Five Adult Women Science, Technology, Engineering and Mathematics (STEM) majors: A Portraiture of their Lived Experiences

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Patrice Prusko Torcivia

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Abstract

A review of literature shows that there have been numerous studies on science, technology, engineering and mathematics (STEM), and their relation to education and gender from elementary school pedagogy to career choices for traditional-aged college students. Little research has been done on non-traditional female students returning to the university to study science, technology, engineering and mathematics (STEM). This research design used the portraiture methodology and the idea of being an educational connoisseur (Eisner, 1997; Lawrence-Lightfoot & Davis, 1997) to explore the lived experiences of five non-traditional female students returning to the university to study a science, technology, engineering or mathematics (STEM) major. It is situated in an interpretivism paradigm and utilizes interview, 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 my study influenced their goals, interests and outcome expectations related to studying STEM. I used the social cognitive career theory (SCCT) 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 their lived experiences. The interview used a conversational format with a semi-structured protocol allowing the participant to lead the direction of their story.
Chapter 1 - Introduction

Background

Why is it important to understand the lived experiences of adult women and the role of social cognitive variables and environmental factors in their choice to pursue science, technology, engineering and mathematics (STEM) related majors and careers? The world is a technology based society where many of the high-paying jobs require a background in mathematics or science. In 2003-2004 students who had a Bachelor degree in an engineering field started out with the highest average salaries (Jacobs, 2005). In 2007 a person with a Bachelor degree had a mean annual income that was more than $36,000 higher than that of a high school dropout (Khatiwada, McLaughlin, Palma, & Sum, 2007). Replicative data also show that with a college education men earn about $7,000 more per year than college-educated women (U.S. Census Bureau, 2009; U.S. Department of Labor, 2009; U.S. Department of Labor Women’s Bureau, 2009). When combined, one can see the significance an education has 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 economic status. In order for women to pursue these careers, they must surmount the obstacles they face related to mathematics so that they can continue on to higher and more advanced mathematics classes, as this allows them greater access to high-paying science, technology, engineering and mathematics (STEM) careers.
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For well over twenty years researchers have been trying to determine what factors influence whether women pursue science, technology, engineering and mathematics (STEM) majors and related careers. After 20 years of research the number of women seeking science, technology, engineering and mathematics (STEM) degrees is still of concern. Subsequent to this research, Jacobs (2005) found that while the gap between the number of women and men pursuing STEM careers is smaller, there are still a significantly lower number of women than men entering the fields of mathematics and science.

Are the career choices women make a result of a critical event in their lives or of the experiences they have throughout their lives? It is important for families, educators, and administrators to better understand why women are poorly represented in science, technology, engineering and mathematics (STEM) fields. Encouraging more women to pursue these areas of study is important for societal as well as economic reasons. Also, we are talking about over half of the population. That is a huge potential resource for employers as well as society. 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…the sky is vaster than we know…we are always viewing only pieces of it. Which pieces get focused on is influenced by individual and social factors” (p. 264). The value of science, technology, engineering and mathematics (STEM) knowledge to the future of our world makes it imperative that these fields engage as wide a variety of stakeholders as possible.

The portraiture methodology allowed for an in-depth exploration of how the lived experiences of the five women in this study influenced their goals, interests and outcome expectations related to a science, technology, engineering and mathematics (STEM) career. Portraiture is important from a research standpoint as it offers an opportunity to provide greater
insight and understanding as to how non-traditional female students in science, technology, engineering and mathematics (STEM) majors experience life and construct their views of the world. It is my goal that, using portraiture, this study of non-traditional female students may help to provide family, educators and administrators 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

**Non-traditional learner:**

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

- have delayed enrollment into postsecondary education
- attend part time
- are financially independent of parents
- work full time while enrolled
- have dependents other than a spouse
- are a single parent
- lack a standard high school diploma.
- 25 years or older (Lumina Foundation for Education, 2010)

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

**Successful completion**—For the purposes of this study successful completion will be defined as completing the course with a grade of “C” or better.

**Self-efficacy**—Mathematics self-efficacy is defined as “…an individuals’ judgments of their capabilities to solve specific math problems, perform math related tasks, or succeed in math related courses (Pajares and Miller, 1994, p.194).” Prior research using Social-Cognitive Career Theory (SCCT) has supported the model where outcome expectations are dependent upon a person’s either 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 Social-Cognitive Career Theory expands upon this idea by maintaining that people with a higher level of self-efficacy for a certain task will tend to develop interests in this 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 will be as defined by Lent et al. (2010) and include social, material, and financial factors such as socio-economic status (SES), family or peer support, or stereotype threat.

**Framing the study**

I used the social cognitive career theory (SCCT) to guide data collection and analysis as I explored how the lived experiences of the women in my study influenced their interests, goals and outcome expectations related to science, technology, engineering and mathematics (STEM) careers (Brown & Lent, 1996; Lent, Brown & Hackett, 1994, 2000; Lent, Paixão, & Leitão,
Social cognitive career theory (SCCT) was originally developed by Lent, Brown and Hackett (1994) as a way to combine different career theories into one model.

Social cognitive career theory (SCCT) has been extensively used to understand how environmental factors impact the ways in which a variety of age groups develop interests, outcome expectations and career goals (Lent, Brown, & Hackett, 1994). A review of literature revealed that the social cognitive career theory (SCCT) has been widely used to look at science, technology, engineering and mathematics (STEM) majors and tested across a wide variety of age groups and ethnicities from middle school through traditionally-aged college students. Literature is lacking in research related to non-traditional female students returning to school in a science, technology, engineering and mathematics (STEM) major. 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.

The social cognitive career theory (SCCT) primarily examines the relationship between self-efficacy, outcome expectations, personal goals and contextual supports and barriers and how they influence choice (Lent, Paixão, & Leitão, 201). Lent, Brown, and Hackett (1994) proposed three different social cognitive career theory models based upon the previously mentioned relationship: interest development, choice and performance.

A review of literature shows there have been numerous studies using social cognitive career theory (SCCT) to look at a range of populations from middle school up to traditional college-age women but none on non-traditional female students returning to school. As seen in The three social cognitive variables within the theory are self-efficacy, outcome expectations and personal goals (Lent, Brown & Hackett, 1994). Bandura defined self-efficacy as, “...people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (as cited in Pajares and Miller, 1994, p. 391). The four
primary sources of self-efficacy are personal accomplishment, verbal persuasion, vicarious learning experiences and physiological and emotional state (Bandura, 1977). Whereas personal accomplishment and physiological and emotion state are individual experiences, verbal persuasions and vicarious learning are social experiences. Figures 1 and 2 show the potential influence lived experiences may have on a woman’s interest, goals and outcome expectations as they relate to STEM.
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Figure 1

Undesirable Experiences (low SE)

High Barriers

Positive Intervention

Lack of interest in mathematics

Chooses non-STEM major

Critical event

Leaves school

No Positive Intervention

interest in mathematics

Chooses STEM major

Critical event

environmental factor over rides

Persist

Changes to non-STEM

Pure interest

Returns to school as STEM major

Experiences related to SE
Supports and barriers
Potential Path 2

Desirable Experiences (High SE)
High support
Low Barriers

Pure Interest in mathematics

Environmental factor over rides interest

Chooses non-STEM major

Chooses STEM major

Critical event

Leaves school

Critical event

Pure interest

environmental factor creates interest

Returns to school as STEM major

Experiences related to SE
Supports and barriers

Persists

changes to non-STEM
According to Tobias (1993) girls base their choices on how valuable they perceive the choice to be and their expectation of how well they will do. A common perception is that women have lower levels of confidence with respect to mathematics and will have to overcome greater obstacles if they choose to pursue a mathematically related career (Henrion, 1997). Henrion discusses how difficult it is to change habits, customs and assumptions that have been deeply embedded in our society. Although as a young girl 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 non-traditional female students in my study influenced their interest, goals and outcome expectations related to studying science, technology, engineering and mathematics (STEM) may lead to a better understanding how to get not just more non-traditional female students, but girls of all ages, to pursue science, technology, engineering and mathematics (STEM) majors.

This study examined how the lived experiences of the five non-traditional female students in my study influenced their interest, goals and outcome expectations related to science, technology, engineering and mathematics (STEM). Through in-depth interviews, observations of online classroom interactions, artwork, journaling and document collection (artifacts) I explored the lived experiences of the five non-traditional female students in this study and gained deeper insight into how they constructed their beliefs about whether they are capable of being successful in a science, technology, engineering and mathematics (STEM) major and career. I gained a deeper understanding into the role self-efficacy, supports and perceived and actual barriers plays in the development of this belief.

Four of the non-traditional female students in this study returned to the university to finish an uncompleted degree and one, with a completed BS degree in Spanish, returned because
her goals had changed. In this study I gained deeper insight into what motivated them to return to school, and why, the second time around, they believe a science, technology, engineering and mathematics (STEM) major is a viable option.

I weaved the threads of their each of their stories into five individual portraits that vividly describes the uniqueness of each of their lives. It is my goal that these stories will inspire other women as well as offer guidance to teachers, families and universities.

It should be noted that how I, as the researcher interpreted the data and retell the stories has been impacted by my personal belief system that was influenced by my personal social and cultural context (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997; Patton, 2002). I discuss this in more detail in the section on researcher bias.

**Significance of Study**

This study is important because it addresses a gap in the literature pertaining to a deep understanding of the lived experiences of non-traditional female students who return to the university to study science, technology, engineering and mathematics (STEM). Where many studies examine the career issues of females with respect to science, technology, engineering and mathematics (STEM) majors (Byars-Winston & Fouad, 2008; Fouad, & Smith, 1996; Montgomery, 2009), a review of the literature shows few, if any, studies to date have examined the lived experiences of non-traditional female students who return to the university to study science, technology, engineering and mathematics (STEM). By studying the lived experiences of non-traditional female students who are within 16 credits of graduating, themes that are specifically related to persistence may emerge.
Lent, Paixão, Silva, and Leitão (2010) specifically state the need for social cognitive career theory (SCCT) to be researched beyond the predominately researched scope of traditional college students with a basic focus on interest and choice. They suggest expanding the research to include a focus on contextual variables such as supports and barriers and include populations of adult learners. In this study I addressed the need for research of non-traditional learners and contextual variables. The information gained can direct future research by bringing to the surface themes that emerge. In addition, the information gained can be used to educate teachers, family, and businesses in how to develop both in reach and outreach programs that engage women and enable them to persist.

Data collection and analysis illuminated the needs and concerns of the five non-traditional female students in this study. Initial studies of social cognitive career theory (SCCT) (Lent, Brown & Hackett, 2000) focused on socio-cognitive variables such as self-efficacy, outcome expectations and personal goals, without considering the interaction of sociocultural variables. Lent and Brown (2006) later modified their theory to include contextual supports and barriers. This expanded the theory from simply looking at internal variables, which seemingly a person can control, to taking into account external variables (such as discrimination, lack of role models and negative classroom experiences) which are outside of an individual’s control. The portraiture methodology enabled me to give the five women in my study a voice, and through the telling of their stories, gain a deeper understanding of the complexity of their lived experiences as non-traditional female women science, technology, engineering and mathematics (STEM) students.
In the next section I review literature around the following themes: 1) Women in science, technology, engineering and mathematics; 2) Non-traditional female students 3) Social cognitive career theory.

Chapter 2: Literature Review

Women in Science, Technology, Engineering and Mathematics (STEM)

Learning Experience

The economic implications for women are clear and need to be looked at from multiple directions. If women opt out of science, technology, engineering and mathematics (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 (SES) 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 (SES), 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 impact later career interests, goals and outcome expectations?

In a study of 600 six and seven year old low income children of single women Ricciuti, White et al. (1993) discovered that the ability level and education of the mother along with poverty level all had a direct effect on a child’s school readiness and achievement. Crane (1996) discovered that it was not specifically the mathematics ability of the mother that impacted readiness and achievement, but the fact that women who did better in mathematics had a higher
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socio-economic status (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 a choice of college major and development of career goals students must make course selections in high school. Davis-Kean and Simpkins (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 only included 180 children (54% were 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 impact on math self-concept then this group, in general, may be expected to have higher math self-concept. According to Zarett and Malanchuk (2005) parental background does not impact 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 information technology (IT) career. Additionally, they state that those who early in their school career perceived themselves to be good at mathematics were more likely to pursue computer-related courses and go onto “hard” information technology (IT) jobs. Even after accounting for social and psychological
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factors gender still predicted that males were more likely to pursue “hard” information technology (IT) career paths.

A study of 100 students (approximately 50% female, 50% male) discovered 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 perceive their mathematics ability to be lower than it actually is. It should be noted here that this was a small sample size of children in grades three through six. 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, twenty-one percent of boys as compared to eleven percent of girls considered their mathematical abilities to be above average; and nineteen percent of boys and nine percent of girls considered themselves above average in science (Sullivan, 2009).

Women in College

Today, more women, overall, are attending college and receiving degrees. 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 in operation, female enrollment in technical fields at El Paso Community College has more than doubled (DiBenedetto as cited in Brown, 2001).
In 1996, as part of a gender equity project consisting of secondary schools across Australia, Willis (1996) discovered that while many women have 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 (Women in America, 2010). Our society needs to hear the diverse ideas of these women. In addition, women deserve equal access to higher paying science, technology, engineering and mathematics (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 (Women in America). Women are more likely than men to live alone (8%:6% respectively) and to be a single head of household (13%:6%, respectively) (Women in America). In 2009, 28% of unmarried working women with children had incomes below the poverty level compared to 6% among male workers (Women in America).

Although the number of women enrolling and completing college has surpassed men (Parker and Wang, 2011), the low numbers of female students majoring in mathematics and science continues to be a problem for our society. Whereas in 1970 only 8% of women were college graduates, in 2009 that number went up to 28% (Women in America, 2010). By 2010 that number increased to a record 36% (Parker and Wang, 2011). Yet, 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 (Women in America). 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, 2011).

In 2009, worldwide, women earned two-thirds of all undergraduate degrees, but only one-third of all undergraduate degrees in technology and science (National Center for Education Statistics, 2009). At the PhD level only 1% of all females earned degrees in science, technology, engineering and mathematics (STEM) fields (Jacobs and Simpkins, 2005). The Conference Board of the Mathematical Sciences (CBMS) numbers show a similar decline in the percentage of women mathematical and science majors since 2000. According to CBMS, the percentages of bachelor's degrees in the mathematical 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 to 2007 the percentage of all bachelor's degrees that went to women increased from 53.2% to 57.4%. However, the percentage of bachelor's degrees in mathematics earned by women decreased from 46.2% to 44.1%. From the period 1984 to 2007, the number of women earning Computer and Information Science degrees dropped from a peak of 37.1% down to only 18.6%. Perhaps the most discouraging figures are for women in engineering. The period of 1990 to 2002 saw an increase from 15.4% to 20.8% in women earning engineering degrees. However, during the next five years this 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 (Bureau of Labor Statistics, 2009). Working women tend to spend less time at work and more time on household tasks which could impact their views on
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accessibility and belief they can be successful in more demanding science, technology, engineering and mathematics (STEM) careers. In 2009 employed married women age 25–54 spent 7 hours and 40 minutes per day on work-related activities as compared to about 8 hours and 50 minutes for men. In contrast employed wives spent about 40 minutes more time on household-related activities (US Department of Labor, 2009).

Information Technology (IT) is a field that is rapidly growing and, therefore, 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 computer ($1,253 median weekly earnings) and engineering fields ($1,266 median weekly earnings) (Bureau of Labor Statistics, 2009). In 2006, according to the National Science Foundation (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). A study by 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, Vilner and Zur 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 as 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, yet for Linear Algebra 31% of men
passed compared with 26% of women. Gal-Ezer, Vilner and Zur are currently working on further studies into the mathematics courses to try and understand whether there is something about discrete mathematics that led to higher pass rates for women.

Enrollment in advanced-level Computer Science (CS) courses was between 78 and 82% male and between 18 and 22% female. Gal-Ezer, Vilner and Zur 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) supports the need for formal faculty and Information Technology (IT) professional mentoring for women to increase retention. Agosto, Gasson and Atwood 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 anti-social. Another critical theme that emerged was the need for role models. The research reviewed supported that a lack of role models leads to women’s lack of knowledge about the field and industry resulting in their pursuing other interests. Literature also supported a continued perception of IT being too nerdy. The literature suggests 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, Gasson and Atwood 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 Information Technology (IT) students, both those who had and had not chosen IT as their major, to learn about their perceptions and misconceptions about information technology (IT) careers. Ninety-eight students
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responded, 63.3% male and 36.7% female. Only 11 of the 31 female respondents had chosen to
study information technology (IT). 69.5% of the female respondents had stopped studying
information technology (IT) by the end of 10th grade with 85.7% of those giving the reason they
didn’t want to be classified as a nerd. On a Likert scale of one to five with one representing
“definitely”, the female participants had a mean rating of 2.42 for the question as to whether it is uncool to be interested in computers. Fifty-nine percent of the students said they didn’t know any
women in the information technology (IT) industry and 56.1% said they didn’t know any role
models. Perceptions about information technology (IT) came primarily from course work, peers and the media.

Ballard, Scales and Edwards (2006) surveyed 42 women who were in career transition on
their knowledge of women in information technology (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 information technology (IT) with 88% feeling information technology (IT) jobs were creative. The perception that information technology (IT) is creative was positively associated
with knowing women in the information technology (IT) field. Ballard, Scales and Edwards
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 women who are currently working may see information technology (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 in this study.

An exploratory case study of nine women (Hua, 2010) who persisted in an information
technology (IT) career discovered that women who had higher aptitude, ambition, self-
confidence, and better coping strategies had greater career longevity. Only one out of the nine women in the study attended college with the intent to study information technology (IT). The other eight women chose information technology (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 supports the theory that socio-economic status, 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 information technology (IT) fields.

Research supports that girls tend to have lower pass rates than boys in advanced level mathematical courses and view studying computer courses and working in that field as nerdy and anti-social. There is a lack of role models available to girls and research supports the need for role models. Studies found women who either worked in the field or knew someone who did had more positive perceptions of information technology (IT) as a career.

**Non-traditional female students in science, technology engineering and mathematics (STEM)**

My study focused on non-traditional female students studying science, technology, engineering and mathematics (STEM), a population on which there has been little to no research.
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A review of literature found many studies based upon a population of non-traditional female students attending community college with a focus on persistence and barriers to success. Research shows women are motivated to return to college so that they can increase their salary, receive a promotion or simply for personal satisfaction (Dey & Hill, 2007; Kramarae, 2003). Women may not succeed due to obstacles such as fear, low self-concept, or low self-efficacy (Gorback, 1994), family responsibilities or access (Kramarae, 2003).

Furst, Bowe and Dittman (2001) examined 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 career. Although these results are inconsistent with the reasons usually attributed to women returning to school, due to 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 impact their motivation to return to school. Seventy-five percent of the women in this study chose distance learning for the convenience and flexibility which allow 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 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, and there was therefore little support for them. Time, family and work were mentioned as barriers which is consistent with other research. This
study only had 40 participants and there was no statistical analysis so it is not clear what significance these results have.

A study of adult women attending a community college by Johnson, Schwartz, and Bower (2000) 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 which included not only their own children but nieces, nephews and grandchildren.

Mohney and Anderson (1988) 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. Mohney and Anderson discovered women were motivated by a need for others to “...recognize, appreciate and reward them for their real worth.” (p. 272). Yet, the women also felt strongly about only attending college if it meant they wouldn’t hurt anyone else. 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. The women in the study had initially postponed college due to the following: 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: finally enough money; they felt their children were old enough (a range the women defined from 3 months to 30 years); they had support of others and adequate childcare. Mohney 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,
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incompatible demands; overload as a feeling of being spread too thin, and role contagion the inability to perform due to worrying about other responsibilities. All the women in the study had jobs and families; 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 perception of demand on their time was often greater than the actual demand with single mothers having the greatest overload. Women who had children under the age of thirteen were found to be at greater risk for role overload and conflict. This was most pronounced in women with the youngest children. Women of low income had greater role conflict than women with higher incomes. Home suggests future studies of adult women include science, technology, engineering and mathematics (STEM) majors.

