HS: success in math and science; mixed messages from parents

**College:** motivation for college major: waitlisted at MIT; accepted at USC: BFA  
1qObstacle that results in not finishing: finances

**Adult life:** AHA moment: desire for consistent paycheck and life balance, interaction with CSE student; return to school; **motivation to study life science:** HS success in math/science; interest in mathematics and science; STEM experience (friend in pharmaceutical research); money

**CSE experience:** positive instructor and mentor support; spousal support; online school critical to balance; had to take term off due to unemployment/lack of funds to pay for school

**Career goal:** Work in pharmaceutical research; master's degree

**Outcome expectation:** able to make a difference in lives of others; will be “fun”; high income; will be able to get a job, positive work/life balance; positive work climate



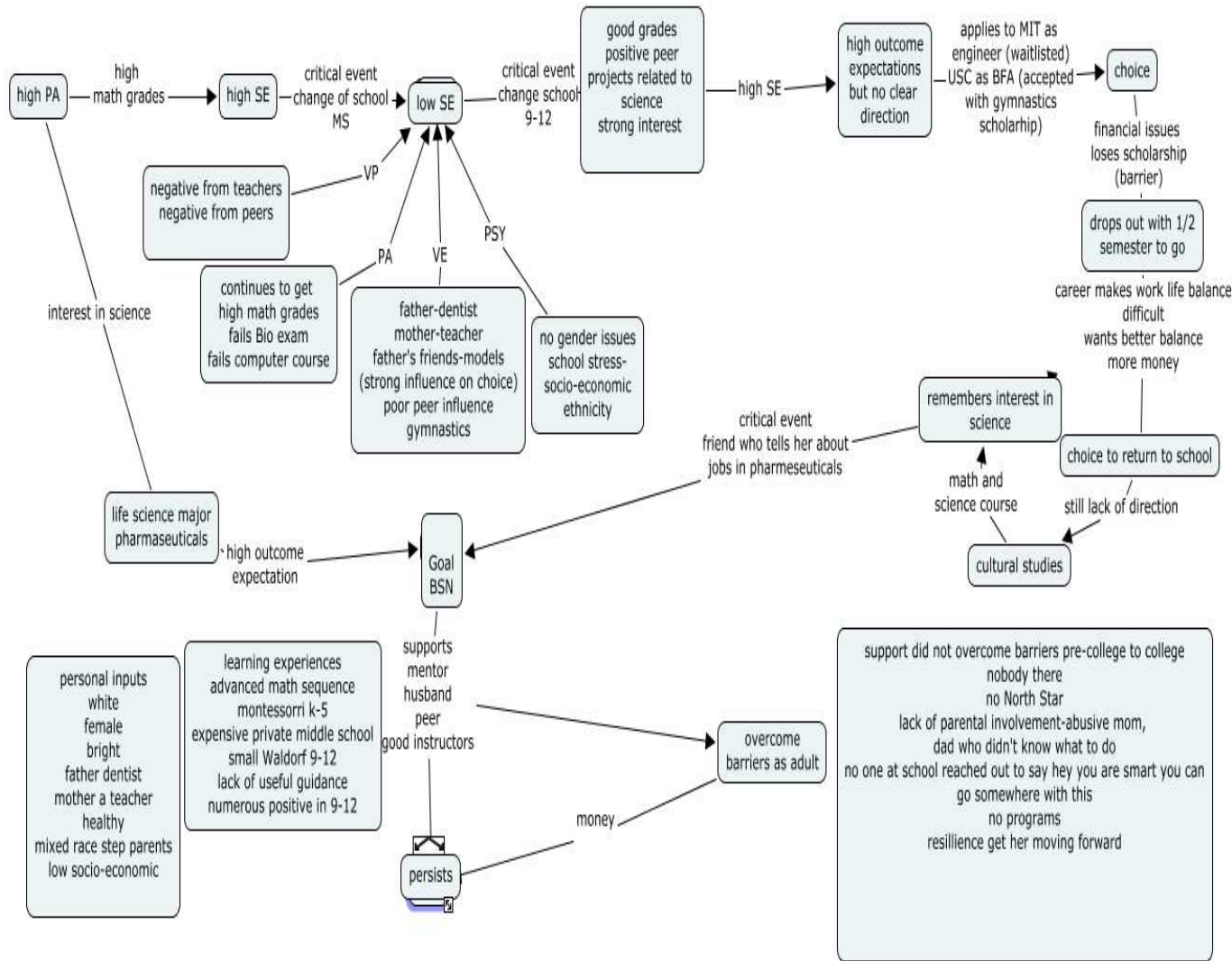


Figure G1. Rosa's life map.

Table G2

*Angie*

Life stage	PA	VE	VP	PSY	Interest	Goals	Outcome expectations
K-5	+A						
MS	+A, +ST						
HS	-A, +ST	+T	-T	-FL, - SE	STEM, MU	LOD	
College	-A, +A						
Life in between	+W	+O	+S				
CSE	+A, +ST		+S	T		PhD, teacher	+WL, HO

PA: STEM (ST); Academics (A); History (H); Art (A); GPA; SAT; Awards; Gifted; Work (W)

VE: Teacher (T); Mother (M); Father (F); STEM experience (EX); Mentor (M); Other (O)

VP: Teacher (T); Mother (M); Father (F); Spouse; faculty support (FS); peer support (PS); Mentor Support (MS)

PSY: School Experience (SE); Family Life (FL); Isolation (I); Finances (F); Gender (G); Health; Tired (T); Frustrations (FR); Anxiety (A); Tragedy (T); Divorce (D); Health Family Member (HF)

Interest: STEM, Art, History, Music (MU); Multiple (M)

Goals: Bachelor of Fine Art (BFA); Bachelor Nursing (BSN); Lack of Direction (LOD)

Outcome Expectation: helping others (HO); Work Life Balance (WL); Money (M)

**Angie:** gender issues in military but doesn't affect her; no gender issues or negative classroom environment

**Pre-college:** negative family; negative HS academics; negative teacher HS; lack of support/guidance HS; success in math and science HS; lack of clear goals

**College:** obstacle that results in not finishing: kidnapped in Lebanon

**Adult life:** success in professional life; completed AS; AHA moment: military will pay for school; return to school; **motivation to study Physics:** HS success in math; lack of HS role model; interest in mathematics and science

**CSE experience:** positive instructor and mentor support; negative instructor; peer support; online school and work from home critical to balance; supportive in discussion posts