Vaccaro and Lovel (2010) used a feminist lens to look at the role family plays in an adult woman’s persistence in college and self-investment. Vaccaro defined self-investment as “…valuing self enough to believe personal growth, learning and education are needed and deserved” (p. 172). Vaccaro and Lovel interviewed 28 adult women in the following majors: 14% computing; 39% communications; 45% business about becoming better people, mothers and employees. Results of the study were 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 Lovel 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 Lovel (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 Lovel’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 “…falls short in describing women’s educational engagement when family is seen solely as a distractor or stressor…From our feminist analysis, a new concept call self-investment (Vaccaro, 2005, pp. 170-171) emerged.

Taniguchia and Kaufmanb (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). Taniguchia and Kaufmanb 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 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).
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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 impacted 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 may have been due to the fact that women started with a lower self-efficacy score than men. While these results show there may be differences, this study was performed on adults in a master’s level program and may not apply across a larger, more diverse population. The paper does not provide enough detail as to the methodology of the study so the quality of this study can’t be determined. However, the statistical analysis was given in great detail.

Other research into self-efficacy and online learning (Chu, 2003; DeTurre, 2004; Hargis, 2001; and Tsai & Tsai, 2003) found conflicting results as to whether or not gender significantly affects self-efficacy in an online learning environment. As this is a fairly new and emerging field of research, more research needs to be performed before any conclusions can be made.

Summary

In summary, studies of adult 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 impact of online learning on self-efficacy in women.
A goal of my study was to gain a deeper understanding of the supports and barriers, goals, interests and outcome expectations in the lives of the women in my study. For this reason, I chose social cognitive career theory (SCCT) to guide data collection and analysis. The next section is a review of literature related to SCCT, women and science, technology, engineering and mathematics (STEM).

**Social Cognitive Career Theory (SCCT)**

By examining the literature in this section I was able to see how Social cognitive career theory (SCCT) has been used to examine the ways a variety of age groups develop interests, outcome expectations and career goals (Lent, Brown & Hackett, 1994). I used SCCT to gain a deeper understanding of how the lived experiences of the women in my study influenced their self-efficacy, interests, goals and outcome expectations related to science, technology, engineering and mathematics (STEM).

Lent, Brown and Hackett (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 social cognitive career theory (SCCT). This theory can be used to find the relationship between interest development, career choice, and performance. Social cognitive career theory (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 social cognitive career theory (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 show that a high mathematics self-efficacy and a high interest in mathematics did not predict a preference for a science, technology, engineering and mathematics (STEM) major. It was thought that this unexpected result may be due to cultural influences. Other studies (Lent, Paixão, Silva, & Leitão, 2010; Navarro, Flores and Worthington, 2007) indicated that culture may play a role in the results and that further research is needed in this area.

Navarro, Flores and Worthington (2007) researched Mexican Americans’ socio-contextual and cultural experiences using social cognitive career theory (SCCT; Lent, Brown, & Hackett, 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 social cognitive career theory (SCCT) to understand the role that math and science-related experiences and beliefs play in the underrepresentation of culturally diverse groups in science, technology, engineering and mathematics (STEM)-related academic majors and careers” (Navarro, et al, 2007, p. 321). “Previous social cognitive research has focused on high school and college students” (p. 322).

Byars-Winston and Fouad (2008) used social cognitive career theory (SCCT: Lent, Brown, & Hackett, 1994) to examine how parental involvement and perceived career barriers have an impact on mathematics/science goals for traditional college aged students from two campuses: the first group had an average age of 18.8 and 19.7 in the second group. 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
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between contextual factors and math-/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 social cognitive career theory model in explaining undergraduate college students’ math and science goals and students’ perceptions of math/science ability. This study did not examine adult learners where rather than parental involvement a more critical factor may be family status (single, married, children) and family support.

Schaub & 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 looked at 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 by social cognitive career theory. 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 and Brown (2003) compared the general social cognitive model of Bandura (1999, 2000) and social cognitive career theory (SCCT: Lent, Brown, & Hackett, 1994) for engineering majors at a traditional college with a mean age of 18.63. They found that self-efficacy was predictive both of outcome expectations and interests. A limitation of this study is that 80% of those studied were male and they were all engineering students.

Lent et al (2002) used a qualitative research design based on interviews to examine social cognitive career theory (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/family influences, negative school/work experiences, and excessive educational requirements were mentioned less frequently as barriers. As this was a small study the results are not generalizable.

Most recently Lent, Paixão, Silva, & Leitão (2010) examined social cognitive career theory (SCCT) through the 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 social cognitive career theory (SCCT). They indicated they may be due to differences in culture and that further researched was needed in cross-cultural validity of social cognitive career theory (SCCT).

Self-efficacy, outcome expectations and personal goals are the three social cognitive variables within the social cognitive career theory (SCCT). Since there is a direct path from self-efficacy to both outcome expectations and personal goals (figure 1) that factor will be examined in more detail next.

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” (Miller & Pajares, 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).

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 mathematical 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 done by Miller and Pajares (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 study results showed that parents tend 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 decrease. According to social cognitive career theory (SCCT) it follows that if a girls interest in math decreases she won’t pursue a mathematics related major nor will she then 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.
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Vicarious Experiences

A woman’s earliest role models are typically her parents. In case studies that Willis (1996) performed she found that rather than a curriculum issue, the perception was that girls dropped out of mathematics and science due to influences from peers and family. Bleeker and Jacobs (2004) did a longitudinal follow up study to one done by Jacobs and Eccles in 1992. The initial study looked at 143 sixth grade classrooms in a predominantly white area. A total of 2,471 students and 1,380 mothers participated. This study only included 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 non-science 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 four times more likely to choose careers in life science and business than in physical science and computing.

Throughout their childhood girls develop a belief about their abilities and what it takes to complete a particular task. 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 social cognitive career theory (SCCT)
how these girls interpret their successes and failures may ultimately impact their mathematics self-efficacy.

Young girls play out learned roles during make-believe play. Eccles (2005) states 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 articles (Eccles, 2005; Hyde and Linn, 2006) describe 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) hypothesizes 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).

Summary

In summary, studies have examined the relationship between self-efficacy and environmental factors and how they relate to a girl’s goals, interests and outcome expectations related to science, technology engineering and mathematics (STEM). However, the literature is lacking in research related to non-traditional 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 and outcome expectations of the five women in my study.
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, Schwartz and Bower (2000) 84% of the women surveyed were the primary caretakers of their children. According to the US Bureau of Labor Statistics (2009) more women than men provide primary childcare. 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 social cognitive career theory (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 by itself does not increase self-efficacy. Typically, a positive role model will use verbal persuasions alongside vicarious experiences (Bandura, 1994).

Portes and Vadeboncoeur (2003) describe 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 show only a modest relationship between adult-child interactions and the child’s academic performance. Yet a recent study done by Benson and Borman (2007) on the seasonal effects of learning found that it was during the summer months, when students in lower socio-economic 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 and outcome expectations of the five women in my study. I explored who played this role in the lived experiences of the five non-traditional female students studying science, technology engineering and mathematics (STEM) in my study. This has not been explored in prior research.

Physiological and Emotional State

A woman may face gender discrimination due to cultural perceptions and societal views related to women and mathematics. Judy Roitman states that “…of her graduating class of eleven hundred students…of the top twenty all but two went to the Cornell University School of Home Economics, so that is clearly a very strong cultural message” (as cited in Henrion, 1997, p. 168). She goes on to discuss that she did not join the science club because she felt women could not succeed in the science fields. She did not feel there were any real barriers so much as a constant cultural message that women were simply incapable (Henrion, 1997). Judy was in college in the 1960’s. In 1977 a study was done that asked the subjects to identify personality and behavior characteristics with 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).

Feelings of isolation and not belonging may also lead to stress and tension for women, possibly resulting in health related issues. Wertsch (1991) discusses Gilligan’s concept that a woman’s social language is different. While her work is based on responses to interviews and therapy sessions it is still relevant to how a woman might respond in a classroom setting. A boy and girl are given a moral dilemma where the boy uses abstract rules and states that it is “kind of like a math problem with humans” (Gilligan as cited in Wertsch, 1991, p. 76). The girl states that it is “a world comprised of relationships rather than people standing alone, a world that coheres through human connection rather than systems of rules” (Gilligan as cited in Wertsch, 1991, p. 76). This supports the idea that boys tend to be more abstract and girls more in tune to relationships.

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

Summary
The review of literature of social cognitive career theory (SCCT) theory reveals 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 science, technology, engineering and mathematics (STEM). However, little to no research has been performed using non-traditional 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 social cognitive career theory (SSCT) to examine the influence of contextual factors on interest and choice. All but one study (Lent 2010) supported social cognitive career theory (SCCT). Out of the six studies reviewed, two, Schaub and Lent and Brown, used social cognitive career theory (SCCT) to predict outcome expectations. Only Byars-Winson and Fouad (2008) used it to predict goals and perceptions. Both Lent and Lent and Brown used it to predict interest. 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 cognitive career theory (SCCT) as a framework, the majority of the studies used a quantitative research design. Data collection typically consists of using surveys with path analysis used for data analysis. A wide range of studies have been performed both using social cognitive career theory (SCCT) as a framework and to try and replicate it under various demographic conditions. While the majority of the studies have applied social cognitive career theory (SCCT) as a framework to look at career goals related to science, technology, engineering and mathematics (STEM) majors, few, if any, have used non-traditional female students returning to the university. A review of the literature supports the gap in research in this area.
Themes that emerged for both women as non-traditional students and computer related majors included a sense of self, strength, and determination. For female non-traditional students low income, small children and single motherhood 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 anti-social, while women with some computer related work experience saw a computer related career as a viable and appealing path. A review of the literature shows there is little to no research examining women as adult learners studying a science, technology, engineering or mathematics (STEM) major.

The vivid description of portraiture enabled me to gain a deeper understanding of how the lived experiences of the five women in my study influenced their self-efficacy, interests, goals and outcomes related to their belief science, technology, engineering and mathematics (STEM) was a viable option for them. This can provide researchers with insights as to exploring social interventions that may eliminate negative views and barriers. The factors effecting self-efficacy, interests, goals and outcomes are complex and the thick description provided by portraiture provides insights that a quantitative study alone could not. These insights will lead to a deeper understanding of how lived experiences affect women over time related to their beliefs about their ability to successfully pursue a science, technology, engineering and mathematics (STEM) major. Listening to the way the women in my study spoke about their lived experiences helped me understand how they perceive themselves and the world in which they live (Gilligan, 1982).

**Research Question**

1) What are the lived experiences of an adult woman returning to college with regard to pursuing a science, technology, engineering and mathematics (STEM) major?
a) What are the sources of self-efficacy in this pursuit with regard to their choice of major?

b) What are the supports and perceived and barriers in this pursuit with regard to their choice of major?

Chapter 3: Methodology

Study Description

The purpose of this study was to explore the lived experiences of five non-traditional female students who returned to the university to study science, technology, engineering and mathematics (STEM) at an online college located in upstate New York. I used the portraiture methodology to gain a deeper understanding of how the women describe their path to a science, technology, engineering and mathematics (STEM) major within the context of the world in which each lives. The goal of this study was to gain a deeper understanding of how the lived experiences of the women influenced their self-efficacy, interest goals and outcomes as they relate to studying science, technology, engineering and mathematics (STEM).

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 and Davis, 1997, xv). I looked at five non-traditional female students who have successfully navigated the path studying science, technology, engineering and
mathematics (STEM). I wove tapestries that give voice to each of the stories of the five women in my study (Lawrence-Lightfoot & Davis, 1997).

While most research using social cognitive career theory (SCCT) has been 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 non-traditional female students returning to the university to study science, technology, engineering and mathematics (STEM) major, a population not previously researched with this model.

I wove tapestries of the lived experiences of the five non-traditional female students in my study and their perceptions and social construction of reality, beliefs, and views of a world where women may or may not believe a science, technology, engineering and mathematics (STEM) major is a viable option (Patton 2002). Social cognitive career theory (SCCT: Lent et al, 2010) guided data collection and analysis in my study.

**Site and sample selection**

CSE is a public state college with multiple campuses. It provides undergraduate and graduate studies through a flexible model of online, blended and individualized face to face courses. Since 1971 the college has graduated more than 62,000 students with associate, bachelor’s and master’s degrees. In 2010-2011 the college received over 9,900 applications and had an enrollment of 19,700, of which 61% were female. In 2010-2011 the average age of an undergraduate student was 36 years old. Business, Management and Economics and Community and Human Services have the highest enrollments of the undergraduate programs. In the Area of Study of Science, Mathematics and Technology (SMT) there are about 800 men and 400 women enrolled (Fact book 2010-2011).
In 2010-2011 the mean undergraduate student age for women was 37.1 and 34.5 for men. The college awarded 198 Science, Mathematics and Technology (SMT) degrees which was 6% of the total degrees awarded. The retention rate for SMT is 46% which is slightly higher than the undergraduate rate for the entire school (41%). The overall retention rate for women is 48.9% and 42.4% for men. The overall median time it takes students to complete their degree is 2.73 years with SMT 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 (CSE Fact Book 2010-2011). The college is different from other typical undergraduate schools in that it does not offer graduate degrees in any science, technology, engineering or mathematics (STEM) subjects. The college also does not currently offer degrees at the PhD level.

By sampling women all from the same college I minimized college differences in course offerings, school environment and available student services support. In addition the college has a population that is similar to the United States non-traditional student population and their primary target population is non-traditional students. In a national survey by the Lumina Foundation (2007) of 1500 students the average age of a non-traditional student was 37 in large schools such as CSE; top fields of study were 1) management, business and marketing; 2) arts, humanities and social sciences. In this survey a sizable proportion of students identified themselves as Caucasian (69.1 percent); African-American (22.7 percent); other ethnicities: Hispanic (3.3 percent), “other” (2.6 percent) and Asian or Pacific Islander (2.4 percent). At CSE about 61% of undergraduates are White, Non-Hispanic, over 13.5% African-American, Non-Hispanic, and 5.6% Hispanic. At CSE 18% of the students chose not to identify themself.

I planned on using on 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 call for participants only resulted in seven potential actors of which only six met the requirements of the study. Five of those six completed the study.

My rationale for choosing a small sample size is grounded in Lawrence-Lightfoot and Davis’ (1997) Portraiture methodology. They suggest that a single researcher select a smaller group of participants in order 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 feel that five actors 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 didn’t want to collect data from more participants than I intended to use.

Actors and Setting

During the Fall 2011 semester I recruited five non-traditional female students of senior status attending CSE* (pseudonym) and studying and advanced level mathematics or science course were interviewed for my study. Since the actors were non-traditional students I used the CSE definition of a senior rather than year of enrollment. For example a student could be in their first year at CSE but already have 96 credits.

According to Horn and Carroll (1996) a "nontraditional" student can be defined by the number of characteristics they have and are considered to be 1) "minimally nontraditional" if they have only one nontraditional characteristic, 2) "moderately nontraditional" if they have two or three, and 3) "highly nontraditional" if they have four or more (National Center for Education Statistics, 2002).
Non-traditional 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 non-traditional student, high risk have greater than three and include minority, financial need, greater than 20 hours of work, and single parent (Breneman, Gansneder, Kohl, Levin, Milam, Pusser, & Turner, 2007). Table 1 shows the associated risk factors for each of the actors in my study. Only Luisa was at high risk for dropping out.

Table 1

Participant Risk Factors Associated with Non-Traditional Students Dropping Out

<table>
<thead>
<tr>
<th>Actor</th>
<th>Age*</th>
<th>Marital Status</th>
<th>Children</th>
<th>Employment</th>
<th>Financial Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie</td>
<td>23</td>
<td>Married</td>
<td>No</td>
<td>Military language analyst</td>
<td>Military covering cost</td>
</tr>
<tr>
<td>Jeanie</td>
<td>28</td>
<td>Married</td>
<td>No</td>
<td>Medical Assistant/Spanish Translator</td>
<td>Federal, scholarships, some out of pocket</td>
</tr>
<tr>
<td>Alice</td>
<td>32</td>
<td>Engaged</td>
<td>No</td>
<td>Computer Service Delivery Manager</td>
<td>Federal loan, some out of pocket</td>
</tr>
<tr>
<td>Rosa</td>
<td>41</td>
<td>Married</td>
<td>No</td>
<td>Sommelier*</td>
<td>No, paying out of pocket</td>
</tr>
<tr>
<td>Luisa</td>
<td>44</td>
<td>Divorced</td>
<td>ages: 21, 18, 17</td>
<td>Administrative Support</td>
<td>Federal, state and grants</td>
</tr>
</tbody>
</table>

*at time of study

In a report by the National Center for Education Statistics on Trend Enrollments of Nontraditional Student from 1985-1992 they found that factors such as single parent, Socio-
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economic status (SES) or working full-time were not directly related to persistence. However, they may be indirectly related due to requiring the student to study part-time (a factor found to be directly related to a lack of persistence).

In order to explore the experiences of non-traditional female students who have been successful studying science, technology, engineering and technology (STEM) I selected my sample from women enrolled in advanced level mathematics and science classes who were within 16 credits of graduation. Women in their first semester or 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 have been successful allowing me to gain deep insights into their experiences and the path they have taken so far. My goal was to create five individual portraits that will provide guidance, advice and in a sense a role model to 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. This enabled me to determine which advanced level mathematics and science 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 I that met my requirements (advanced level mathematics and science, offered Fall term). The area coordinator then put me in contact with the instructor of each course. Next, I explained my research to each instructor and asked their permission to post in their course. All but one instructor gave me permission. I posted recruitment information in the following September courses:
Linear Algebra: female instructor

Discrete Mathematic: 2 sections, both female instructors

Calculus 3: male instructor

Numerical Methods: female instructor

Genetics: female instructor

Data Structure and Algorithms: male instructor

Real Analysis: The Theory of Calculus: female instructor

In my initial round of recruitment I only got six participants. Since I initially wanted to have seven participants and planned on using 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 in the following November term courses:

Management Information Systems: male instructor

Genetics: female instructor

Computer Information Systems: male instructor

Exploring the Disciplines: Information Systems: 2 sections, male instructors

While I did get a second potential participant in this round, she was a business student and therefore did not meet the selection requirements. A limitation of this study was my inability to use the maximum variation sampling technique and get a more diverse pool of participants. Out of my six participants only one has children and they are grown. Due to the time requirements of my study I believe students with small children, both married and single, may have felt they didn’t have the time to commit to my study.

I recruited students by asking the instructor of each course 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, student lounge, and ask a question area in the course management system. I only observed the online course interactions of the students in my study. Student interested in participating in the study filled out a short demographic survey which included questions related to my selection criteria.

Based upon their responses I personally invited those women who met my selection criteria to be in my study. I set up a time to discuss, individually, with those women interested in participating in my study, to provide them with additional information related to participating in the study. I let them know:

- why I had selected them;
- that their identity would be kept confidential;
- the length and number of interviews,
- they would be asked to journal about their experiences in the course in which I was recruiting
- they would be asked to create artwork about their experiences as a mathematics student (collage, drawing, painting, online drawing tool).

They were also 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 fair compensation for their time. This incentive was be approved by IRB.

**Context.** Context includes framing the terrain, setting the site, and priming the canvas. Lawrence-Lightfoot (1997) describes context as “…the setting-physical, geographic, temporal,
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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. These sources included: three in-depth interviews, three journal entries, two pieces of artwork, observation of online interactions, document review and instructor and mentor interviews (not all sources of data were collected for each participant. See Data Table 4). This enabled me to weave individual portraits that illuminate how the reality each actor experienced is similar and different to the story demographic statistics and prior research tells. In the results section I discuss where the stories converge and where there are contrasts. Three semi-structured interviews centering on personal, educational and professional experiences, as well as journal writing that focused on the current classroom experiences, enabled me to provide a rich, thick description of the physical setting in which they grew up and are currently living so that the reader will feel as if they are transported there.