**Career goal:** PhD Physics; physics teacher; start school in Africa;

**Outcome expectation:** able to make a difference in lives of others; able to be the "fun" teacher

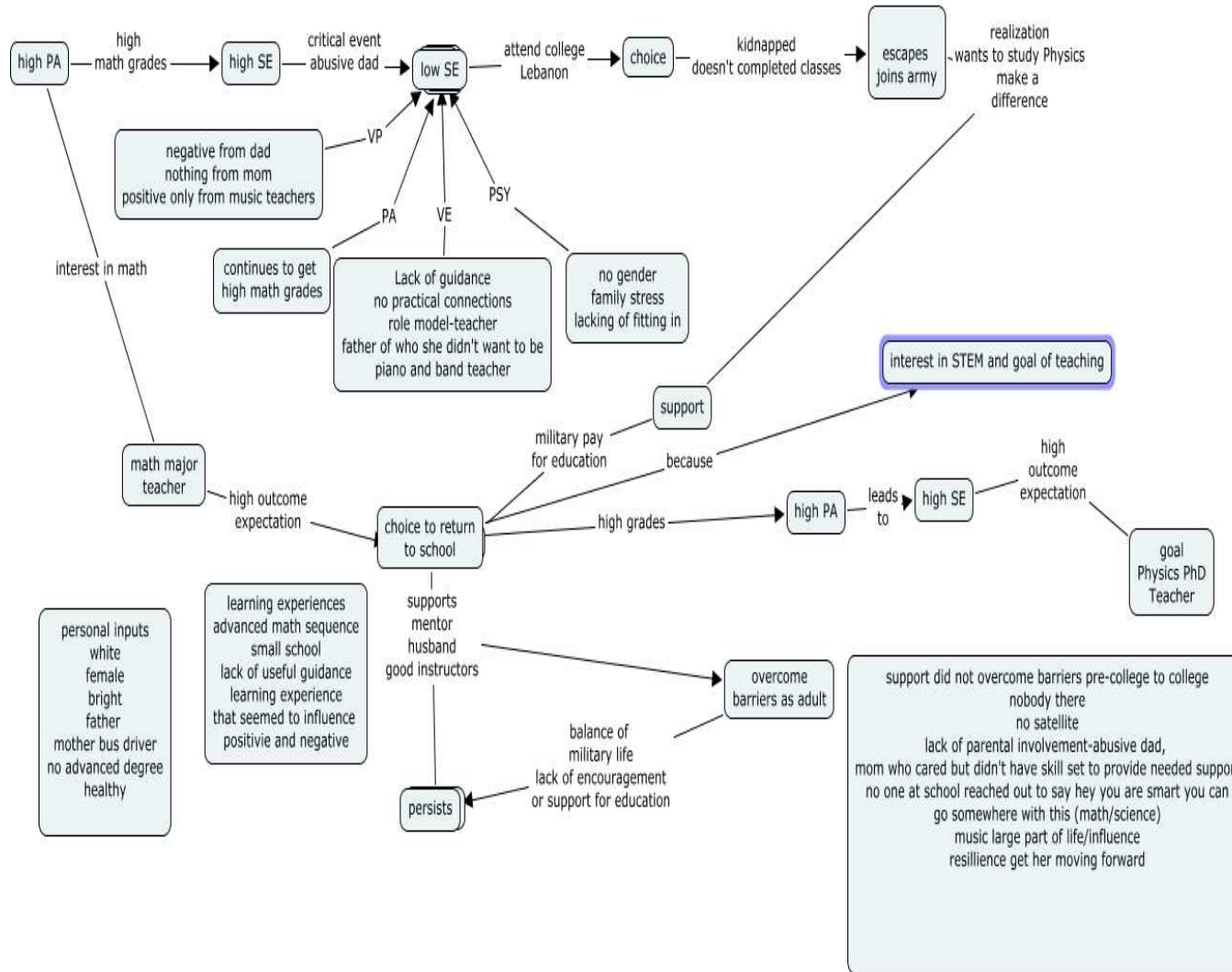


Figure G2. Angie's life map.

Table G3

*Jeanie*

Life stage	PA	VE	VP	PSY	Interest	Goals	Outcome expectations
K-5	+A	+F	+M, +F	-HF	STEM		
MS	+A, +ST			-HF	STEM		
HS	-A, +ST			-HF	STEM		
College	+A, +ST		+S	-H	STEM	Pre-med	HO
Life in between	+W	+O	+S		STEM	Pre-med	HO
CSE	+ST		+S, +FS		STEM	PA	HO, WL

PA: STEM (ST); Academics (A); History (H); Art (A); GPA; SAT; Awards; Gifted; Work (W)

VE: Teacher (T); Mother (M); Father (F); STEM experience (EX); Mentor (M); Other (O)

VP: Teacher (T); Mother (M); Father (F); Spouse; faculty support (FS); peer support (PS); Mentor Support (MS)

PSY: School Experience (SE); Family Life (FL); Isolation (I); Finances (F); Gender (G); Health; Tired (T); Frustrations (FR); Anxiety (A); Tragedy (T); Divorce (D); Health Family Member (HF)

Interest: STEM, Art, History, Music (MU); Multiple (M)

Goals: Bachelor of Fine Art (BFA); Bachelor Nursing (BSN); Lack of Direction (LOD); physician's assistant

Outcome Expectation: helping others (HO); Work Life Balance (WL); Money (M)

**Jeanie:** no negative classroom environment or gender issues. Acknowledges gender issues do exist within medical community but don't impact her

**Pre-college:** positive family; negative health; lack of support/guidance HS; success in math and science HS; clear goals

**College:** motivation for college major: experience as translator-Spanish obstacle that results in not pursuing pre-med: health issues in college, doesn't get accepted

**Adult life:** success in professional life; AHA moment: meets physician's assistant; return to school; **motivation to study science:** prerequisites for PA school;

**CSE experience:** positive instructor and mentor support; negative instructor; online school critical to balance; reaches out for instructor help in e-mails

**Career goal:** PA

**Outcome expectation:** able to make a difference in lives of others; work life balance; positive work environment, no gender issues

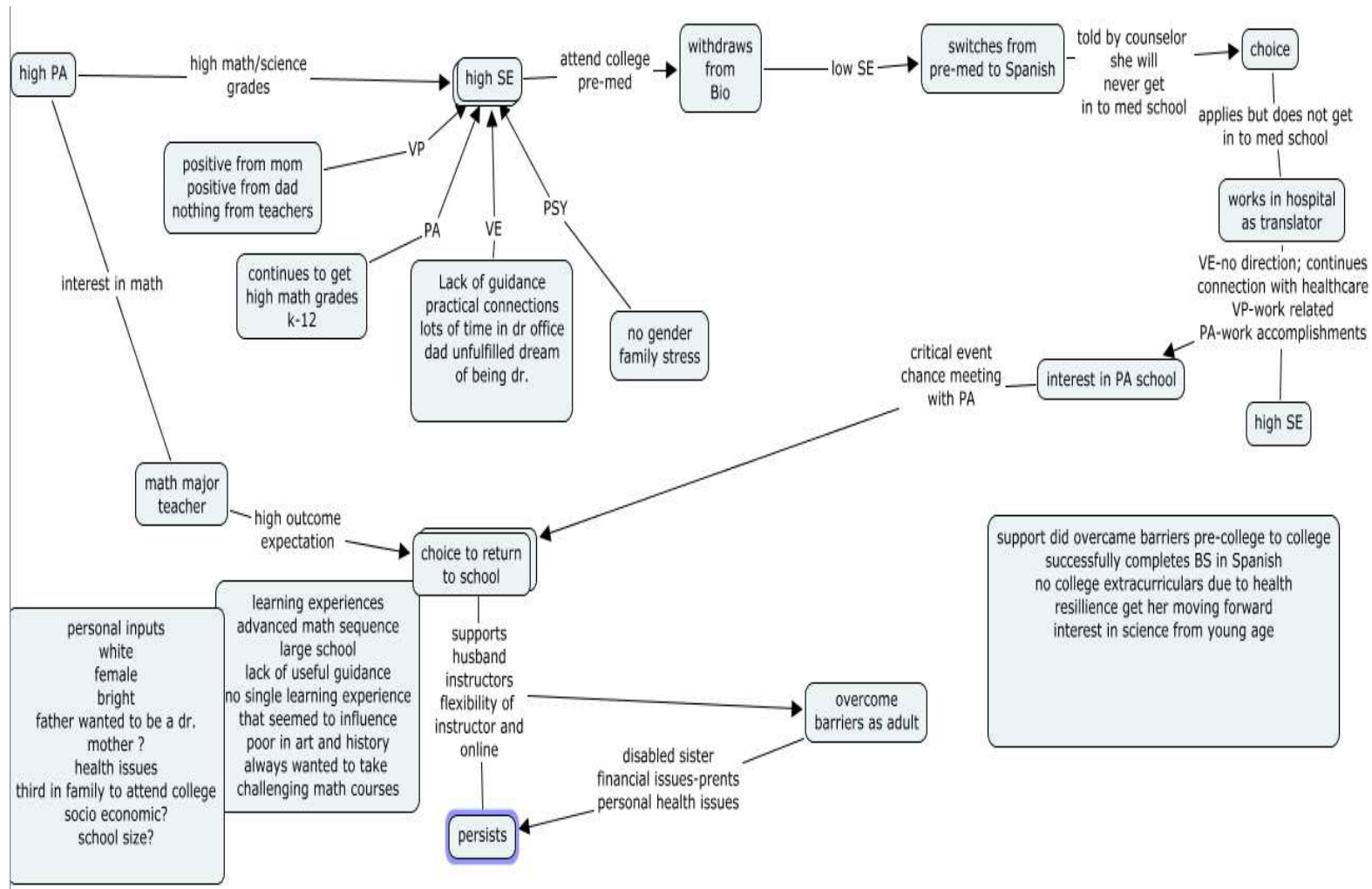


Figure G3. Jeanie's life map.