The internal setting for this study included gaining insights into the environment in which these women have lived and continue to live. This included reviewing data such as demographics and prior research, observing their online classroom interactions (discussion posts and e-mails), document review (course content and written course work), interpreting artwork and stories from interviews. I began the process of creating a macro picture by performing a literature review. This enabled me to describe, through demographics and prior research, attributes related to women and science, technology, engineering and mathematics (STEM) in our society. Through
their stories, observation of online interactions, a review of their personal history (family background, standardized achievement test (SAT) scores, mathematics courses taken, and grade point average (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 include a description of the communities they grew up in and currently live, the type of industries that are prominent there, demographic statistics, and quality of available education.

By observing online classroom interactions I gained additional insight into the current sight they are living. Since the women in my study are participating in class online there was no physical classroom to describe. I did describe the online classroom environment so that the reader can “feel” what it would be like to be in their classroom. I began by describing the college itself, services offered, and population (described previously). Next I will provide a general description of the online classroom environment. The instructor interview and review of course announcements and course syllabus added to the thick description of the individual classroom environments.

**Classroom environment.** Prior to their first enrollment CSE 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 where students are asked to share some background information. They are also able to upload a picture and include personal information in the profile section. Student’s 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, student lounge, 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 which 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 only be seen by the instructor and through e-mail only those on the distribution. Online discussions that take place in Angel are threaded discussions only accessible by the 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.

I only analyzed data from students who agreed to participate in my study. 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). I also looked for examples of participants seeking out support such as reaching out to student services or encountering barriers such not being able to complete assignments on time due to difficulties balancing school, work and family.

The personal perspective I bring to the setting description becomes 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) I opened myself up to the reader, allowing the reader to make her own interpretations.
Personal context. Personal context warrants “…inclusion only insofar as it illuminates the subject of the portrait” (Lawrence-Lightfoot & Davis, 1997, p. 69). I clearly documented how my relationship with the participants affected my understanding of the context by disclosing my bias as a researcher in the following section and specifically noting any times my bias may have impacted data collection or analysis.

Historical context. Historical context refers to the journey, culture and ideology. Lawrence-Lightfoot (1997) says the portraitist must “…be alert to the convergence (and contrast) between the external signs of the physical environment and the interior culture, noting the symmetry and dissonance” (p.52). I asked the women in my study to create a timeline of meaningful events in their life and a collage depicting how they see themselves as a mathematics student. 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 my study. This enabled me to offer context not only in “…terms of literal space and time, but also in terms of that place in the subject’s personal or institutional journey in which the action is situated among the past objectives, current realizations and visions of the future” (p. 70).

Learning about the values of the society and family that shaped their childhood; the educational philosophy of the schools they attended and the places they worked, enabled me to “…weave into the narrative external contextual elements that help provide a clarifying backdrop to the action at center stage” (Davis, 1997, p. 70).

The final piece of context is aesthetic features such as symbols and metaphors. Aesthetic features add to the reader’s ability to feel like they are on the journey with my participants since
“…Metaphors capture the reader’s attention, call up powerful associations, and resonate throughout the piece” (Lawrence-Lightfoot & Davis, 1997, p. 55). The metaphors I selected symbolize the phenomena and themes that were woven as data was gathered (Lawrence-Lightfoot & Davis). During data collection and analysis I took notes in my impressionistic record as I listened for the central contrasts that shaped each of the lived experiences of the women in my study and the metaphor that symbolizes it.

As I shaped the context I kept in mind that “…the context is not static and that the actors are not only shaped by the context, but they also give it shape” (Lawrence-Lightfoot & Davis, 1997, p. 57). During our interview I carefully listened to their stories, taking detailed notes in my impressionistic journal, and reflecting about the data as soon as possible. I discovered that each time I listened to their stories and read through my data I heard something subtle that I had missed before. I noted in my impressionistic journal when I heard something new that changed my interpretation of the experience. My goal as a portraitist was to capture the “…dialectic of contextual structures and forces defining individual action and perception and of actors inventing and shaping the context they inhabit” (Lawrence-Lightfoot, p. 58). As I wove the tapestry my goal was to move the reader through how these women were not only shaped by their environment, but how it expresses who they are (Lawrence-Lightfoot & Davis, 1997).

By using rich examples to set the stage I am creating a setting where the reader can develop a relationship with the participant and, through their own perceptions, make meaning of the participants lived experiences (Lawrence-Lightfoot & Davis, 1997). It is my goal that the reader: a woman who may be thinking of returning to school; an administrator looking to increase persistence or enrollments of women in science, technology, engineering and
mathematics (STEM); or a family wondering how they can provide support, will find meaning that they can relate to in their own life.

Data Collection

I collected data through semi-structured interviews of the actors, mentors, and instructors; journaling, artwork, document review, instructor and mentor interviews and online observations of classroom interactions. I took notes of first impressions, things that surprised me or that reminded of a personal experience 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 if my interpretations changed or questions arose each time I listened to my participants stories. By collecting data from multiple sources I was be 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).

Prolonged engagement allowed for sufficient time to gain an understanding of the culture, testing for misinformation and building 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 six month period and reviewed the online classroom interactions of a 15 week course. Observation of online interaction 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 an area to ask questions about homework so the discussion data was limited

While I was aware that sharing the goals of my study could lead my participants to tell me what they think I wanted to hear or tell the story they want 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.

I conducted three interviews with each participant that were approximately 90 minutes long with all but one participant (Due to personal circumstances Alice was not able to do the third interview). Table 2 shows a summary of the participant interviews and the 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, the exchange of 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 ensured them I wouldn’t ask them to do anything beyond what they committed and that my questions only directly related to my research questions. While my intent was to not keep them beyond the agreed 90 minutes for an interview I discovered that they got so involved in telling their stories they frequently went over the 90 minutes.

Table 2

Summary of Participant Interviews

<table>
<thead>
<tr>
<th>Actor</th>
<th>Interview 1</th>
<th>Interview 2</th>
<th>Interview 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie</td>
<td>Skype</td>
<td>Skype</td>
<td>Skype</td>
</tr>
<tr>
<td></td>
<td>Video/sound</td>
<td>Video/sound</td>
<td>Video/Sound</td>
</tr>
<tr>
<td>Jeanie</td>
<td>Skype</td>
<td>Skype</td>
<td>Skype</td>
</tr>
<tr>
<td></td>
<td>Sound</td>
<td>Video/sound</td>
<td>Video/sound</td>
</tr>
<tr>
<td>Alice</td>
<td>Face to Face</td>
<td>Face to Face</td>
<td>N/A</td>
</tr>
<tr>
<td>Rosa</td>
<td>Face to Face</td>
<td>Face to Face</td>
<td>Skype</td>
</tr>
</tbody>
</table>
My first observation was of the opening discussion in the first Module of each course in which the participants were enrolled. Since these were online classes I could observe the classroom at any point. I made first observations prior to the first interview. 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. Due to differences in course structure the timing of the discussions and total number was 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.

I originally planned on having the participant’s journal between interview one and two, again between interview two and three and after interview three and create the timeline prior to interview one and the collage prior to interview two. Due to the multiple obligations my participants were trying to juggle they were not always able to complete the journals and artwork based upon the original schedule. The timing of data collection can be seen in Table 4.

Lawrence-Lightfoot (1997) and Eisner (1998) stress that although a portraitist should expect that changes may occur to the original research design it is critical to record an initial framework. Lawrence-Lightfoot states that this is something portraiture has in common with other forms of qualitative research which emphasize “…flexibility of research design and the iterative process of data collection and thematic development” (p. 188). My research questions, data collection, and sample selection were all guided by social cognitive career theory (SCCT). Based on a review of literature related to the portraiture methodology and studies using social
cognitive career theory as a theoretical framework led to the structure of my research design and the types and instances of data collection I designed. Sources of data will be described in detail next and include: three in-depth interviews of participants, instructor and mentor interviews (not all instructors and mentors were available for interview), three separate observations of online classroom interactions; homework; instructor-participant e-mails; researcher-participant e-mails; journaling and artwork created by the participants. A data source table is included in Table 3.

In qualitative studies the researcher can’t always 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 my 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 due to time constraints).

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.

I ensured the participants knew what the research was about and what the goals of the research were so that I didn’t deceive them (Eisner and Powell, 2002; Lawrence-Lightfoot and Davis, 1997). I wanted my participants “to leave the encounters feeling safe and whole. At the center of the relationships, portraitists hope to build trust and rapport…” (Lawrence-Lightfoot
A concern I initially had was getting a level of commitment from my participants to follow through to the end. Since they were non-traditional female students who were balancing a full time job, family and schoolwork, time was something they were short on. I believe that by thoughtfully sharing with them my goals for the end result of this study and my belief that it was important to them as well as other women helped in creating a relationship with them in which they felt a level of commitment to my study. I discovered that my participant’s has a passion for the importance of this study that was equal to mine. They had a strong desire to not simply have their story, but have their struggles and resilience 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, 1997). I did this by making eye contact with them when they were talking, occasionally repeating back what they 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 relationship. Jeanie and Angie, the two participants that I interviewed over Skype were the only two who completed the timeline, collage, all three interviews and all three journal entries. Since I am an online instructor it did not surprise me that we were able to develop such a close “virtual” or relationship or that they shared their feelings and experiences with ease.

Where as many studies focus on women who dropped out, who might be considered failures, in order to better understand why they failed, I chose to look at stories of success. I shifted my focus from “…weakness to pursuit of strength…” (Lawrence-Lightfoot & Davis, 1997, p. 141). By doing this I was able to unveil the women’s failings, imperfections and
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weaknesses (Lawrence-Lightfoot & Davis). By unveiling these attributes I was able to gain an understanding of where their strength, perseverance and resilience come. In order to weave get a complete picture of how they managed to persevere not matter what obstacle they faced, I needed to gain an understanding of their shortcomings, the obstacles they faced and how they overcame them.

Each of the pieces of data was a piece of their whole story. Their stories of success were about so much more than just their SAT scores, GPA, number of credits they have completed, or length of time to completion. While all these attributes help to describe their journey they don’t provide “…less tangible, more elusive qualities that can only be discerned through close, vivid description, through subtle nuances…” (Lawrence-Lightfoot & Davis, 1997, p. 143). Through portraiture I was able to give the five women in my study a voice and tell a story that includes their human side, inescapable struggles, and tragic flaws (Lawrence-Lightfoot & Davis). I strove to provide a “…generous, balanced, probing perspective…an authentic narrative…” (p. 146).

Empathetic regard refers to trying to understand the perspective of the actors. “What would I feel like if I were in his shoes? If I was looking at the world through her eyes, what would I see?” (Lawrence-Lightfoot & Davis, 1997, p. 146). Lawrence-Lightfoot describes empathy as “…quality of attention, the connection of life experiences, and the deep understanding…” (p. 148). My personal life experiences and knowledge base enabled me to identify with many of the experiences in a way that my participants were be able to see in my eyes and read in my words that I empathize. As their story was unfolding I frequently found myself going back to a similar experience or reflecting upon the contrast between our struggles and how we overcame them. Eisner (1987) notes the importance of creating this level of comfort so that my participants felt safe to share their stories. While Eisner cautions that occasionally a
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participant may have regrets about having shared too much none of my participants expressed that feeling. I was struck by how open they were and how much they shared about themselves. One of my participants mentioned that the only other person who knew as much about her as I now did was her husband.

Reciprocity and boundaries refers to my responsibility to “…define boundaries and protect the vulnerability and exposure of the actor” (Lawrence-Lightfoot & Davis, 1997, p. 152). Lawrence-Lightfoot stresses that this is both an ethic as well as empirical responsibility. I stayed focused on the objectives of my research and on only asking questions related to my research questions. I found myself in many situations where my participant shared something where it was tempting to give advice or “…play the role of therapist for someone more than ready to share their intimacies” (Eisner, 1987, 218). I constantly needed to be aware of the difference between “…legitimate inquiry and voyeurism…curiosity that is crucial…prying that is invasive and presumptive” (p. 153). I kept at the forefront of my mind my research question and used my interview guide to ensure I only asked questions specifically related to my research question. When I felt my participant was getting off track I would gently bring her back by first letting her know I felt what she was saying was interesting and important and then guiding her back to my interview topics.

As a way to ensure reciprocity and boundaries Lawrence-Lightfoot (1997) suggests setting clear expectations from the beginning. I did this through the informed consent where I addressed things such as length of interview, confidentiality, and participant checking for data accuracy. I encouraged the participant to ask questions and discuss with me any items about which they had concerns. The informed consent form (Appendix B) was approved by the
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Institutional Review Board (IRB) October 2010, prior to the start of any data collection or participant recruitment.

Eisner (1998) notes that while the purpose of the portrait may be to bring the participants story to life through vivid description this also enables, at a minimum, the participant to identify herself. This reinforces the importance of allowing the participant to read the portrait and comment prior to publishing it. During the writing of initial drafts I removed information which I felt might make the participants identifiable. My participants reviewed a first and second draft of their portraits. I asked them to review for factual information, their thoughts on my interpretations of their experiences and any information they felt I should remove due to concerns it may identify them.

I was aware that certain situations may make me question whether I should break confidentiality and question exactly what information should be included in the final portrait. None of my participants shared any information about inappropriate or illegal behavior. During interviews some participants share feelings related to what they saw as an incompetent teacher or specific shortcoming of the college and/or course. In the case of this study since there were no children the question posed by Eisner (1998) “Is the pursuit of knowledge so important it overrides the immediate needs of children” weighed less heavily. Yet, 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. Due to confidentiality I couldn’t ethically do this unless the issues involved the safety of a student or faculty member. More frequently, as Eisner points out, I observed and heard about teachers who were exceptional. While it is not part of my study to specifically commend a teacher it is 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.

**In-depth interviews.** Eisner (1989) describes interviews as “…a powerful resource for learning how people perceive the situations in which they work…connoisseurship is aimed at understanding what is going on” (p. 82). I interviewed the five actors in a place where they felt comfortable and safe, provided an assurance through the informed consent of confidentiality, gained their confidence in me as a researcher and the importance of their story to society as a whole. This enabled me to create a setting that encouraged “…expression of strength…vulnerability, weakness, prejudice, and anxiety” (Lawrence-Lightfoot, 1997, p. 141) during interviews. I used a semi-structured interview protocol which can be seen in Appendix C.

Since Alice, Rosa and Luisa lived within a reasonable distance to me I suggested face to face interviews take place at one of the campuses. While Rosa and Luisa like this idea, Alice invited me into her home which I saw as expression of her level of comfort, safety and desire to share all of herself. Although Jeanie’s interviews took place over Skype she went over and beyond to “share” with me her neighborhood and home. Jeanie took photos and video and sent them along with thick, rich description 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 being interviewed view their world…to capture the complexities of their individual perceptions and experiences” (Patton 2009, 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. Since 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 social cognitive career theory (SCCT) to ensure I collected the data I needed to answer my research questions. Table 3 shows which interview questions were a source each part of my research question.

While I see my participants as “…knowledge bearers, as rich resources, as the best authorities on their own experience” (Lawrence-Lightfoot, 1997, p.141) I used a semi-structured 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 covers the entire span of lived experiences of participants and create a full picture of how it shaped their self-efficacy, interests, goals, outcome expectations and supports and perceptions of and actual barriers.

Zeldin (2010) and Zeldin and Pajares (2000) designed interview protocol 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 upon the previously mentioned literature lends credibility to my findings.

There are four hypothesized sources of self–efficacy that both Zeldin (2010) and Zeldin and Pajares (2000) explored. Zeldin (2010) specifically explored career self-efficacy. Past research shows that mastery is the most significant source of self-efficacy. There is little prior research on how the lived experiences of non-traditional female students influences their self-efficacy as it relates to studying science, technology, engineering and mathematics (STEM) so
there is little literature to guide what experiences might be most significant or that I might want to focus on. Ushers 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 my participants. The review of literature supports the conflict of balancing work and family for non-traditional female students and women in science, technology, engineering and mathematics careers. For this reason I included questions related to self-efficacy and work-family conflict.

Eisner and Powell (2002) suggest conducting an interview more like a conversation, without explicit criteria letting the data speak to the researcher. I designed my protocol to not lead my participants but rather let them lead the conversation. That way as themes emerged, they were not initiated by my questions (Ashby-Scott, 2005; Zeldin, 2010 and Zeldin and Pajares, 2000). This enabled me to see which experiences surfaced first and which memories were the most vivid.

Since 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) suggest that by looking at the interviews as conversations they will have a “…natural and organic quality…” (p. 137). In reading through excerpts from interviews 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 and 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…feel the shift from that kind of role-playing to a real
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conversation, driven by a genuine curiosity and directed towards trying to understand or discover something with another person” (Kiegelmann, 2009 para 29).

Reissman (in Hubermant, p.54) 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”. This is also the type of questions Ashby-Scott (2005) used in her portraiture study. Reissman further states the “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).

I let the participants lead the conversation and as suggested by Eisner and Powell (2002), tried not to feel compelled to ask my questions. This 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: 1) the informed consent, 2) what would be asked of them, 3) their pseudonym, 4) their right to drop out of the study, and 5) how I would maintain confidentiality of their data. One of my primary goals for the first interview was to create a relationship between myself and the participant as co-constructors of their 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 my 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 was educational experiences during their k-12 years and through college the first time; the final interview focused on their professional experiences and the time “in between”. I found that many of the topics crossed interviews as my participants talked about their experiences. I used my interview guide to ensure that I covered all the questions related to 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: 1) lived experiences that may have influenced their choices in some way; 2) sources of self-efficacy, supports and perceived and actual barriers. During each interview I asked them about interpretations I made during observations of their online classroom interactions, journaling and their 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 portrait between their second and third interview and following the final interview. 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. I 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
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(Lawrence-Lightfoot & Davis, 1997). I transcribed the interviews and uploaded them to Atlas for data analysis. While I found the notes from my impressionistic journal very helpful in ensuring I didn’t 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 my 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 (1997). Eisner refers to artwork as an alternative form of data representation. When discussing how artwork fits into the participant’s story he says “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) describes it 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 (2002) explains that creating art is a purposeful human endeavor. He states that,

> 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 that and found it enlightening to see what images my participants chose to represent their feelings. “Arts-based research methodologies have broadened the domain of qualitative inquiry to include/incorporate art
arts provide a special way of coming to understand something and how it represents what we know about the world (Eisner, 1993). Newton (2005) used graffiti mats and poetry to bring out the underlying nuances in the stories of her participants. Newton describes 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).

Eisner (1997) describes 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 interpret 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. This helps the reader interpret what the participant was experiencing.

Galman (2009) suggests having the participants draw a visual narrative as a way to get at the essence of their story. Galman stresses that we can’t ethically make a participant draw and I need to be aware that some of my participants may be uncomfortable drawing. For this reason I will give them a choice between drawing, making a video, painting or a collage.

When deciding what forms of art work to use I looked to the following questions posed by Eisner (1997): “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 stresses the importance of ensuring the artwork I chose had substance and added to the portrait; that I didn't simply use artwork for the novelty. This is something I gave a great deal of thought to and it took several iterations before I felt I came up a question to pose that would give the artwork substance and meaning with respect to my research question.
Before the first interview I asked each actor to use their choice of artwork, either by hand or computer generated, to draw a timeline of the experiences they perceived as having impacted their academic decisions. Each of them asked me exactly which events I wanted them to include. Since my goal for this piece of artwork was to see what experience came to their mind as significant enough they wanted to include it on a timeline of their life, I didn’t 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 life.