Table G4

*Luisa*

Life stage	PA	VE	VP	PSY	Interest	Goals	Outcome expectations
K-5	+A, -ST	+O	+M				
MS	+A, +ST	-F					
HS	+A, +ST	-A			STEM	LOD	
College	-ST	-T, -A			STEM	LOD	
Life in between	+W	+O		-F, D			
CSE	-ST, +ST				STEM	money	

PA: STEM (ST); Academics (A); History (H); Art (A); GPA; SAT; Awards; Gifted; Work (W)

VE: Teacher (T); Mother (M); Father (F); STEM experience (EX); Mentor (M); Advisor; Other (O)

VP: Teacher (T); Mother (M); Father (F); Spouse; faculty support (FS); peer support (PS); Mentor Support (MS)

PSY: School Experience (SE); Family Life (FL); Isolation (I); Finances (F); Gender (G); Health; Tired (T); Frustrations (FR); Anxiety (A); Tragedy (T); Divorce (D); Health Family Member (HF)

Interest: STEM, Art, History, Music (MU); Multiple (M)

Goals: Bachelor of Fine Art (BFA); Bachelor Nursing (BSN); Lack of Direction (LOD)

Outcome Expectation: helping others (HO); Work Life Balance (WL); Money (M)

Luisa: no negative environment or gender

**Pre-college:** negative family; lack of clear goals in HS; success in math and science HS; positive verbal messages from mother; senior year HS in college

**College:** motivation for college major: seemed natural progression-engineer

Obstacle that results in not finishing: academic failure, doubt about direction. Lack of peer support or faculty guidance

**Adult life:** motivation to return to school: divorce, money, desire to do something more challenging

AHA moment: interaction with CSE student; return to school; **motivation to computer:** HS success in math/science; interest in mathematics and science; money

**CSE experience:** positive instructor and mentor support; negative instructor experience; online school critical to balance; lacking motivation to keep going