I found that each of the women were unsure how to approach creating the timeline. I sent them links to several online tools and also suggested they could simply create it in a word document. I discovered that not only were none of my participants able to complete the task prior to the first interview, but it took several gentle reminders over a period of two months. They were busy with work, school and family and simply just forgot or didn’t get to it. At our first interview each expressed how badly they felt about not completing the task. I got the sense that doing what was asked of them and not letting others down was important to each of them. I also got the sense that sharing their story 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 may be apprehensive about drawing. For this reason I planned on allowing them to choose the type of artistic rendition they would create, suggesting it may be a collage, drawing, or painting. While I expected some apprehension I was surprised at how each of them reacted when I suggest 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 science, technology, engineering and mathematics (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 emulates that feeling. My goal was for the artwork to further enable me to understand the essence of their story 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 reminders before I received the artwork. (See Table 4 for which participants completed the artwork and the timing of it)

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 didn’t 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 couldn’t 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.

The artwork served as an additional form of data and a form of triangulation to increase the credibility of my study. By analyzing the pictures I compared how they artistically perceived their experiences with how they described them in words. I was aware that by simply asking them to draw I may influence them. My original intent was that they would draw in private and before our second interview. Since they created their collages after the completion of our second or third interview this 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 they chose to include them in their collage and how they expressed that experience through art.
Journal writing. My participants created three journal entries which served as an additional form of data collection. I planned on having them respond to journal questions after each of the interviews. Again due to time constraints my participants were not always able to meet this schedule or complete all three entries (see Table 4). I asked my participants to write in journals as a way to reflect on a deeper level about their experiences as non-traditional students. Clandinin and Connelly (2000) refer to journals as “…a powerful way for individuals to give accounts of their experiences” (p. 102). They go on to describe the deeper reflection as “an intimately reflective puzzling quality...a way to puzzle out experience” (p. 103). I e-mailed them the journal prompts seen in Appendix D splitting the questions up into three separate “entries”. The purpose was for my participants to: 1) reflect upon why they returned to school, 2) what their classroom experiences in the course I was observing were, and 3) what their experiences at the college had been like. They simply e-mailed back their responses.

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. This included questions related to the four sources of self-efficacy and supports and barriers they may have perceived (see data source Table 3). Prompts included asking my 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. Since we touched on some of these concepts during our interviews I wasn’t sure what my participants would choose to include in their journal entries. I was curious if they would simply rewrite much of what we already discussed or go deeper by having the time to further reflect. I was elated as I read each of their first journal entries. Each of my 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. Journal protocol can be seen in Appendix D.

Journal responses were triangulated with interview responses from the mentor and the instructor. This enabled me to compare and contrast my participant’s perceptions of their self-efficacy and the classroom and college environment with that of their instructor and mentor.

**Online observation of classroom interactions.** Patton (2002) describes 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, p. 263). Observation of online classroom interactions gave me an additional form of data collection and the opportunity to observe the kind of experiences my participants had in their online classroom. Eisner (2002) stresses the importance of understanding the experiences students have in the classroom. Since my inquiry is focused on non-traditional female students who chose to study science, technology, engineering and mathematics (STEM) online, understanding the experiences they had in the online classroom was critical to answering my research question.

Questions Eisner suggested I focus on:

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 the back of my mind as I developed my observation protocol and analyzed the data. Observation of their online interactions served three purposes: 1) to see how my participants experienced their online classroom, 2) to gain a deeper understanding into the role the verbal exchanges that took place within the classroom played in their experiences and 3) triangulation of data. By observing their online interactions I was able to see if the way they perceived their self-efficacy aligned with the way they actually act in the online classroom. I was looking for examples of mastery; vicarious experiences between participant and instructor and participant and peers; any instances that illuminate stress or frustrations they are having; examples that demonstrate supports or barriers (gender issues, asking for help). Observations included online discussions, Ask a Question area, student lounge, and e-mail between instructor and participant (with those who gave permission). As I made my observations and saw what data was available to me I did make some changes to my observation protocol. Since I only had permission from the participants in my study to observe their online interactions I couldn’t look at replies from other students. Not all the courses had the same type of discussions. One course only had a homework help discussion so if a student didn’t have any questions they didn’t need to participate. Some discussions only asked a student to post an article and summarize it. Initially, I planned on observing a discussion from the beginning, middle and end of the course. Upon 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 of support or observation of barriers. The icebreaker discussion was a good source since this was the opportunity for the participant to introduce themselves to the class. It was enlightening to see what they shared and how they chose to present themselves. When there was a final reflective discussion this a good source of data since the participant was asked to reflect upon their
experience 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 came across with explaining something or stating their opinion.

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 participants about their experiences as they were happening. Eisner (1998) suggests an observation schedule when the researcher is concerned with things such as frequency of an occurrence. In this study I want to “…describe or interpret the meaning, the relevance, or the appropriateness of something…” (p. 178) and therefore won’t be using an observation schedule where I would track the number of instances something occurs. As suggested by Eisner I noted everything I thought at the time was important, I felt and what emotions and thought emerged as I was observing in my impressionistic journal. Since this was an online class I could go back at any time to observe and “relive” the moment so it was not as critical I take detailed notes about interactions and what was happening in the classroom. As a new researcher it was hard for me to initially know what was important and what was not and search 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. This enabled me to narrow down which discussion posts were meaningful to answering my research question and sort my way through what was interesting, but not relevant.

When observing a classroom Eisner (1998) suggests 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 their online classroom interactions I was not looking for instances of engagement. I only observed the experiences my participants were having as they related to my research questions and tried to get an image of their overall classroom experience. A behavior I did look for as I observed was when and how often the participants posted in the discussion as an additional form of data collection and triangulation. If I saw the participant always posting late and posting the minimum number of times or less I could compare that with their perception of their 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 on each of my participants (Eisner 1998, Uhrmacher, 1993). My goal is that these observations will allow my participants, other women, the teacher and the institution some insight into the previously mentioned dimensions, how student’s experience the online classroom and the college, self-efficacy and needed supports and barriers faced. This supports the goal of an educational critic to “…contribute to the enhancement of the educational process and through it the educational enhancement of students” (Eisner, p. 114). In my conclusion I offer guidance not predictions (Uhrmacher, 1993).

As I made my observations I was open to any emergent 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 my participants reached out to their classmates, offered to help and answered questions their classmates posted. My 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 was used in structural corroboration and convergence of emergent themes (Eisner, 1998; Lawrence-Lightfoot & Davis, 1997). Observation protocol can be seen in Appendix E.

Table 3

Data Source

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<th>Data Source</th>
<th>Number Items</th>
<th>Research Question</th>
<th>Sources</th>
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<tr>
<td>Interview</td>
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<td>Q2: supports and barriers</td>
<td>Supports:6; barriers: 6</td>
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<td>Q2: supports and barriers</td>
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<td>Artwork</td>
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<td>PA:1, VP:1, VE:1, PH:1</td>
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<td>PA:3, VP:4, VE:2, PH:1</td>
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<td>Q2: supports and barriers</td>
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Table 4

Data Collection by Participant

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<th>Actor</th>
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<th>Collage</th>
<th>Discussion Posts</th>
<th>HW</th>
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Data Analysis

I used an “...iterative process of data collection and thematic development” (Lightfoot-Davis, 1997, p. 188) to refine and develop emerging themes. I began my data analysis early in the study (after the first interview) while data collecting was still occurring (Lawrence-Lightfoot and Davis). I continually compared each interview, observation, piece of artwork and journal entry (Figure 3). By analyzing my data in iterative cycles I was be 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). As mentioned in the previous section I was not able to analyze data according to my original timeline due to not receiving all sources of data at the time and in the order I initially thought I would.
Figure 3 shows a representation of the data collection timeline. Note taking in the impressionistic journal was a continuous and took place throughout the entire study. Data analysis and thematic development was an iterative process and will take place throughout data collection.
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 and Davis, 1997, p. 188). Eisner (1998) refers to this type of note taking as “…crucial…details that make for credible description and convincing interpretation” (p. 188). As I continually reviewed my day and refined emerging themes I used my impressionistic journal to track my data analysis journey.

I brought my laptop to each interview and had a blank word document with the interview questions listed and space between them for note taking. During the interview I made note of any mannerisms or body language that I felt were important to associate later on with the participant’s answers to each question. There were times when the participants laughed or eyes seemed to light up that I wanted to remember as I went back and read the transcripts. Since the interviewed flowed more like a conversation my participants frequently “jumped” around and the responses did not always directly fit with the question. I did my best to transcribe what they were saying during the interview. After each interview I had permission to record I then transcribed the data based upon the recording.

As soon as possible after completion of each interview, I made notes in my impressionistic journal, reflected upon what I had written and added any additional thoughts that came to my mind. Each time I read through the transcripts, my impressionistic journal and other data I noted: 1) patterns that seemed to be emerging, 2) questions that arose, and 3) 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.

I used my impressionistic journal for observation of online interactions, artwork and journal writing in the same way. I initially planned on using Gilligan’s listening guide (as cited
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in Kiegelman, 2009) to guide data analysis but after my initial analysis of the first set of interviews I found it helped to guide me in listening to the voices of the women but not in analysis of the data.

I used prepackaged computer software Atlas as a tool in the data analysis process. Atlas helped me to create codes, look for emerging patterns and themes, find quotes associated with certain terms or concepts and look at different ways of organizing my data. 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 are feeling. As I did this 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 learning a new type of software while simultaneously learning how to analyze data. This made me empathize with my participants who said it was more of a struggle to learn the software than the content. For the final data analysis and for ease of searching, looking for patterns and instances of codes I did load all the data into Atlas.

As suggested by Eisner (1998) I used the social cognitive career theory (SCCT) as a guide rather than a “…recipe or script” (p. 242) but remained open to whatever patterns and themes emerged. “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).

The first time I listened to the interviews I listened for plot as suggested by Gilligan (as cited in Kiegelman, 2009). I noted things such as repeated words that are “…clearly and persistently articulated by the actors in the setting” (Lawrence-Lightfoot and Davis, 1997, p.
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. As I read through the transcripts I created codes as they came to my mind, later going back and looking for patterns within the initial set of codes I created. When reading through discussion posts I listened for words or phrases, and tone or interaction that might give me insight into how my participants were experiencing the class in the context of self-efficacy, supports and barriers. I noted my interpretations of the meaning behind any symbols that emerged in my impressionistic journal. I used classroom content such as course announcements, course syllabus and the bulletin board to aid in the rich description of the online classroom itself.

Gilligan’s (as cited in Kiegelman, 2009) second step in the listening guide suggests I listen for the “I” by listening for instances that stand out to me and strike a chord with something I want to know. While I followed this concept as I analyzed the data I did not create “I” poems. Instead 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 and Davis, 1997, p. 187). I did this by coding data related to the four sources of self-efficacy, sources of support, perceived and actual barriers, and experiences my participants perceived as influencing academic decisions they made. I continuously kept my eyes open to where the data is important to the research questions, as well as where it diverges (Lawrence-Lightfoot & Davis). I did this by constantly reflecting on the data and interpreting and reinterpreting it’s meaning in relation to the interests, goals, expected outcomes and self-efficacy of my participants.

Gilligan’s (as cited in Kiegelman, 2009) third step in the listening guide suggests I listen for contrapuntal voices by distinguishing between the different voices in the story: those aligned
and distanced with self; first and third person, and active voice. When analyzing the online classroom interactions I noted things such as my interpretation of the tone of a post or message, whether a different tone or style is used when interacting with peers or the instructor, the tone of the instructor and statements that seem to either reinforce or contradict what a participant said during an interview. I continued to be amazed at how you can “hear” the tone of a person in their e-mails and discussion posts. As I read through the discussion posts of my participants and read through e-mails between my participants and their instructors I could hear a range of emotions including: anger, frustration, a lack of sympathy, caring, support, and desperate cries for help.

As I listened to the interviews and read through the transcripts and journal entries I did take note where my participants used the “I” and when they seemed aligned or distanced with themselves with respect to the sources of self-efficacy.

Lawrence-Lightfoot and Davis (1997) discuss 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 participant’s stories.
I listened for data that would give me insights into their perceptions of societal values and their own roots and traditions within the context of how they experienced school, made academic choices and developed goals and outcome expectations. I was surprised that none of my participants perceived facing any negative experiences based upon their gender nor did they describe science, technology, engineering and mathematics as a man’s world. While each stressed the importance of a work life balance and having meaning in their work they didn’t perceive this as a feminine trait.

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

Since I was new to portraiture I reviewed the following books by Lawrence-Lightfoot: The Essential Conversation; The Good High School and Respect and literature (Gary, 2010; Good, 2010; Hill, 2005; Newton, 2005; Semon, 2009) in order to gain a feeling for how to present my portraits.

The goal of each portrait is that the reader gain a deeper understanding of how the lived experiences of each of the five non-traditional female students influenced their choice to study and ability to persist in a science, technology, mathematics or engineering (STEM) through self-efficacy, outcome expectations and supports and perceived and actual barriers.

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 and Brinkman 2009, p. 244). Kvale and Brinkman state 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) suggest a researcher “confirm” and “verify” in a way that gives readers confidence in the data; Lightfoot and Davis (1994) suggest 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) suggest establishing credibility, transferability, dependability and confirmability; and Eisner (1998) refers 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). In order to achieve credibility the researcher must carry out 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 and Guba). They state that the “…naturalist must show that he or she has represented those multiple constructions adequately” (Lincoln & Gouba, p. 296).

Lincoln and Guba (1985) suggest the researcher can increase the likelihood of achieving credibility through prolonged engagement, persistent observation, reflexivity, triangulation,
member checking, peer debriefing and clarification of 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, 1994; Lincoln & Guba, 1985; Miles & Huberman, 1994). Patton (2002) points out that the purpose of triangulation is not to confirm your results are consistent across various data sources but to “…test for such consistency” (p. 248). When consistencies are discovered it offers “…opportunities for deeper insight into the relationship between the inquiry approach and the phenomenon under study” (Patton, 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: 1) interviews of the five women in my study, 2) mentor and instructor interviews, 3) observation of online classroom interactions, 4) document review of written coursework, 5) journal writing, and 6) 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 was in support of the same fact and not multiple data sources that support different facts (Yin, 2009). I did this by comparing from the observations of online interactions to that from the interviews as well as data from documents such as written work, journals kept both by me and my participants, artwork and instructor and mentor interviews.
Examples of how I triangulated data include:

- I asked the instructor, mentor, and participants about student services provided by the college that the participants sought out. I then compared what my participants shared with what their mentor and instructor told me.

- I asked the participants about words of encouragement they perceived they either received or didn’t receive from their instructor. I compared that with what I observed in the online classroom interactions, e-mails and asked the instructor about words of encouragement they perceived they provided.

- I asked my participants about their belief in their mathematics ability and compared this to factual information such as their GPA, 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 my participants described their image of themselves as a mathematics student during our interview with their pictorial representation.

These are examples of ways 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 (1997) refers 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 observation of online interactions. She refers to this as hearing their voice, reviewing the facts and seeing it in action. I heard my
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participants voices in three different interviews, journal entries and artwork; review the facts by examining demographic information, prior research, SAT scores, GPA, credits completed, time to completion, and coursework taken prior to college; I saw the data in action through observation of online interactions.

I asked my 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 life. I also asked their instructor and mentor about any role models they may have heard my participant mention or if they see themselves as a role model. I compared what they say as non-traditional female students returning to school to study science, technology, engineering and mathematics to what prior research supports 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 my participants such as demographic information, SAT scores, and GPA as well as subjective data such as interview questions, journal entries and observation of online interactions. While I can’t make any generalizations I was able to find themes emerged in the portraits of all or a subset of the women in my study. Emergent themes that converged across portraits include resilience, passion for mathematics and science and a desire to make a difference.

The data collection process enabled my participants to see things about themselves they hadn’t previously. When first asked about role models Angie said she didn’t have any. As she was recalling a story about one of her teachers during her second interview she realized that the teacher had in fact been a role model. As she reflected upon this “aha” moment she realized that this teacher had a significant influence on the academic choices she ultimately made. Several of
my participants said the interviews and journaling had resulted in them thinking about experiences they hadn’t thought about in a very long time. Reflecting on these memories enabled them to gain new insights into the choices they made.

Lawrence-Lightfoot (1997) describes the situation where the data does not converge, where it is divergent and dissonant, as a story in itself. While in a quantitative study this would result an inability to tell the story Lawrence-Lightfoot suggests, for the portraitist, it is an opportunity to make sense out of chaos and try to understand what the underlying patterns are. In my study I saw subtle ways in which the data didn’t converge primarily related to my participant’s belief in their mathematics ability and belief in their ability to succeed. I looked for logical, reasonable explanations for the divergence by listening again to the stories and reviewing the data listening for what seemed to most influence her beliefs in herself growing up and through her adult life, as well as what her grades were like in HS, college the first time and now. Each of my participants described themselves as always being good in mathematics and always having a strong belief in their abilities, yet in their stories each had an experience where they performed poorly in mathematics and briefly lost their belief in their abilities. In listening again to their stories I discovered that when they performed poorly in mathematics there were other obstacles they were facing. Their ability to ultimately do well in the face of these obstacles I believe is at the core of their resilience and strong, unwavering belief in their abilities today. I also noted that when talking about mathematics it was the successes and their passion that emerged first. In this case I was constructing a “…theme that will explain the dissonance, that will bring order to the chaos” (p. 209).

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). It 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).

I believe 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 goes on to say “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 impact 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. While in college I did have several negative experiences and was made to feel I did not belong due to my gender, yet I persisted. As an adult the mathematics background I have has opened many doors and I feel strongly it is beneficial to study mathematics. My experience as a female of a certain age, with a bachelor’s degree in engineering, a master’s degree in business administration and now 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 are mine and I don’t currently teach any mathematics 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 non-traditional 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 non-traditional student.

**Transferability.** Transferability is the naturalist term for generalizability and is related to external validity. Eisner (1998) describes generalizability as “…transferring what has been learned from one situation or task to another” (p 198). The content that can be generalized includes 1) skills, 2) images, and 3) ideas. While randomization is required for formal inference, one can also use attribute analysis or pattern matching (Eisner). Eisner suggests we can make inferences based upon partial information about a unique attribute or a generalized image he refers to as a *gestalt*.

Lawrence-Lightfoot (1997) also uses the term gestalt when describing conception as “…the overarching vision, the embracing gestalt that will give the narrative focus and meaning” (p. 248). As suggested by Lawrence-Lightfoot I will begin by looking for the dominant emerging theme, the most powerful repetitive refrain or the life litany. I looked for themes that “…resonate through the narrative, expressed in explicit statements…subtle nuances of behavior…illustrative and evocative stories” (p. 248). When listening for the gestalt I was listening for specific experiences that led the five non-traditional female students in my study to choose to study science, mathematics or technology and be successful. While it wasn’t necessary for all five women to have the same experiences to be successful, they did share some of the same experiences. This result can guide other women, administration and families as well as future research (Eisner, 1998).

Eisner (1998) describes educational connoisseurship as a form of qualitative study that leads to vivid descriptions. The vivid description of portraiture and the way it captures “human experience in social and cultural contexts conveying the perspectives of the people who are
negotiating those experiences” (Lawrence-Lightfoot, 1997, p. 3) will help me convey to the reader a deeper understanding of how the lived experiences of the five non-traditional female students in my study influenced the ways in which they constructed their beliefs and ultimately the path they took to returning to the university to study science, technology, engineering and mathematics (STEM) major. Witz (2006) says the purpose of portraiture is “to understand this experience, with empathy and sympathy as part of the larger unity of the person of whom this experience forms a part, and to communicate this understanding in carefully constructed portraits” (p. 246). Witz describes portraiture as “sensitive to deeper aspects in the individual, such as sources of inspiration and higher aspirations, and to subtler levels in experience and consciousness” (p. 246).

**Dependability.** Lincoln and Guba (1985) describe 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 accomplished this 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, looking for emerging themes, and how I ultimately weaved each portrait.