**Career goal:** make 6 figures.

**Outcome expectation:** able to make a difference in lives of others; high income; will be able to get a job

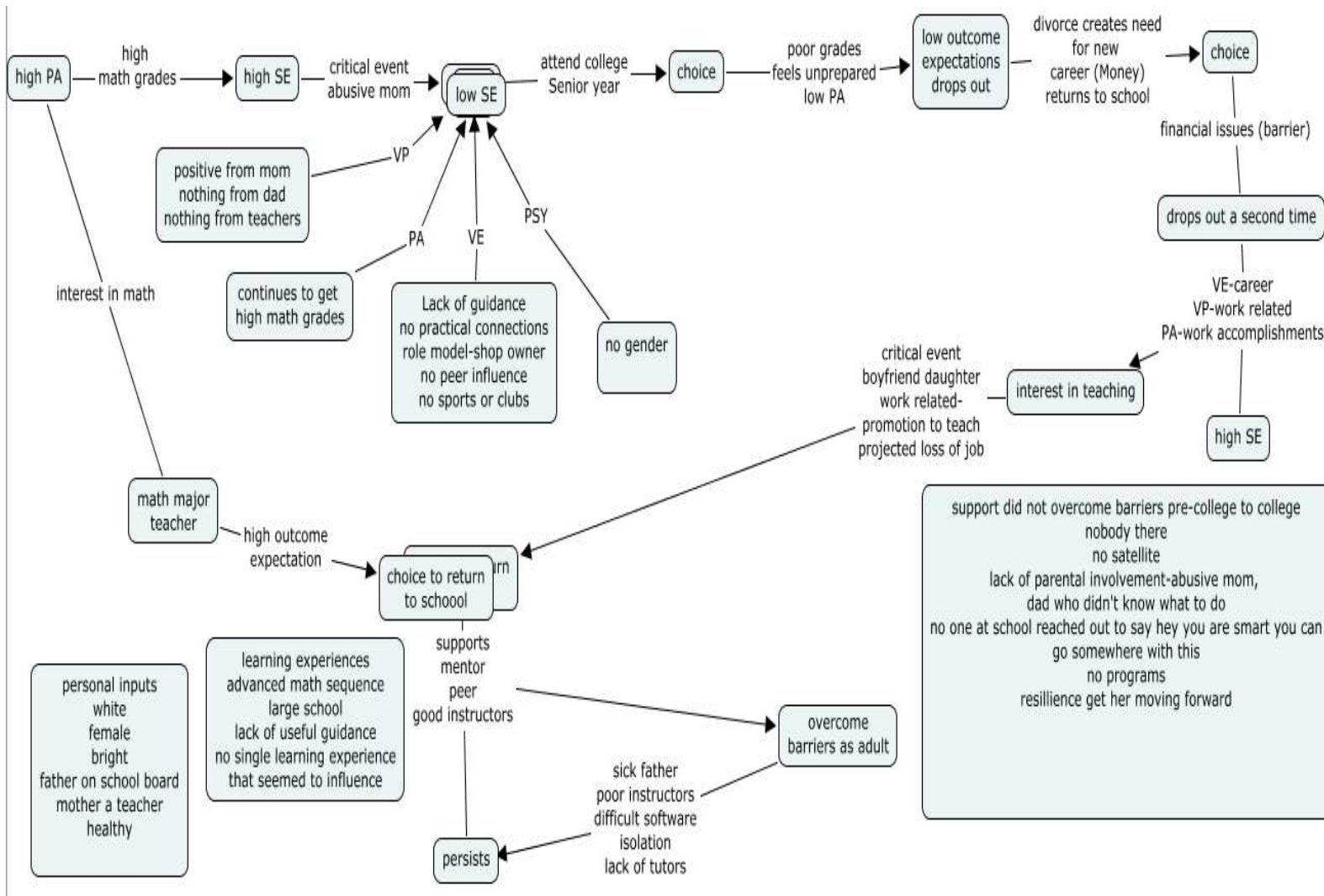


Figure G4. Luisa's life map.

Table G5

Alice

Life stage	PA	VE	VP	PSY	Interest	Goals	Outcome expectation
K-5	+A	+M, +F	-M	-FL			
MS	+A, +ST						
HS	-A, +ST, -H				STEM	LOD	
College	+ST				STEM	BS computers	
Life in between	+W	+O			STEM		
CSE	+A, +ST, - ST				STEM	teacher	HO, WL

PA: STEM (ST); Academics (A); History (H); Art (A); GPA; SAT; Awards; Gifted; Work (W)

VE: Teacher (T); Mother (M); Father (F); STEM experience (EX); Mentor (M); Other (O)

VP: Teacher (T); Mother (M); Father (F); Spouse; faculty support (FS); peer support (PS); Mentor Support (MS)

PSY: School Experience (SE); Family Life (FL); Isolation (I); Finances (F); Gender (G); Health; Tired (T); Frustrations (FR); Anxiety (A); Tragedy (T); Divorce (D); Health Family Member (HF)

Interest: STEM, Art, History, Music (MU); Multiple (M)

Goals: Bachelor of Fine Art (BFA); Bachelor Nursing (BSN); Lack of Direction (LOD)

Outcome Expectation: helping others (HO); Work Life Balance (WL); Money (M)

**Alice:** No negative environment or gender issues

**Pre-college:** negative family; negative HS academics; poor peer role models HS; lack of support/guidance HS; success in math and science HS; lack of clear goals; last year of HS in college

**College:** obstacle that results in not finishing: financial;

**Adult life:** success in professional life; positive teaching experience; AHA moment: interaction with boyfriends daughter, notice at work, interaction with CSE student; return to school; **motivation to study mathematics:** HS success in math; lack of HS role model; interest in mathematics; career goal of becoming a mathematics teacher

**CSE experience:** positive instructor and mentor support; negative instructor; peer support; online school and work from home critical to balance; supportive in discussion posts; didn't graduate in spring due to father's stroke and passing