Specific steps I took include: 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 is to enable other researchers to better 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, how I prepared the data for analysis and created emerging themes and what conclusions I made (Miles & Huberman, 1994).

**Confirmability.** Confirmability relates to external reliability. Miles and Huberman (1994) describe 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 ensure procedures are described in detail; the sequence from data collection through analysis and final portrait can easily be understood; there is an audit trail by documenting all my work and storing in a safe place; being explicit about my personal biases, allowing other researchers to review the data and discuss competing theories and retaining study data.

**Summary**

In this chapter, I described in detail how I followed the portraiture methodology, collected and analyzed the data in my study. I described how I selected my participants, the setting, the steps in data collection, analysis and weaving of the final portrait. My study consisted of five non-traditional female students who successfully returned to the university to study science, technology, engineering and mathematics (STEM). Data was collected over a six month period and included three interviews, observation of online classroom interactions, journal writing, document review of coursework, a demographic survey and artwork. Data was analyzed following the techniques described by Gilligan, Eisner, Miles and Huberman 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 non-traditional female students studying science, technology, engineering and mathematics (STEM) and inform future studies. Future studies should further identify factors that will help families, universities, and society encourage and support women in their pursuit of STEM.

**Summary of Study**

The goal of this study was to gain deeper insight into the influence the lived experiences of the five non-traditional female students in my study had on both their choice to return to school to study and ability to persist in a science, technology, engineering and mathematics (STEM) major. Portraits were woven based on analysis of interviews, artwork, observations of online classroom interactions, document review and journal reflections.

Using social cognitive career theory (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 my participants to choosing to return to the university to study science, technology, engineering and mathematics (STEM).

**Chapter 4 Portraits**

**Students in Context**

The actors in this study were five non-traditional female students returning to university to study science, technology engineering and mathematics (STEM) online. One was divorced
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with three grown children, three were married with no children and one was engaged at the time
of the study. All of the women except one were employed at the time of this study and ranged in
age from 23 to 44. For each of these women their return to the university was 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 science, technology,
engineering and mathematics (STEM) field: Luisa in engineering and Alice in computer science.
Both Alice and Luisa did their first year of college instead of their senior year of high school and
neither successfully completed that year. Jeanie, Alice and Rosa cited better work life balance as
a primary motivator for their return to school while Luisa and Angie had financial motivators for
returning. When discussing their chosen career and expected outcome all the women cited the
opportunity to make a difference as being critical to their choice of career goal.

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 for personal satisfaction (Dey &
Hill, 2007; Kramarae, 2003). Results of this study are similar to those by Vaccaro and Lovel
(2010) who found that while 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 study had strength, resilience and a strong drive to complete their college degree.

All of the women cited the opportunity to study online as critical to their ability to persist.
In a study by Furst, Bowe and Dittman (2001) seventy-five percent of the women in their study
chose distance learning for the convenience and flexibility which allowed them to juggle work,
family and educational responsibilities.

A Brief Introduction to the Participants
Jeanie spent most of her childhood in doctor’s 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 healthcare 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 Physician’s Assistant school. At the completion of data collection she had been accepted and is currently enrolled in a program.

Rosa returned having never completed her Bachelor in Fine Arts due to 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. Rosa returned to school with little direction except a desire to have a job with “regular” hours and a steady income. When she took her first science course she made a connection with the instructor and content that enabled her to rediscover her passion for science. It wasn’t until lunch with a friend that she was able to translate this passion to a career. She now plans 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 a 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 due to 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 has chosen to purse mathematics due to her passion for the topic, the need for teachers in this field and the desire to provide the guidance and support she never received.

Luisa began her college career her senior year of high school studying engineering. One of two women in the program Luisa eventually dropped out due to poor grades and a lack of direction. After a divorce Luisa returned to complete a degree in Information Technology, a degree she saw as leading to a career that could support her and her family.

An abusive father and negative learning experiences, including being reported to the FBI by one of her teachers as a terrorist, drove Angie to want to distance herself as much as possible from her family and community. This led to her enrolling in school in Lebanon 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 US enlisted. 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 has 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 path they took to returning to an online school to study science, technology or mathematics and the role self-efficacy, supports and barriers placed in their belief they could succeed.

Setting
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). In order to achieve this 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 science, technology, engineering and mathematics (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 refer 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 was influenced by my personal history and prejudices.

The personal perspective I bring to the setting description becomes 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) 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 setting her I would like to share a view from a mentor and instructor to give additional context to the school and classroom experiences of the actors in my study.

Through the Eyes of Rosa’s mentor
Prior to our first interview I had “met” Dr. V during several work related virtual conferences but never sat down to talk and met her for the first time face to face while we were both at a conference in Orlando. While I knew “of” her, I didn’t really know her. Based on my virtual interactions I had a picture in my mind of her and face to face she was just as I 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 passion and sincerity in her voice.

Since we don’t work in the same location we made plans to get together for the interview at an upcoming conference we would both be attending. After several failed attempts to connect, we decided to set a time when we both got home to meet over Skype. Dr. V had her camera on and her office was warm and inviting, just as I imagined it. Students who are studying completely online don’t 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 right away she knew the mentee and could recall such detail about her. I explained that I had gotten Rosa’s permission to interview her and that we would be discussing her general student experiences as well as those specific to Rosa. I mentioned how strange it feels 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 a student has their first meeting with Dr. V she always starts by asking “what would you do for free, what would that look like” (interview 1)? What are you passionate about” (interview 1)? She describes 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 tells me she has an, “electronic b-line corridor to student services to help students write and try to get them services in that area because it is pretty abominable” (interview 1). Dr. V frequently refers her mentees to student services but describes a lack of consistency in follow up. “I usually refer them over there to get some help. The problem is there is no continuous follow up. If a student is told your writing skills really need to be honed and it is problematic. And after you say it there is no follow up and they continue going on. So for me that has probably been the main thing” (interview 1).

Dr. V feels writing skills are the weakest link for most students and where stronger support services are most needed. “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).

Dr. V describes her first impression of Rosa as “initially when Rosa came into the environment I felt whatever Rosa decided to do, whatever path she took, she is going to be successful” (interview 1). Later in our interview, when talking about Rosa, she states, “I think she is phenomenal” (interview 1). She described a challenge for Rosa related to the way CSE
advises “...we’ll take all your credits, whatever it is we’ll take it. That is not necessarily always the case” (interview 1). Rosa came in with years of gymnastics both as a participant and a coach. The challenge was trying to turn that life experience into college level learning and figure out how it would fit into her degree plan. It was difficult finding an evaluator to do the prior learning assessment (PLA) and Dr. V “checked around trying to get people who could test her gymnastic background because it became problematic” (interview 1).

Dr. V describes Rosa as having “gone through this dance for several years” (interview 1). Rosa originally enrolled as a community and human services major and changed her direction several times. Dr. V mentioned Rosa at one point wanting to go on for her masters since “now we want business, because she ultimately wants to own her own business” (interview 1). She currently has decided she wants to pursue Life Science.

When describing Rosa Dr. V uses words 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” (interview 1). After completing 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” (interview 1). Dr. V describes it as her aha moment. Prior to this course Rosa might describe a course as a “good course” or say “it was ok” but with this science course “she was in love” (interview 1).

Through the eyes of the instructor

I have known Dr. T for about two years. Several months prior to our interview we both happened to be at a local coffee shop working and discovered it was a favorite place for both of us. So, when it came time for the interview it seemed like the perfect place to meet. We could have privacy, 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 a dentist appointment earlier, got
out early and when she finished up wanted to grab some lunch. Like me, and the participants in my study, she is 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 plays in her support system as well as the flexibility of teaching online.

As we began the interview we both commented how it seemed strange to have me interviewing her. Once we got past the first interview question the conversation flowed and it was as if we were just two faculty members talking. Dr. T described her course as an advanced level science class that meets general education requirements. She gets a range of students from those who are taking the course as part of their degree plan to those who think it just sounds interesting. She explained how when she initially taught the course it had already been developed by someone else and that it “feels weird but I knew the developer and it was a very sound course” (interview 1). It is common at CSE 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 two years of teaching this course she worked with a developer and another instructor to update it. She discussed how teaching it for two years enabled her to get a feel for the course and what areas needed changing in order 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 describes 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 sees someone having an issue she “lets 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 sees 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 is a constant frame of reference for her and something she goes 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 describes how in a face to face class she would just say “drop me a line” (interview 1) and in her online course she tries to send them the same message and “make them feel more comfortable” (interview 1). Dr. V starts 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 includes an overview of the assignments and discussions. She also includes tips, information on how she grades assignments and CSE policies and support services.

When discussing issues related to technological abilities Dr. T says “students have gotten better over the years….some trouble with the labs. 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….students want things very literal” (interview 1). She describes students as “sometimes frustrated…they want to be the best they can be every time” (interview 1).

A common problem she is faced with is plagiarism, “They Google answers all the time” (interview 1). She described one situation where a student posted answers to an assignment on Yahoo answers and two students copied their answers from there. This resulted in her having to change the assignment questions. It is a constant struggle for her to “try to write questions they can’t Google” (interview 1). As far as student services she posts the link to the Smarthinking writing tutor but doesn’t know of anyone who uses it.

Rosa and Jeanie were both enrolled in Dr. T’s class. She describes them as “very diligent, keep in close contact…very strong…diligent about keeping up with assignments…..reach out…” (interview 1). For the non-traditional students in this class it is 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 tries to help them with time management by suggesting they “print out the schedule and check things off…it will make you feel good…ask questions…reach out…it is the nature of adult learners” (interview 1).

Through the Eyes of the Student

Each student eagerly invited me to observe their online interactions. Having the flexibility to study online was cited by all the participants as what made it possible for them to persist in school. They spent a range of time online studying.

When reading discussion posts I looked for examples of 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). I also looked for examples of participants seeking out support such as reaching out to student services or encountering barriers such as not being able to complete assignments on time due to difficulties balancing school, work and family.

After obtaining permission from both the student and instructor I was able to “see” what the student sees, experience the support each sought out and received through instructor e-mails and the support she offered to her peers in the discussions. I “listened” to each participant express the barriers they faced and the difficulties they were having balancing work and school. I “heard” instructor’s provide words of encouragement and offer the flexibility needed to persist.

Looking at the course announcement I could “hear” the instructor encouraging them, letting them know what was coming and how best to approach it. In looking at Alice’s postings she posted early and often, tended to offer words of encouragement to her peers as well as explained to them how to do things. 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 that post after the term is over.

Alice told me about the way she approaches each course. First she looks at the course schedule then she puts everything on a calendar and makes lists. She describes this as a critical step to her staying on track and managing her time. Angie also mentioned making lists and crossing things off as critical to her success.

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).

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 shows 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 9/7/11)

Rosa posted often and gave careful thought to her posts. I could hear her excitement and
passion for the subject in comments such as “This article is truly fascinating. It amazes me…”
(reply to classmate, 11/19/11); “I am really interested in learning more…it touches me…I am
excited to be working with everyone.” (original post, 11/30/11). In her journal Rosa describes
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
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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, 9/10/11). In another post directed to the entire class Rosa says “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” (9/15/11).

Luisa describes the Maple software as a barrier. “The other hard thing about 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. Maple 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). E-mails between Luisa and her instructor shed light on the frustrations and ongoing barrier the software was throughout the course. 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 can hear not only Luisa’s frustrations with the technology, but her resilience in the following post, “Maple was a previous demize in a course and I will not let it frustrate me 2xs” (original post, 9/30/11). 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
has 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, 10/9/11).

Alice on the other hand found her years in the computer field gave her an advantage with the technology. She was quick to share this knowledge and I saw several examples of her reaching out in her discussion posts as well as during out interviews. Alice appeared very at ease with the technology related to online learning as well as with reaching out and creating a support network. She has taken online courses before and her technological background enabled her to quickly set up online support groups as well as virtual student meetings. It was access to a virtual meeting tool she uses at work that enabled her to do this. Alice was thankful she has a prior teacher who did a good job explaining how to use the Maple software as she felt this teacher did not. She shared her knowledge and experience with her peers and it seemed important to her to be able to provide this kind of support.

What struck me about all posts that I read, and is something I have experienced as an online instructor, is the intimacy and connectiveness that develops in an online course. You can hear caring, frustrations, words of encouragement and on occasion 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 or not online learning left them feeling isolated. Alice didn’t see online learning as isolated although the mathematics group is small. She felt that since they tend to take classes together they get to know one another and form a close supportive bond. Luisa, who was studying information systems and taking a math course found herself feeling isolated and alone. Due to the small number of students in Angie’s concentration she found herself alone and did mention she misses 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. Looking at the course announcement I could “hear” the instructor encouraging them, letting them know what was coming and how best to approach it. In looking at Alice’s postings she posted early and often, tended to offer words of encouragement to her peers as well as explained to them how to do things. 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 that post after the term is over.

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**Alice-I am Stronger Than My Past**

*There was never any doubt in my mind THAT I would return to school to obtain my Bachelor's Degree.*

When I first read Alice’s survey responses the thing that came through was her passion to make a difference and feeling that her life would have been different if someone had just reached out to her. 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. When I suggested in an e-mail we meet in a room at the school 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). When I asked about a time she said “During the week any time after 5pm is good. I work from home, so I’d be free right at 5 pm. On weekends pretty much any time is good. I’m really flexible” (e-mail, January 8, 2012). After scheduling our interview we exchanged phone numbers in case either of us needed to make a change. On the day of our interview Alice texted me asking if I was OK with dogs. I mentioned I had a black lab and she texted “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).

On the day of Alice’s interview I had to bring my car in for repairs. When I went to pick it up they told me it would be another hour. Meaning the car wouldn’t be ready until 6 and our scheduled interview was at 5:30. I felt horrible having to tell Alice I wouldn’t be able to make our scheduled time but at the same time I felt a level of comfort with her. We had exchanged cell phone numbers so I texted her letting her know of the situation and asked if she wanted to reschedule. Her response was “tonight is still fine....I work from home and go to school from home. You’re not inconveniencing me at all”. She also added that “the driveway is pretty snowy but my fiancé carved a path for you” (text, January 12, 2012).

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. Alice lives in a suburban town in the Northeast 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. The road Alice lives on is a
main, fairly high traffic road, and one that I have driven down more times than I can count
driving my son to the hockey rink up the 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 open space with high ceilings and beautifully remodeled.

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). This sense of exhaustion came through in
one of her 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 : (“). I was struck by the caring
words of the instructor’s response “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 helped
us both overcome what would otherwise be impossible obstacles.

Pre-College Years

Family. I was surprised at the ease in which Alice’s story unfolded. It seemed clear she
had spent time reflecting upon her experiences and how they had shaped her life. Alice grew up
in a small farm town on the rural outskirts of a town where over half the population currently has
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at least a HS diploma and over 25% have at least an undergraduate degree. While 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.

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 versus an inner city school where I imagine the values are very different.

Alice was not allowed to watch TV or listen to music and recalls,

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. My dad is really technical, I mean I have my two parent’s brains, my mother with the reading aptitude and my father with the math technical (interview 1).

Alice’s dad traveled a lot as a member of the school board. While she remembers that as having a positive impact 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 due to 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 100’s, two 99’s 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).

Thinking back to role models at home evokes memories in Alice of her mother’s 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.

While Alice didn’t directly mention her father as a role model his technical background and involvement with the school board served as vicarious experiences for Alice and I believe influenced her choice to work in the computer science field. 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.

Growing up Alice struggled with undiagnosed ADD. She spent her teen years surrounded by friends who were drug addicts and experimenting with drugs. Alice almost died during her junior year due to a drug overdose. She found herself being homeschooled most of the year and doesn’t even remember her prom being announced and never took the SAT’s.

When she initially returned to school she was so overwhelmed with anxiety she couldn’t function without anti-anxiety medication that made her sick. As Alice recounts this experience I am imagining feelings of isolation and missing out on fun, as well distress over missing so much school. Yet, it doesn’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 impact Alice’s school environment had on her.

**School. Nobody cares that I am drowning.** The contrast between a lack of guidance, support and role models and a belief in her mathematics abilities permeates Alice’s interviews and journal entries. Throughout her high school career Alice’s belief in her mathematics abilities never wavered. Alice repeatedly speaks of how easy mathematics and science had always been for her and the straight A’s she received up until her middle school years when things in her family life took an unfortunate path. “I could have gotten straight A’s but it just wasn’t a focus for me anymore” (interview 1).

Alice’s pride in her personal accomplishments comes through as she describes 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 describes 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 reflects back on this memory it dredges up feelings of regret and missed opportunity.
I was excited to get it 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 listen to Alice’s words I can’t help but wonder who Alice would have been? If she didn’t face the challenges in her life, and overcome them, would she still have the same strength and resilience I see in her today? I believe each life experience shapes us into who we are. I see before me a strong, amazing, resilient woman and hope that she sees the same in herself.

Alice contrasts her own life experiences and outcome 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).

As I listen to these final words I hear Alice describe who she hopes to be and the role model that inspired her.

It is this lack of guidance and support throughout her childhood that seems to drive her passion to make a difference. “When I become a teacher I have every intention of pinpointing students and sending notes home to their parents. Your child is excellent at math you may want to do this.” Her goal is to be a life raft for others. I thought of my own passion and drive to be
that life raft for others. I am struck by the lasting impact childhood experiences have on beliefs, values, choices and actions well into adulthood.

**Challenge me please.** Alice vividly remembers being bored in school. She takes me back to 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 recounts this story I gain insight into how important her childhood academic accomplishments are 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).

When thinking back to her greatest academic success without hesitation Alice says,

“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).
The repetition of this story further reinforces the importance of childhood personal accomplishments long into adulthood. Alice mentions her ability to read the Lord of the Rings at a young age and earning a 92 on the regents with little effort several times in our interviews and in her journals. These seem to be a symbol to Alice of her academic abilities.

**The Road in Between**

*Bumps along the way.* At the end of her junior year it was suggested she finish her high school year at a local community college. Alice describes 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. It turns out it was this decision, based upon an offhand comment by a guidance counselor, would be the event that led Alice to not finish college the first time around.

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 describes 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. It was this job that would help her find her way and eventually lead her back to teaching.

Alice started out working for a large computer company from 1999-2000 as an Education Broker responsible for data input of class scheduling and course descriptions. She found herself finishing her 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 changed companies in 2000 and began work as a computer instructor. In the spring of 2001 that company went under 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.

Alice soon returned to school but found it difficult to balance the heavy work schedule with school and took a leave of absence. Yet another obstacle prevented her from returning to school when she planned. Due to 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. 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 hr. a 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 took a full time job at a local computer company and was optimistic about her future.

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”. The company cut 15% of its workforce but Alice describes 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).

Eight months later when Alice returned to the US 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 CSE because it was online and set up to support adult learners.

Alice’s perseverance and inner drive comes through 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). She goes on to share the following story on how she came to the decision while working in India:

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).

This statement brings out the logical way her mind thinks and her ability to always look forward and always have a plan.

**The Journey Back to School**

**Life in the Fast Lane.** Alice doesn’t tend to seek advice from others and remains driven by an inner motivation and self-confidence. “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 if yourself. If you don't please yourself then you will never be happy” (interview 1). Due to her negative experience the first time around Alice was hesitant to try online learning again until a conversation with a colleague who was on unemployment and attending CSE. 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). This was the turning point for Alice and she began her research and journey back to school.

When speaking of the support she receives from her fiancé she states “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. Alice’s deep sense of caring and desire to help others emerges as she describes 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). The incongruence between the support that she receives and the support that she gives out stuns me.

When in need of support Alice feels it is difficult to seek it from people who are not going through the same experience. She seeks 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).

Alice is currently in her last semester and has an arsenal of tips that enable 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).