**Career goal:** mathematics teacher

**Outcome expectation:** employment due to demand for mathematics teachers; able to make a difference in lives of others; will allow for work/life balance



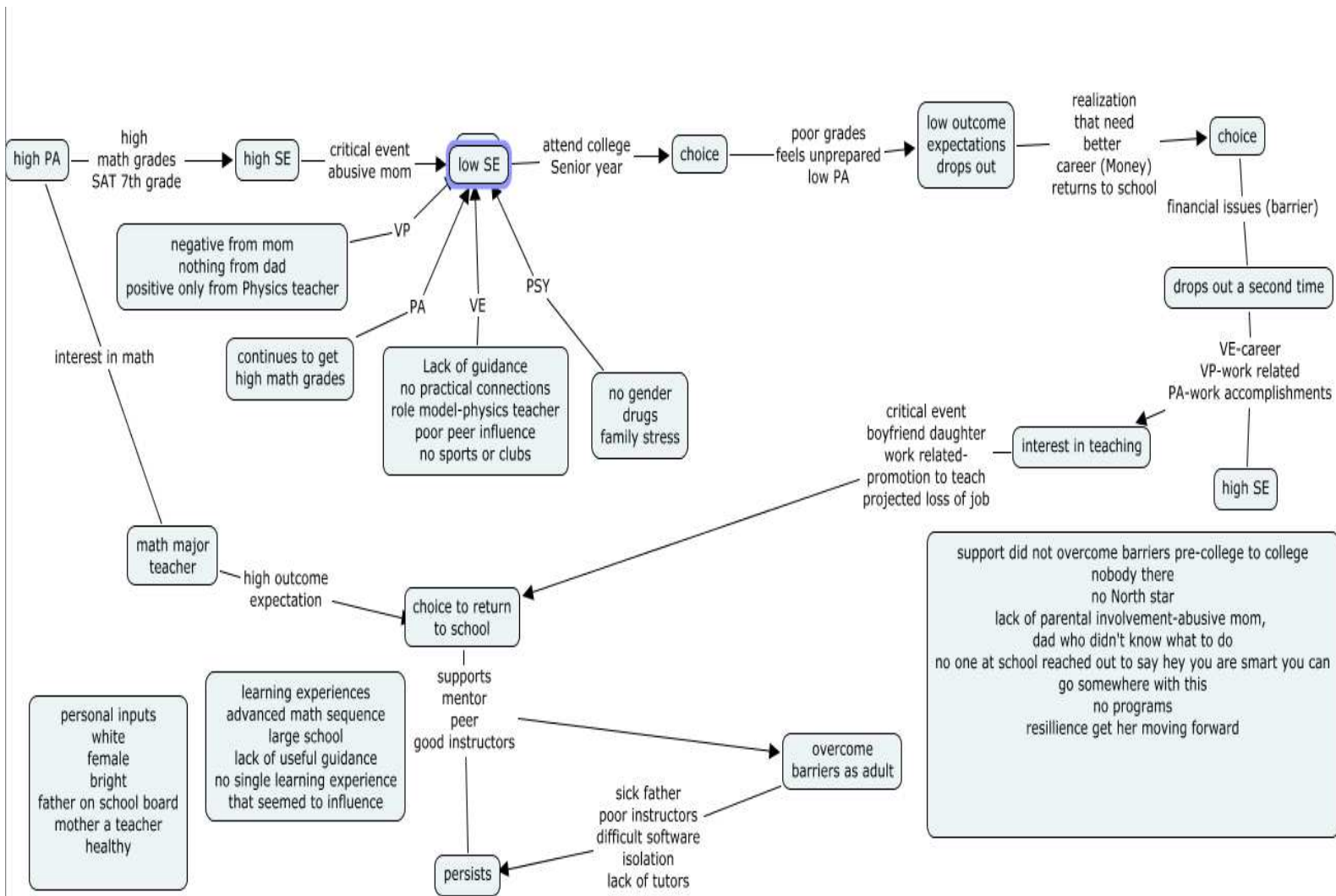


Figure G5. Alice's life map.