Be There for Me. Alice was having a very frustrating semester due to 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 has high expectations not just for herself but for her instructors as well and is not willing to settle for the status quo when it comes to the quality of education she is receiving. This semester she is

…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 reflects back on a range of experiences she has had with instructors and intensely describes how critical instructor support has 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 describes the obstacles she faced due to 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. I believe it was Alice’s drive and inner motivation that enabled her to persist through these foundation courses. I can’t help but wonder about other students who may have less confidence or drive.

Alice has avoided certain courses due to bad previous experiences with instructors. This is not the first time I have heard someone mention not taking a course due to the instructor but it
becomes a problem when it is a required course and there is only one instructor. Alice is fortunate in that she lives near a center and is able to seek face to face support from a tutor there. Alice knew that she needed help and took the initiative to seek it out. Alice is also fortunate to have her fiancé’s brother who has taught calculus 1, 2 and 3. While he has provided a significant amount of support in the past he “…had a baby last year. So now unfortunately he has no time” (interview 2).

In an e-mail from Alice on March 15, 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. :)”

Identity with Mathematics and Science

Alice is passionate about her love of mathematics. When she thinks back to her image of herself as a mathematics student the first thing she says is that high school was her last mathematics classroom experience. All of her college mathematics courses have
been taken in a virtual classroom. She is 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 thinks back to high school mathematics the picture she verbally paints is 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 wooo as you go down” (interview 2).

Alice brings up her difficulties with remembering things several times during our interviews. She contrasts the type of thinking needed to be successful in a history class with mathematics and relates 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). Alice has the life experience and self-confidence to self-reflect on her strengths and weaknesses and know what she needs to do to be successful.

**Path to Mathematics Teacher**

The imprint that Alice’s mother left on her emerges in our interviews and in her journal entries. As a child, her image of who she thought she should be when she grew up was forever reshaped by her mother’s abuse. “As much as I always wanted to be a teacher I didn’t want to
follow in her footsteps so when it came down to it I threw that out the window. I’m not going to be a teacher and I have no idea what I am going to do with the rest of my life” (interview 1).

Alice recounts several transformative experiences throughout her adult life that ultimately enabled her to reclaim her dream of becoming a teacher. Alice 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 impact 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”. I hear in her voice how meaningful this is to her and how it is 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). While I could hear the regret in her words, Alice’s resilience comes through “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)”. 
What does the future hold for Alice?

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 shared the following in an e-mail,

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.

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. I was thinking about methodology and effectiveness of educator reviews… I also reached out to CSE to find out what the college level professor review process is all about. I find that the end of term surveys are garbage. They allow CSE to get just a small enough amount of information that they don't really have to do anything about the problem professors. Anyway, that is just my two cents for now. 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- Small Town Girl, International Linguist and Mathematics Teacher

“…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...”
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 shares with her husband at the military base they are both stationed. I feel an immediate connection with Angie seeing her bicycle sitting in the corner of her room. I found myself feeling surprised when Angie shows me the piano that she still has from her childhood, sitting right in the middle of her apartment. It was not something I expected.

Angie’s resilience came through within the first minute of our first interview as she described her decision to attend college in Lebanon and the events that led her to where she is today. Her journey started with a high school teacher reporting her as a terrorist and the FBI knocking on her door just hours before her high school graduation. “So, it was interesting, even just from the beginning. So I moved to Lebanon in 2006. I started college over there. 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 Syria 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).

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 currently has no children. While Angie is young in years she is old in life experience, wisdom and perspective. Angie works 40+ hours a week as an Arabic Language Analyst in the United States Air Force (survey). Angie is pursuing a BS in Physics and her husband, who is also in the military, is pursuing a BS in mathematics at the same college.
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A typical day for Angie is 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 home work for her language class from 8-10 PM and finally going to bed at 10:30 PM. She does her CSE home work on weekends.

Pre-College years

Family. 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”. When describing where she grew up, Angie states, “I grew up in the woods”.

Angie describes 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 the school had to be combined with another town. Her graduating class had only 80 students. Although her town was small and isolated Angie was only about 30 minutes form NYC where she found herself escaping to during the weekends. She credits these trips to her desire to see the world and go far away to college (e-mail 4/1/11). 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”.

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 owning the piano she still keeps today. When Angie thinks about the household roles of her immediate family members I hear 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).

When Angie recalls the environment of her home growing up I hear 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).

Angie vividly recalls the impact 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).

Angie’s mother provided much needed words of encouragement by repeatedly telling her she can definitely do whatever she wants. “She always wanted me to do what she didn't do” (interview 1). 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). Angie’s father is a role model of who she doesn’t want to be and his actions continue to 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.
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. 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. This further reinforced in my mind her resilience.

**Music is at the Center of her World.** 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 due to working three jobs. 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).

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 her greatest disappointment.
Piano and music were close to Angie’s heart throughout high school and provided a continuous source of personal accomplishment as well as a role model in Angie’s life. “…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.

School. When Angie reflects 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).

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…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. Um but it kind of my success kind of caused the teachers to give me extra attention and push me to do better but they probably should have been working with kids who needed it so I feel guilty. It might be because of my brother too…in kindergarten 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
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studying. I hated recess, always, so much” (interview 2). The images Angie included in her

collage reflect this passion and love of learning. As I listen to Angie recount this story I am
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.

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.

*Somebody reach out and show me the way.* 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 and um I think things were generally easy for me up until then. 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 it wasn’t difficult but I got 10th, 11th,
12th grade. 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). 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 was an academically strong student who, due to the stress of her home life, stopped going to school and without anyone there to reach out to her and provide the needed support and guidance continued to let things spiral down. Angie describes the net result, “missed 50% of last year of high school, got 50’s and 60’s. 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). Her resilience comes through when she states, “I thought you know what I am still going to graduate” (interview 1). As Angie said this 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? Through the stories she shared during our interviews and in her journal entries I realized that while she may not have felt it at the time she was surrounded by people who provided a support system.

I hear the regret in Angies’s voice as she recounts 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). I hear Angies’s resilience and commitment to education come through, “Although 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). The optimism I continually hear in her voice is another piece of her resilience.

Angie recalls 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 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).

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, Arabic…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 and it was like well everybody needs an Arabic language course. So I will choose Arabic, it was weird, kind of out of nowhere. 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). Now she has come full circle and returned to school to study Physics and eventually be a mathematics teacher.

The lack of any role model or positive verbal persuasion in her life is evident as she shares the following story about her decision to study Arabic and go to Lebanon. “Yeah, so
nobody was ever helpful in terms of helping me decide. When I did finally decide I wanted to go for Arabic, which is what I eventually decided, my family members were like oh well alright what is that, basically 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. So originally I was planning to go to SUNY Binghamton because they have an Arabic program and then when I switched to Lebanon the 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…So my mom didn’t know much about it 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 even after Syria 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 Lebanon for college. That’s ridiculous, and to this day they 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). In this last statement I again hear her resilience. Angie also points to the importance of her mother’s support. While she couldn’t be a role model or provide any direct guidance for Angie, just knowing she was there, seemed to be enough.

While she was in high school the only adults Angie felt any connection with were her language teacher and piano instructor. Language and piano are two things that remain a strong part of her identity today. “My Spanish teacher was very proud of me because I was in AP Spanish and she thought that language was a good idea. The rest of them 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 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. Especially the world history teacher who thought I was a terrorist…I talked to my piano teacher about wanted to be a piano person and I even started to I kind of started to prepare my audition repertoire but that fell through when I stopped going to piano lessons” (interview 1).

Angie vividly recalls her mathematics teachers and the influence they had upon her interest in the subject. “My math teachers were always the coolest and I wanted to be like them”. 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).

Angie recalls a lack of any real words of encouragement or direction from this teacher, “I don’t think she really cared. No, she was probably, out of everyone in my school, she was probably the most helpful in terms of picking a college because she had actually gone to a good school, NYU and graduated. So, I mean if anything she encouraged me to go to NYU but in terms of a major she never really gave me advice about it or anything um nobody else was involved enough in the college process to help me decide” (interview 2).

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 are 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...SUNY Binghamton, applied to NYU, Columbia…” (interview 1). I think 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 realize how context not only impacts the words given but how they are heard.

College the First Time

A journey across the globe and back. Prior to enrolling at the college in Lebanon Angie knew she was interested in science and mathematics but wasn’t sure what she wanted to concentrate in. Her choice to attend school in Lebanon 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, Lebanese 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).

Angie recalls the challenge of her course work in Lebanon not in the content but that they were all in French, a language that she “… just picked it up as I went along. I kind of self-taught myself a little bit with those learn French books” (interview 2). Thinking back to her classroom experiences in Lebanon dredges up memories of helplessness. As part of her business marketing course Angie had to find a business on which to base her business plan. Due to her inability to communicate, drive or even know her way around Beirut, 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 has 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 Arabic. And I couldn’t speak Arabic 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, including most recently Beirut. I try to imagine myself in her shoes and wonder what it must have been like being in a foreign land, unable to speak the language and with absolutely no support system.

During her short time in Lebanon Angie became involved with an abusive Lebanese boyfriend who didn’t let her have friends which led to her feeling further isolated and alone. She described her best friend, and the one who taught her to speak French, as the Philippine maid at her boyfriend’s house. As she recounted her story I could still hear the fear in her voice. Yet, I believe much of this experience has made her the strong, resilient woman she is today. Each experience we have, good and bad, defines us.

**Back to College**

Angie mentions boredom in our interviews, her artwork and her journal entries as a motivation for returning to school to study mathematics and science. While she had already earned an AS in Arabic she felt “foreign language seemed boring. I decided if I did physics I could do a lot of math and physics” (interview 1). Angie’s eyes light up as she enthusiastically describes what she sees in her future. “I will be done in two years and want to get my PhD. I don’t want to be stuck in one place. I hate being forced to stay in one place. I don’t like it. I want to teach but I wanted the flexibility to start a non-profit. I want to teach them something. There are so many choices. We (her and her husband) want to start a healthy fast food chain. I am getting degree in physics and he is getting one in math. He is overseas and will be back in March” (interview 1). To this day Angie continues to be overwhelmed with the range of choices.
She describes how she narrowed down her area of study to science and math, “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).

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”. It is evident that memories from high school continue to influence Angie as she reflects on her feelings about previous school experiences. “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).

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).

Several times during our interviews and in her journal entries Angie mentions the immense source of support her husband is for her. “My husband is one of my biggest motivators…he is my support system. He has been there for anything…he 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…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. They had to pull in some random physicist. Somehow 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 husband when mentioning I wanted to return to school for my PhD. This lack of support prevented me, at the time from returning.

**Life as a Non-Traditional Student.** The schedule is clearly taking a toll on Angie and she has 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 hrs. 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 4 classes right now, work ahead in case I get busy, mentor 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”

Angie describes 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 HW. I get stressed out when I have to remember, writing it down takes away the stress” (interview 1).

Within the military Angie seems to have finally found a female role model to provide the guidance she has been seeking. “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).
Angie doesn’t feel a connection with other mathematics and science students which she feels is due to the online setting. “I think it is difficult in the online environment…” (interview 2). 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).

Where Will her Path Take Her?

When thinking about her future, uncertainty creeps into her voice as she recalls 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 micro-biology. 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 has a clear vision of what she hopes 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 Middle East, putting up an institute, I think about it” (interview 1). When thinking about her image of who she will be after graduation Angie says, “Eventually I would like to be a professor at a university and would be fun. We (her and her husband) will be the fun teachers. So some work for the Peace Corps…” (interview 3).

When talking about her future Angie repeatedly mentions helping others as a source of inspiration for her goals. “…teaching at high school would be ok because I like the idea of helping people learn…I also reached the point where I am more of a mentor…I like the idea of doing cool things and contributing…the kind of teacher kids come to after class and give them
advice and make them awesome” (interview 3). 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).

Angie can 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). Angie traces her motivation to be a teacher back to experiences she had, “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…it doesn’t seem impossible at all” (interview 3).

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. The Air Force is a pretty big organization. In all these people why would one person be recognized? They nominated me as the top linguist across all the Air Force. I was recognized as the top linguist. 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.

Angie offers 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-A Lifelong Passion for Medicine**

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

Jeanie grew up in the country in a two parent family with her twin sister. Jeanie and her sister were born premature. Her twin sister struggled with illness throughout her life and in our first interview Jeanie describes 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 doctors office. We were there 1-2 times a week.” 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 Dr. I just knew I didn’t want to be a nurse. I had a constant drive of wanting to do that (become a Dr.)” This is the first instance where I hear her resiliency and the role her father played in her interests and goals. Jeanie faced
numerous obstacles on her path to medical school that prevented her from attending immediately after graduating with her BS. As an adult woman returning to school, Jeanie has the perspective of life experience and an ability to see the work life balance in a way she couldn’t at 18. She has returned to school to be a physician assistant. A profession she feels will allow her to meet her personal desire to make a difference, keep busy and enjoy her family life.

Prior to our first interview Jeanie and I e-mailed about setting up a time. Due to distance we agreed to do her interview over Skype rather than face to face. Jeanie lives in the southeast while I am in the northeast. On Jan.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. As an online student I incorrectly assumed Jeanie would be familiar with Skype, yet her self-confidence came through as she showed no apprehension or concern about using this technology with which she was not familiar. Having her husband download Skype for her was the first time I began to see the critical role her husband plays in her ability to persist. In her journals, our interviews and in her e-mails Jeanie refers to her husband and the support he provides numerous times.

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)

In this e-mail I gained insight into the numerous obstacles Jeanie faced as she was trying to balance school, work and her life. I also gained a deeper appreciation for the time constraints she has 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 plays. Despite working opposite shifts and balancing numerous things her husband took the time to support her. Jeanie tells me in an e-mail the following day “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 can hear in her voice not only how much she appreciates her husband’s support, but how much she needs it. I find myself anxious to her more about her husband, relationship and how it fits 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. Yet, 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 self-confidence could be heard in every intonation of her voice. Jeanie sounded very at east 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 Jeanie’s voice.

While 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 share a house with her parents and sister, who live upstairs. They have many farm animals including 8 horses, 3 cats, a large rabbit, two dogs—once of which they have been caring for while her cousin has been in Kuwait for 2 years with the military and so they seem to have inadvertently adopted it! Jeanie and her family live in the country in a small town with a population of roughly 1500. The road she lives on is barely one lane in a rural farming community. 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 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”.

Jeanie is a 28 year old married woman with no children. Making a difference and constantly being challenged are at the core of who she is. In her voice I hear a strong, confident woman who knows what she wants, feels confident in her decisions and path, and is always looking forward. I don’t hear regret in her voice or get a sense she is stuck in the past. After reading the first draft of her portrait Jeanie says, “I am so flattered! Unfortunately, after being denied so many times by medical schools and currently on a wait list for that 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).

I hear in her voice a sense of appreciation for the support her husband provides and frequently noticed her ability to reach out for and accept this support. She does not see herself as an island. During our interview her husband “popped in” and I could hear in their voices the support and encouragement he provides to Jeanie.

Pre-College Years

Family. Thinking back to her childhood Jeanie recalls, “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. My mother didn’t seem to care too much about it. She at one time told me she should have been a vet” (interview 2). 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 can remember there was a strong connection to the medical field. I believe the experiences in the medical offices and seeing the compassion her sister received from the nurses and doctors strongly influenced her never wavering pursuit of the medical profession.

Thinking back to high school conjures 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”. The desire to work and not stay home with the kids is strong for Jeanie. The role of a woman working is in her family
history but she sees that the women inevitably put the family first and career second. This is not what she wants.

Thinking back to a time when she struggled with a particularly hard course Jeanie remembers her mom taking her to the library every week to help her find the answers. Her dad was often a source of support when doing homework and the one who discovered she needed glasses. She vividly describes 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”? She remembers both her parents helping her with mathematics homework.

The desire to help others permeates the stories she shares in her e-mails, interviews and journals, as well as in her course discussion posts. Due to being born prematurely, and the resulting medical conditions, Jeanie’s sister had difficulties learning. Throughout high school and college Jeanie helped her sister with mathematics. Even today, Jeanie continues to help her sister, who lives upstairs from her, in mathematics. Jeanie recalls, “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).

School. Jeanie recalls a consistently strong sense of her academic abilities. Throughout her childhood earning “A’s all the way” (interview 1) during her K-8 years. In high school her grades slid due to being sick. “I got honors and awards in everything in elementary school and in middle school I received an award for excellence. 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). She describes her passion for math as something that was always there. “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). Like several of the other women in this study Jeanie mentions several times not being good in history or art.

Jeanie shares a story where she received a reward in first grade as an example of when she first realized she had an ability others didn’t. “In first grade I was awarded an A’s something and 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).

Thinking back to her childhood experiences it is the social memories, not academic, that emerge 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…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 am struck by the paradox between the strong, confident woman I see and the mousy, quiet child Jeanie describes. I believe the physical and emotional obstacles she overcame throughout her life fueled her resilience and helped her develop the self-confidence she has today.

Jeanie had such a difficult time socially in school I find myself in awe of her resilience. I believe the strong relationship she had with both of her parents was a significant support for her. “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 does 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). Jeanie has the ability to see every obstacle as an opportunity. She recalls being forced to move due to the issues with the legal battle as 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).

When it came to selecting courses Jeanie quizzed friends about which teacher was best, reviewed textbooks, considered what courses she needed to graduate and always wanted to be challenged. Jeanie is not afraid to ask for advice or reach out for help when she senses she needs it. I believe Jeanie’s comfort with herself and who she is as a person enables her to do this. She does not see asking for help as a weakness. Beyond the input from her friends it was her constant desire to be challenged and lack of interests in electives that drove her choices. “The fact that I didn’t want to take any other course led to taking challenging math courses. When I ran out of the elective courses, I filled in with advanced level math courses” (interview 1).

When describing her love of math Jeanie says “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). Unlike other participants in this study when Jeanie thinks back to high school she remembers 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). Jeanie doesn’t see herself as someone who just got it or for whom mathematics came easy. “…a little fuzzy thing that I need to learn more in order to succeed in the next topic. It is kind of like when the cameral goes out and it turns blurry. My eyes and brain felt like that. No, I wasn’t struggling.
I had really difficult times with the calculator. The Ti 83, I hated those things. I took my entire geometry course without a calculator…my teacher was in awe that I got an A without a calculator.

She sees 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). 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). She describes both parents as a source of support when it came to home work 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).

Jeanie held herself up to extremely high standards academically and describes how when she didn’t meet these standards she felt sick physically and emotionally. “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 describes 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 describes an experience in a junior high geography class where not knowing the answers left her in tears. Needing to withdraw from a college freshman Biology class left her scared and “as far as the W I hated it…it discouraged me for awhile” (interview 1). Jeanie demonstrates resilience throughout her academic career. While she had academic and social struggles, each time she overcomes them and moves forward.

Jeanie takes pride in the fact she is the third in her family to attend college. When it came time to apply to colleges, other than her mother and father, Jeanie didn’t receive or seek guidance from anyone. She knew what she wanted to do.
College the First Time

A Translator I Will Be. Jeanie’s path to a career as a translator was somewhat by chance. 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 hrs. a week, primarily as 12 hr. shifts over the weekend. One day the translation system was broken and Jeanie was asked to do some translating. It was at this point she thought “this is a really good thing” (interview 1) and switched from pre-med to Spanish.

Jeanie’s husband seems to ground her. She shares the following story which she refers to as her husband’s “favorite story” (interview 1). “My junior year of college I finally had a surgery that was going to help me alleviate my symptoms. 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 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 adds the exclamation point after the word fun, making me realize just how fondly she remembers this) 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).

Life After College Graduation

After graduation Jeanie “kind of floated around” initially taking a full time position as a translator at the local hospital she worked at during college. She held on to her dream of one day attending medical school and continued to take medical related course work while applying to medical schools. She reflects upon the work she did at the hospital prior to becoming a full time translator. “Before that 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 recalls 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 worked up until today. As Jeanie talks about this experience I see her eyes light up and voice has an enthusiastic, excited tone. I can hear and feel her passion for medicine.

**Medicine Keeps Calling.** 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…physician assistant is not my second choice” (interview 1). She describes how those around her questioned her choice because there were other, lucrative things she could be doing but she states “I don’t see this as valid for me” (interview 1).

“I already have great potential as a translator but it is not fulfilling. It is not as fulfilling as practicing medicine” (interview 1). Jeanie vividly describes her personal motivation for wanting to enter the medical field and make a difference through her recounting of a story where 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 due to a prescriptive treatment the patient was recently engaged in. “I still want to keep going for this. I still have a knack for this type of job” (interview 1).

The idea of a work-life balance has been at the forefront of Jeanie’s mind since high school. She comes from a family where women had a career but once the kids arrived her career came last. Jeanie didn’t want this for herself but questioned how she would have children and a
ADULT WOMEN IN STEM MAJORS

career. “I always struggled with the how do I work and have kids” (interview 1). Her one grandmother was a nurse while the other managed the family business. She told her husband (boyfriend at the time), “these are my plans for the next 10 years. Either be ok 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). This was the first of many instances the support of Jeanie’s husband enabled her to move forward in her career.

The balance of work and school has been something Jeanie has constantly had to balance. While her work is not enthusiastic about her changing her schedule around to fit school they have allowed her to do this. She describes online distance courses as what makes it possible.

In her first journal Jeanie describes the time after college graduation and 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. Medical schools weren't biting, and I had promised my fiancé' (now husband) that he would only have to wait through 8 years (my suspected time to become a doctor) before I would marry” (journal 1). Jeanie even 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 approximately 17,000 applicants were accepted to medical school (journal 1).

At the 8 year mark Jeanie married her boyfriend and in her first journal entry describes the place medical school prospects now took as, “my 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). Shortly after Jeanie met a coworker who was a physician assistant and she “… loved how he worked, his rapport with patients, and I could see myself in that position” (journal 1). Life experience gave Jeanie a new perspective and she found she had new motivations and goals for herself. 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 states 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 am struck by Jeanie’s image of herself being a student again in her first journal entry. Her enthusiasm, optimism and excitement seem to jump right out of my computer screen. “I would have to say that it 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’s husband provided the much needed words of encouragement. “He 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). I hear in Jeanie’s voice her resilience and ability to just keep moving forward and not look back with regret. Jeanie describes it as “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).

Jeanie’s husband is her rock and the person she most frequently turns to for advice. She shares a story where she wanted to take a biochemistry course online but the school didn’t offer financial aid or payment plan. She was feeling stressed and unsure of what to do. Her husband helped talk her through the decision making process. “I turned to him 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). I see Jeanie and her husband as a team. They are in this together. The mutual respect and support they have for one another reinforces in my mind the importance of spousal support.
What’s Will the Next Challenge Be?

When imagining her future career Jeanie pictures, “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…to make someone happy makes me happy” (interview 3).

When thinking about her belief in her ability to be successful in her chosen career Jeanie’s strength, confidence and resilience shine through. “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. I know that I don’t like being told I can’t do something even in 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. I didn’t like my college advisor and I said I am still doing premed whether you think it is worth it or not. 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. My advisor didn’t like my my MCAT pre-tests and my GPA and my extra curricular activities. The back of mind I was screaming oh I will show you” (interview 3).

I was struck by the story of her advisor telling her she didn’t have what it takes to make it in medical school and how that only drove her more. As I listened to this story I recalled a similar experience in college where I was told I would never make it as an engineer. I believe it was the challenges and obstacles overcome throughout childhood that gave Jeanie this inner
Jeanie sees this career as a way to balance work and family. She sees herself working 3-4 days a week so that she is neither working all the time nor completely home with her kids. Jeanie does have concerns about her ability to get pregnant. “…pregnancy is only issue I have, medically dangerous for me to get pregnant. I thought of where we are living. How long do I need to be at my job for maternity leave…our nurses are currently overworked they don’t have time to spend with kids and doctors are overworked. Nurse practitioners have much more time on their hands for family life… Physician Assistant is interchangeable with nurse practitioner” (interview 3).

While Jeanie didn’t express any gender related issues as obstacles for herself she does feel general issues exist. “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. The men have the high above, not exclusive to the doctor, includes a lab person, a male engineering staff, not exclusive. It is still the male thinks they are better. The engineer who comes into repair, he only talks to men…I think it matters only as far as who is the most important to be there and the surgeon has priority. The administration doctors are the males whether that is because of a hierarchy or not, it is who has more authority” (interview 3).

Jeanie offers 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.

**Luisa-Divorce is the Springboard to Fulfilling a Dream**
“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, is attending school while working and trying to find balance in her life. 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 seems clear they are at the core of who she is today. Luisa described a vivid memory where she was being teased on the playground for being overweight. She went home feeling discouraged but her mother lifted her up by conveying to her those words.

When I asked her what came to mind when her mother told her she could be anything, 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.” 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.

In listening to Luisa’s story I realize how many obstacles she overcame to get to where she is today. It seems these obstacles have given her the inner strength to be resilient and consistently maintain an optimistic attitude no matter what road block is placed in front of her. 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, since 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…..my 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 and I did some classes and personal growth…I never understood why people didn’t want to get out of the pit…I was terrified” (interview 3). As I listen to Luisa tell her story I only hear strength, resilience and acceptance in her voice. She has an optimism that is grounded in reality and carries no regret or bitterness. I see a woman who isn’t trapped by her past. She takes misfortune, repackages it and only looks forward.

Pre-College Years

Family. Luisa grew up in a two parent family in a town where the population is almost 100% white, about 60% of the people currently have a HS diploma and 25% a college degree. The average age is between 40-60 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 four, 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 Vietnam and he was self-medicating at the American legion and, um, and I remember my mother always having to go to the American Legion to see him and saying I wish I could just talk to him in the house. So, he
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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. I think we went boating once to go
fishing and I think I fell out of the boat and got a concussion. That was just my brother and me.
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. And everybody did kind of stay local, I was thinking about that the other
day” (interview 1).

When asked about the roles each of her family members played Luisa responded, “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. As far as my sister, the oldest one, I never really saw
her. She was always out...And the older sister like I said she moved to Germany so I never really
saw her. I didn’t get to know her, she moved back into the house, she divorced, moved back into
the house, and we shared a room during her pregnancy and the delivery of my niece” (interview
1).

Luisa’s ability to stay focused and inner motivation comes through as she describes 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 says this I think about my own ability to
filter out chaos and how that may stem from the chaos that surrounded me growing up. I wonder
if 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?
She said her sister describes 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). Luisa’s resilience, deep sense of optimism and positive outlook on life came out throughout our interview.

**School.** Throughout her k-12 years, Luisa’s inner motivation was driven by 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 you can play. You know, and then nobody bugs you” (interview 1). Luisa described a time in high school when she had a rough math teacher. “A very rough teacher to me was a very easy teacher because I wanted the teacher’s reaction. So, if I did the home work I didn’t get a negative reaction. It was only until we went as a family to the local zoo, um, I had my first born in my arms, so it was about 6 years after HS 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). For Luisa, her brother was a role model of the kind of student she didn’t want to be. Seeing the negative reactions her brother received motivated Luisa to do the opposite.

Luisa described the following as a time she felt she wasn’t meeting the teachers 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
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her how this made her feel about her abilities Luisa responded, “It discouraged me at first, we were, the small class was held at a table at the back of the accelerated math class, so 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).

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 states, “I never understood why people weren’t good at them....” (interview 1).

Someone tell me which way to go. When asked about what guidance she received in her high school years, Luisa remembers 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). While Luisa recalls most of her high school math teachers being female she doesn’t recall them being a role model or influencing her in anyway. “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)?

In relating the following story of getting her driver’s license Luisa describes 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) And we are all going from the same place too. But I can
remember then, it was expected, it was expected and I was the first one in my family to go
college...my older sister CLEPed some classes but um nobody and 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).

College the First Time

Can Anyone Tell Me Why I am Here? Luisa attended her last year of high school at the
local community college with three other students. Her choice to study engineering seemed odd
to her friends. Since she was good in mathematics and science and her father was an 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 this,
“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).

It was here, for the first time, that Luisa struggled with mathematics. Although her fellow
classmates chose to retake at the local community college the Calculus 1 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 credits 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.

Luisa 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 remembers 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)”. It is not clear if this was a gender related response or they just didn’t offer that type of guidance.

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

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. She credits this opportunity as having “saved myself thousands over a lifetime” (interview 1). 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 where 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.

An exchange with a new neighbor and teeth marks on her own child led Luisa to make the decision to stay home. Hearing that one child in daycare was documented as having bit other children 650 times 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 due to 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.

During our first interview Luisa described her situation prior to 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). Luisa left that job and during the time she was 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
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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 hear not just Luisa’s inner strength, resilience and ability to look forward, but also an ability to take a risk. I wonder if some women have a greater ability to take a risk to achieve something greater and if that is part of their ability to be resilient. I reflect upon my own decision to pursue my PhD, and remember having a similar thought. How do I get out of this situation?

Back to School

During our first interview I asked Luisa what led her to return to school to study operating systems. “Basically I wanted to finish what 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. During the degree planning course, when she had to research what she wanted to do, she discovered the opportunities in the technology field. 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).

When I asked Luisa about the reactions she got from others about her return to school, she said when she told her parents she was going to study computer science they “…looked at her with four eyes” (interview 2). Luisa describes as one of her keys to success a lesson she learned the first time around. At the community college she says she constantly felt frustrated and behind and “…seldom able to put it all together” (interview 2). With perspective she now can self-identify when things are moving too quickly and recognizes the need to reach out and ask for help. She also describes a frustration with the turnaround time of some instructors. “If
you are falling behind you need to act. If you wait you are already at module 3 and won’t get help until module 6 and the final is in module 8” (interview 2).

Prior to 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”. About three hours later she sent the following e-mail “I give up...on this final...your distraction this moment is welcomed”. In the following e-mail, written prior to our first interview, Luisa conveys her frustrations with the required software “there has been such a negative experience in this course using MAPLE 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”. It is in this e-mail that I get the first hint at what is one of the greatest struggles, not just for Luisa, but other women in my study. Rather than the content itself being an obstacle it seems to be difficulties with the software program that is the greatest problem.

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).
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 responds, “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. Since they would be driving back to her daughter’s school on Wednesday she planned on working 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 tells this story I can hear how much the importance of instructor support and understanding of what she is trying to balance has been critical to her success.

In her journal Luisa vividly described the support system she has and what it takes for her to stay motivated and persist.

“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. 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 kids guidance counselor, church members, my psychologist (I through everyone in therapy because I wasn't going to pick up all the pieces from someone leaving alone.). Even
during volunteer hours at a Haunted House at elementary school - the co-volunteer women has had a few promotions 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. Work was crappy at that time but there was one coworker who was relocating back to the area and soul searching. I stayed away from those who complained or could distract me with tasks of assistance which I wouldn't consider a healthy relationship. I had all the support I needed to succeed just by people saying I don't know how you do it. 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. I think I have more senioritis now and my drive at the last 3-4 courses are 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).

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. The transition to college level learning was not easy for Luisa but it has been rewarding. She describes her experience in Intro to Web Design as “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 grade in the course.
At the end of our first interview Luisa’s summarized her experience, “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 light up as she tells me this and I can hear in her voice optimism and resilience.

**Identity with math and science**

As a child Luisa’s image of a woman was, “I guess working part-time was ok. Working full-time really wasn’t done in my nucleus. Anybody I knew, their mom didn’t work full time” (interview 1). Luisa sees 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 think of my own struggle to balance working from home.

Years later, upon returning to school, Luisa described her mathematical ability as “ In this class, because the calculus was taken so many years ago, 25-26, it is like I have relearned that calc. Because I never use it in my workplace. 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, ok, 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).

Luisa has a strong desire to make a difference and finding meaning in her work. When I asked her what her current image of who she should be is 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). Life experience and perspective has helped Luisa develop an image of who she wants to be now. “Obviously you have been through a lot of changes. I didn’t really have an image young” (interview 1).

Luisa couldn’t recall any experiences where a friend or family member influenced her perception of who she wanted to be, and this is the only time I hear 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). 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.

While her mother did encourage her to be anything she wanted she never received any specific guidance or help in creating goals. “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 states, “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).
When asked if there was anyone outside of family and friends that she remembered as a role model, there was a long silence before Luisa thought of 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 60’s. 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).

**The Lifetime Journey Continues**

Luisa’s resilience and optimism shine through as she talks about what the future holds. Luisa is open to where the road may take her and continues to look forward to the journey, bumps and all. Her desire to make a difference and help others continues to be an integral part of who she is. She is now tutoring the mathematics course in which she struggled, hoping to provide a better learning experience for other students.

When I asked Luisa if she had any doubts about her ability to be successful in her chosen career I hear an acceptance of the reality of her current employment situation, “I think I have
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some doubts. The only way I see me progressing where I am is to start at the help desk” (interview 3). Reality again creeps into her voice when I ask about an experience that created her interest in this career, “Money was my motivation” (interview 3).

Luisa continues to see herself as an island and doesn’t tend to look to others for support. She sees herself as independent and a leader, traits she has tried to instill in her own children. “My children are proud of me…I never raised them to be dependent on me, when they fell down I wouldn’t overdo it. Even that small act has made them independent” (interview 3). Luisa craves that personal, face to face interaction and therefore doesn’t look to her instructors at CSE as role models.

An obstacle for Luisa has been her inability to find a mentor in her field. “It is a quandary, where do I get a mentor in that field” (interview 3)? She does see her old boss as a source of inspiration, “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 on a regular basis I can hear in her voice how much it means to know she is only a phone call away. It makes me think that support comes in all sorts of forms and sometimes just knowing it is there is enough of a safety net.

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 - From Actress to Research Scientist

“Work hard and you can do literally anything”

My first impression of Rosa was energetic, excited and passionate. We exchanged several e-mails and text messages prior to our first meeting. Since Rosa only lived a few hours from me we agreed to meet face to face. I arranged to take the train down and meet her at the local CSE
center near where she lives. Although CSE has a center near Rosa she attends completely online and had never been to the center. 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.

Rosa is a 41 year old married woman with no children. She and her three brothers grew up in a single parent family where she was the youngest. She split her time evenly between her mother and father. The community she grew up in was in the Upper East Side and Soho. A typical day for Rosa includes waking up around 8 AM to do her homework before heading to work just after lunch. She typically gets home from work around midnight. In her current household Rosa is the primary income earner. Her husband is an actor and they share 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.

Pre-College years

Family. In our first interview Rosa talked extensively of the strong, but different, influence each of her parents had on her. This resulted in a strong interest both in the arts and mathematics and science.

Rosa was 5 when her parents divorced and she doesn’t really have any memories of them being married. Rosa’s resilience comes through even at a young age, as she describes how she remembers 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 ok, I just knew we were going to have two houses now (interview 1)”. While she describes her dad as more lenient, it seems 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 teaches Autistic children and teaches teachers who teach Autistic children. She describes her mother as, “like such a missionary, she’s do good, she’s always, she’s lemonade, make lemonade, she’s great…she teaches autistic children, what can I say, it doesn’t get more selfless than that” (interview 1). Her feelings for her parents seem very equal and it seems she has a good relationship with them both and respects and appreciates that they are 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 where she was crossing paths with famous people and making 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 that impacted her success in college. For Rosa, family was not one more obstacle to overcome but a constant source of support.

When I asked Rosa about the value her parents placed on education she responded, “My dad was a dentist and I think that 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.
There was no like we need to talk about, until I started doing badly in a new environment” (interview 1).

School. Rosa describes her K-12 years with both a sense of accomplishment and regret. Her resilience comes through as she describes the obstacles she faced during her middle school years and how they led to several years of poor grades and a lack of self-confidence. Her parent’s decision to enroll Rosa in a private middle school on the Upper East Side was detrimental to both her academic and emotional health and resulted in her losing belief in herself.

“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 and then after that my parents sent me to an all-girls academy, like a very snooty, Upper East Side 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 and there was nobody there to guide or support her. She soon found herself spiraling down. “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). Feeling isolated and alone Rosa escaped to the gym practicing gymnastics five days a week, which ultimately led to her receiving a college scholarship. I think about what it must have been like for Rosa in this environment and try 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.

She describes the impact 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 describes the stress and frustration
she felt during this time. “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 hear regret in Rosa’s voice when
she states, “I was like frustrated and angry and I was especially angry at my parents for not
getting me out of there” (interview 1).

The first time Rosa failed a test is a vivid memory for her. It was in 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).

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). 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). Rosa fondly remembers this doctor who she still keeps in touch with, “to this day I still love him. I still keep in touch with that guy” (interview). As Rosa is telling me this story I hear in her voice how fortunate she feels, 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’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, ok, 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). Rosa flourished at the Waldorf school and her self-confidence immediately returned on the first day of school when 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?” All these years later I can hear in Rosa’s voice the difference being accepted by her peers made to her and I found myself considering what impact peer relationships have during these critical years. I began to consider whether a lack of strong peer relationships has a greater influence on self-efficacy than academics.

Rosa describes the disparity between the two schools, “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).

Rosa’s passion and belief in her abilities comes through whenever she starts 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 remembers 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). When it came to selecting classes Rosa said she always wanted to challenge herself.

**College the first time**

**Where is my North Star?** Rosa describes the path to college as something that was just expected. Her choice to study art over mathematics and science, in the end, was largely due to being accepted at USC and waitlisted at MIT. Rosa’s studies always came easy to her and she remembers just always being good in mathematics and science.

When I asked Rosa what guidance she sought out or received when planning for college her response was,

“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. I didn’t want to go to college and have the same experience I had in junior high school. That is when we really started looking out west. We looked at UC Berkley and oh my god I loved it but their team was so much better than USC and I never would have competed at UC
Berkley. I might have made the team but there is no way I would have been an all-around starter. So my dad said let’s go south, let’s see USC and LA and look around there. It just worked out that way. It seemed more laid back and fun with the academics and the sports. East coast was all very, I think if I went in New England, I was going to bump into all those girls I went to junior high with. All the Vassar girls. So, I was just like, no. Our college guidance counselor was horrible. She never really said much” (interview 2).

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 feels to this day.

**Academics.** Rosa enrolled at USC planning to earn a bachelor’s in fine arts (BFA). Her major only required her to have remedial math skills and she was able to test out of having to take any mathematics courses. While she wasn’t required to take a science course 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 math 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)”

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’s resilience and internal motivation
come through when she describes her realization that she needed to find a balance between her academics, sports and social life.

"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… A couple of hung over practices. I learned lessons the hard way. I mean really you learn the hard way, sleeping through a class, and you realize you are behind and think ok I can’t do that again. I think every freshman goes through that.” (interview 2). I think of my own freshman year and struggling to figure some of the same things out. 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.

After that Rosa didn’t have any academically stressful or difficult experiences. While she carried a heavy load of courses the strongest college memories relate 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.

Rosa attended USC for 3½ 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 comes through again when talking 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). When Rosa talks of this experience I don’t hear any anger or resentment in her voice. I hear the voice of someone who accepts this as one event that needed to happen in order for her to find the path to where she is today. “It was so fricking unfair. But good things happened. I came back to NY which I am glad I did. I never would have pursued anything in science which I am glad I am doing” (interview 2).

The Road in between

After Rosa lost her scholarship and had to return home both her parents offered their support. Rosa went from job to job without any real direction. She tried acting, comedy and singing. While she describes those jobs as fun she quickly realized she couldn’t make enough money to support herself. At 29 she was working as a nightclub manager and soon was promoted to general manager. This led her down the road to working in the restaurant business but she never felt satisfied. “I have never been satisfied with my career. Why can’t I be satisfied with my
Back to School

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 and so I applied to CSE first, because she (mom) knew somebody who got a masters 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”. Rosa’s path back to college was primarily due to 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 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 writes, “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 ended up taking a different job that would enable her to better balance work-school-life. “...if I had continued at that buying position I would never, never, in a million years been able to do it all”.

paycheck? I feel like I don't have a life, what mom said: she always told me I could be anything I wanted to be wanted to” (interview 1).
When Rosa first enrolled at the college she was thinking about physical therapy for sports medicine, but after a few classes found that was not what she wanted. She went back and force knowing only that she wanted to do something scientific. “I just think science is cool. I am doing it because I want to”. It was a friend who worked in the pharmaceutical business that eventually gave Rosa direction. She suggest 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.

**Academics.** Rosa has had a very positive experience since her return to school although she recently needed to take a break from course work due to financial constraints from being unemployed. She describes the professors as amazing and her friends and husband extremely supportive. When describing how she fits 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 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”.

Rosa’s passion for mathematics and belief in her ability to finish emerges in our interviews, her collage and in her journal entries. In our third interview she says, “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).

**Identity with math and science**
In our first interview I asked Rosa about her image of who she thought she should be when she grew up. Her response was, “Ok, 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 describes 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”. Rosa vividly describes how widely 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”. I hear slight regret in her voice when she states, “Obviously none of these things have turned out to be true”.

Rosa’s struggle with her identity comes through again when I asked about her image of who a woman should be. “...strong women, like the Margaret Thatcher’s and Hillary Clinton’s 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 Hepburn’s and Grace Kelly’s but that is also not who I was”. Life experience has given Rosa the perspective she needed. “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
ADULT WOMEN IN STEM MAJORS

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” (interview 1).

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. She remembers 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”.

Rosa’s childhood was void of female mathematics and/or science role models. She remembers all of her doctors being men and her dad was her dentist. Although her mother was not in a mathematics or science field she credits 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 her response was, “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’s image of who she wants to be centers 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...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”.

**What Does the Future Hold?**

Rosa’s confidence in her ability to be successful in her chosen career comes through when I ask her about the future. “I am hoping to pursue a Master’s degree that will be funded by the pharmaceutical company. I can use my friend’s connections (as per her advice). I think I will be doing it like now for the money but unlike what I do now it is important work” (interview 3). I can hear in her voice how important the meaning in her work is to her perseverance. It seems to contribute to her sense of enjoyment in what she is doing.

Financial concerns permeate Rosa’s world and she comments on money in our interviews as well as her journal. Her mentor also mentions the fact that it is a struggle since she is paying for all her courses herself. When I asked Rosa about school and how it has impacted her emotionally her response was, “Not the mental ability. Just the financial ability…I am actually in a much better financial position now that 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).

I hear confidence in her ability to succeed she talks about what it will be like working in her chosen 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…she (her friend) says it can be boring and lonely, but validating” (interview 3).

Rosa’s friend has clearly been a role model for her as well as a source of support. Rosa describes 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…when 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).

Although we were on Skype for our third interview I could still see her almost jumping out of her chair with excitement as she talked about what lies ahead for her. When asked about advice for other girls and women Rosa showed no hesitation, she knows exactly what needs to be done. “Work hard and you can do literally anything” (interview 3, Skype).

Chapter 5 Results

Construction of Meaning

The purpose of this study was to explore the lived experiences of five non-traditional female students who took a path to successfully returning to school to study science, technology, engineering and mathematics (STEM) at an online college located in upstate New York. Portraiture methodology was used to gain a deeper understanding of how the women described their path to science, technology, engineering and mathematics (STEM) within the context of the world in which each lives. The goal of this study was to present portraits of the lived experiences of these five women who chose and have persisted in science, technology, engineering and
mathematics (STEM). Throughout the data collection and analysis process we worked together to co-construct meaning. Data analysis, which was guided by social cognitive career theory (Lent et al, 2010) resulted in the convergence of four major themes that emerged in all five portraits.

Using portraiture, I weaved 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 to set the stage 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: a woman who may be thinking of returning to school; an administrator looking to increase persistence or enrollments of women in science, technology, engineering and mathematics (STEM); or a family member wondering how they can provide support, will find meaning they can relate to in their own life.

Each portrait focused on the individual lived experiences of the participant and their unique path to returning to the university. In this chapter I present findings based upon the individual voices of each participant’s story as well as my interpretation of their experiences. For each of the four major themes I support my findings with quotes from multiple data sources as part of the process of triangulation. Triangulation refers to collecting data in a variety of instances, from a variety of sources using different methods (Eisner, 1998; Lawrence-Lightfoot & Davis, 1994; Lincoln & Guba, 1985; Miles & Huberman, 1994). Patton (2002) points out that the purpose of triangulation is not to confirm your results are consistent across various data sources but to “...test for such consistency” (p. 248). When consistencies are discovered it offers “…opportunities for deeper insight into the relationship between the inquiry approach and the phenomenon under study” (Patton, p. 248).
Triangulation also addresses construct validity as “...multiple sources of evidence essentially provide multiple measures of the same phenomenon” (Yin 2009, p. 116-117). This chapter concludes with my interpretations of the meaning as it relates to the path women take to science, technology, engineering and mathematics (STEM), and potential contributions to practice, theory and policy.

Findings

Data analysis resulted in the convergence of four major themes that emerged in all five portraits: Resilience, Relationships, Women and STEM, and Commitment to Education

**Resilience:** self-confidence, voice, questioning, belief in academic and math/science ability, defeat, disappointment, discouragement, finances, goals, perseverance, strength, growth, pride, health, optimism, opportunity, perspective, sacrifice, struggles, hope

**Relationships:** support, community, family, role models, verbal persuasion, stress, disappointment, regret, parents, siblings, extended family, friends, networking, teacher, mentor, peers, mother, father, isolation, trust

**Commitment to Education:** academic accomplishments and failures, bored, body image, classroom experience, college during senior year, regret, knowledge, power, pride, resources, school, teachers, education, social life, values, achievement, priorities, keys to success,

**Women and STEM:** helping others, be something more, history, memory, guidance, interest, motivation, direction, making a difference, perspective, work life balance, activities leading to STEM, passion, caring, fun, future, meaning, quality of life, teaching, work, wages

The first thing that I realized is that not all women coming to CSE 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.

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. Jeanie was the only participant who grew up in a two parent family where she had a 
strong relationship with both parents. While Rosa’s parents were divorced she had 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 due to an abusive relationship and Luisa due to alcoholism. None of 
these three participants completed past their first year of college the first time. This is in line 
with the literature that supports the importance of the parent relationship.

All the participants in my study remembered having always been good in mathematics 
and science. All but Jeanie, moved through middle and high school with little to no guidance or 
direction. All the women were non-traditional students who had returned to the university to 
study science, technology, engineering and mathematics (STEM) at the same school and were all 
enrolled in online courses. Rosa is pursuing a life science degree so she can go on and earn a BS 
in nursing which will enable her to have normal hours and good pay. Jeanie was taking a classe 
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 healthcare
field. Angie is pursuing a Physics degree and fulfilling her dream of completing her BS. She plans to go on to earn her PhD and would like to teach. Alice was in her last semester of her mathematics degree during the data collection period and during that time she was taking four classes, and planning her wedding (during what would have been her final semester her father had a stroke from which he passed away after several months of providing care for him. Alice was unable to finish her course work.)

All the women in my study were always good in mathematics and science and for various reasons either dropped off or didn’t pursue the path. Now as adults they are returning but with a new perspective. It is not just about the career or money, although this is 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" science, technology, engineering and mathematics careers is in itself enlightening. As young adults they were unaware of careers such as a physician’s assistant or pharmaceutical research. As adults they are also able to look back and see the world from a different perspective. Alice and Angie live with regret for the academic choices and path they followed and want to prevent other women from that same path. They are pursuing teaching as a way to provide that safety net and be the role model they didn’t have. Since my study was about the women returning to study science, technology, engineering and mathematics their goal for what they want to do after the completion 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 where 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 science, technology, engineering and mathematics (STEM) world in search of a better work life balance, the women in this study are 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 (I was working toward my MBA at the time), a part-time wife and a part-time mother. At the time my place of employment only allowed for 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 CSE. I found it interesting that for Jeanie and Rosa it too was a chance encounter that ultimately set them on their current path. It was the combination of the engineering degree and MBA that got me the job. Years later I found myself divorced and thankful I had the educational background that enabled me to have this job.

**Resilience**

The initial question driving this research, for me, has always been why some women succeed in science, technology, engineering and mathematics (STEM) while others don't. Why are some people resilient? Why do they succeed and overcome obstacles while others don't?

Each of the women in this study lost their way or at some point and had a deflated self-efficacy due to some type of negative experience related to social persuasion, vicarious experience or personal accomplishment. In line with Bandura’s theory (1997) personal
accomplishment seemed to be the strongest influence on self-efficacy for each of the women. Even when these women lacked words of encouragement and positive role models they maintained a strong sense of belief in their ability to do mathematics.

I hear Luisa’s resilience,

For me being a student brought me emotionally back to a comfort zone where chaos currently existed in the other aspects of my life. I excitedly ordered my books and they sat until the class started. I was diligent in doing what was expected of me—because that is just me. I fumbled around angel software. Felt like I was getting the jist of the program but then I was supposed to be reading and fell behind. I remember being frustrated and wondering if I had really thought this through. Luckily, I wasn't out any money due to grants. Several times I took a deep breath and said to myself this is a lifetime journey just like the one getting me to today. I have nothing to lose only gain” (journal 2).

I felt resilience was a piece that was missing from the social cognitive career theory (SCCT). As I continued to hear instances of resilience emerge in the data I looked for a theory to help me understand how this 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” (in Meichenbaum, ND). 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.

Those who are resilient (Brafman, 2011; Meichenbaum, ND)

- Have the tools to overcome obstacles
- Persevere and adapt to whatever situation they find themselves in
ADULT WOMEN IN STEM MAJORS

- Are even tempered

Meichenbaum (ND) describes resilience as something that, “…turns victims into survivors and allows survivors to thrive” (pg. 3). He goes on to describes 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 my participants. When observing my participants in their online classroom I listened to each of them reach out to their classmates and each had a “friend”. For Rosa, Jeanie and Angie their spouses are a significant source of strength. Alice reaches out to her classmate. Luisa was the only participant who truly did not seem to lean on anyone but herself. Each of my participants very clearly laid out their plans and were active participants in their futures. I continuously heard optimism in each of my participants. As they recalled their story 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 on has an unwavering belief in herself.

The following are characteristics of resilient children (Meichenbaum):

- Easy going
- High IQ, abstract thinking
ADULT WOMEN IN STEM MAJORS

- Easily get along with others
- High self-efficacy
- Goal oriented
- Optimistic
- Academic success

Angie reflects 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…when my passport was ready I caught a bus to Damascus…and a taxi to Beirut…waited for my mom to get money for my plane ticket home, it was an adventure (interview 3).

Commitment to Education

Each participant described a never ending commitment to completing their education. They each stated it was never a matter of “if” but “when”. They each seem to have a strong internal drive and resilience that keeps them pushing forward. As I listened to them talk about their learning experiences I could hear the passion and excitement they had for learning. The participants see knowledge as power. A way to show the people who didn't believe in them, or wronged them in some way, their resilience and ability to persist no matter the obstacle placed in their way. I sense they also see knowledge as power to change things and make a difference.

As non-traditional female students returning to the university the independent mastery experiences seem to drive their confidence in being able to pursue science, technology, engineering and mathematics careers. The responses of these women echo the findings of Zeldin
ADULT WOMEN IN STEM MAJORS

(2000) with respect to men. In her study men made comments similar to the women in this study related to math and science coming easy to them. Also similar is that the women in this study talk of their motivation coming from within and give very little credit to any outside influences.

Rosa describes the period of time between when she left college the first and her return,

...circumstances were just that I couldn’t afford it. At 22 I thought I was doing great… the plan was always to go back it is just that time got away from me. You know it was always like I am definitely going to do it. And then of course when I went back I decided to completely change the focus of what I wanted to do so of course I painted myself into a corner because I can’t just take three quick history and theatre courses and be done” (interview 2).

Rosa reflects upon the images that come to mind when thinking back to the time she first thought about returning to school.

Just before my decision to apply to CSE I had returned to the classroom to get some wine certifications that my boss was kind enough to pay for. I really enjoyed that experience of being in the classroom and being challenged as a student. That put me at ease about returning to school. I came in feeling a little nervous because I had never studied remotely before. But I was mostly confident that I could meet the challenges head on (journal 2).

I can hear Rosa’s resilience, and the result of a new perspective that comes with life experience, come through as she talks about her internal drive to be successful in school,

I felt pretty good about going back to school. I had no set expectations because I had no idea what on-line 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).

I can hear Angie’s love for education when she thinks back to her decision to return to school,

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. 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).

**Relationships**
There is a convergence across portraits with respect to the importance of relationships within the context of self-efficacy. The importance of relationships can be seen in the following sources of self-efficacy: verbal persuasion, vicarious experiences, and physiological.

_Throw me a Life Raft_

A lack of someone being there to guide them or support them echoed throughout the stories of each of my 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 that 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. While Lent et al (2002) found that negative social/family influences and negative school/work experiences to be a minimal barrier for the traditional students in their study, these were cited as primary barriers for all women in this study.

Each of the women in my study described a situation where they perceived either a lack of support and encouragement, lack of positive roles models, or stressful home or school environment. The perceived barriers left these women without direction and in some cases attending school or living in an environment in which they couldn’t successfully function.

Rosa describes 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 three years. Study, tumble and cry” (interview 2).
“I have had a hard time finding people to go to for advice. I have never not wanted to go to people but with exception of a few people the problem is usually when I ask for advice I make this mistake of asking my mother, and then it is like why would you give me that for advice, why would I ever asked anybody or should have asked so and so” (interview 3, Angie).

Luisa's story is one of someone who just kind of went with the flow, didn't want to make any waves and followed the natural progression until one day she realized the path she was floating on was not for her. While attending college the first time she was doing poorly in Calculus and when to her advisor for help. His response was that he couldn't help her. It is unclear if this was a gender related response.

For Alice, Luisa and Angie family was the greatest barrier and none of them completed college the first time. Alice had an abusive mother with whom she cut ties at the age of thirteen 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 just didn’t have the background or skills to provide the guidance and direction each needed.

Support Systems

Alice describes the support systems the college offers 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 SUNY 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).

When asked about her support system in her second journal Luisa says, “My support came from anybody who knew me and what I was going through - abrupt single parenthood and no money. The girls softball coach was affiliated with CSE, other alumni graduates I met along the kid’s activities, other adult learners working on their Masters, my parents were very supportive. I would always read my grades to them so we could enjoy the journey together” (journal 2).

When talking about what it takes for her to be successful and stay on track Luisa says, “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 kids guidance counselor, church members… I chose to look for health 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” (journal 2). Luisa cites the importance of words of encouragement but stresses it was her own inner strength and resilience that kept her going, “I had all the support I needed to succeed just by people saying I don't know how you do it. But man is very strong when he/she wants something. I like the peer mentor program ESC 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 2).

In her second journal when asked about what support she needs to persist Rosa responds,
“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! Beyond that...Dr. V 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).

Family. The literature supports the importance of a strong relationship with parents and support from family as critical to women pursuing science, technology, engineering and mathematics studies and careers.

Bandura (1995) poses vicarious learning experiences as having 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 family four of the women in some way identified their passion for learning and pursuit of mathematics and science with their parents. Alice had a mother who was a teacher and a father who was very active in the educational system. Rosa had a father who was a dentist and a mother who was a teacher. Jeanie’s father always wanted to be a doctor and Luisa’s father was a “non-degree” engineer. Only Angie did not have a parent with a background related either to education or mathematics and science.
None of the women in the study described their parents as providing words of encouragement or specifically taking any actions to lead them on path to study mathematics and science.

During my interviews with Rosa and Jeanie each reinforced the importance of family relationships in their lives. While Rosa’s parents were divorced she maintained a strong, positive relationship with both parents. Jeanie was the only participant in the study whose grew up with both parents. Previous studies indicate that a strong family influence 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 Bachelor of Science the first time.

Alice describes the support she receives through words of encouragement from her family as,

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). She described a situation where 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).

Jeanie and Rosa repeatedly mention the importance of their husbands as a source of support.
Mentors and Instructors. All of the women in my study described CSE mentors as a significant source of support and a mix of instructors who were incredibly supportive and others who were barriers and almost resulted in them not persisting.

When talking about the difficulty Angie had in finding a Physics instructor after the only one employed by CSE passed away, she describes the level of effort her mentor made to find her someone. “My mentor is really great. I made her a lot of work. I really appreciated she has really helped out a lot” (interview 1).

Alice describes 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).

When talking about her journey at CSE Rosa describes the guidance and support she receives from her mentor,

And Dr. V who is the best mentor who you could ever possibly have, she is amazing, and Dr. T as well, was I know they are tight, she has been super helpful as well. I have never met her (Dr. V) but I am on the phone with her all the time. I just think she is a trip, so helpful and she has faith in me and when I am making the wrong decision she is like no, no you can’t do that” (interview 1). Rosa describes how her mentor gave her the guidance and support she needed to overcome her initial nervousness when returning to study online, “I came in feeling a little nervous because I had never studied remotely before. But I was mostly confident that I could meet the challenges head on. I was really excited after speaking with Dr. V the first time. I knew what classes I needed and I had a
plan. In my professional career I never had a goal or a plan, and now there was an aspect of my life where I had that sense of purpose. It was very gratifying to feel that way.

Other Relationships. 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).

Women in the World of STEM

Data collection and analysis was guided by social cognitive career theory (SCCT) which is based on the concepts of self-efficacy, supports and barriers. Selection criteria for this study included the participants being non-traditional learners, female and studying science, technology engineering or mathematics (STEM). Throughout their lives each of the participants had a passion for mathematics and science and described the subjects as always coming easy to them. While not a selection criteria each of the women in this study faced a major personal obstacle that prevented them from successfully reaching their academic and career goals the first time they attended college. The lived experiences of each of these women eventually brought them back to the university to complete what they had started. Along the way, each of them had lived experiences that eventually brought them back to pursue STEM. Each participant had always had a passion for mathematics and science but only with perspective and lived experiences were they now able to find their way.
Academics. According to Bandura (1997) performance accomplishment has the greatest influence on self-efficacy. Zeldin (2000) and Lent and Brown (2003) found that independent mastery experiences had the greatest influence on the development of mathematics self-efficacy and was predictive of outcome expectations and interests. Both of these studies consisted of all or primarily all men. A study by Ozyurek (2005) found that a high mathematics self-efficacy didn’t predict a preference for science, technology, engineering and mathematics (STEM) which was described as an unexpected result and one that may have been caused by cultural differences in Turkey. In the current study while all of the women had positive independent mastery experiences and a high mathematics self-efficacy only two of the five participants immediately went to school to study a science, technology, engineering or mathematics (STEM) major and none completed a STEM major the first time around.

Lent, Paixão, Silva, & Leitão (2010) found that self-efficacy and outcome expectations jointly predict interest and that social supports and barriers influenced career choice indirectly through self-efficacy. In this study Luisa, Rosa, Alice and Angie had the self-efficacy and interest but not the needed support to have outcome expectations related to a career in science, technology, engineering or mathematics during their pre-college years. Jeanie had the self-efficacy and outcome expectations but it was her poor health that prevented her from pursuing her career choice.

It was only later, as adults, through life experience and perspective that they were able to combine their performance accomplishment and interest with a career path which they felt connected. Throughout the interviews and in their journal entries the women continuously went back to their strong mathematical ability when they were younger. It came up frequently when asked to think back to their k-12 school experiences.
Each of the women spoke of always being good in mathematics and science even when they didn’t try or other barriers got in the way. Rosa spoke of her junior high school experiences, and Alice and Angie in high school. Studies show that a math intensive high school load leads to a science, technology, engineering and mathematics (STEM) major. This is true with the women in this study but not directly. Each of the women in this study had a mathematics intensive high school load but only Luisa and Alice initially pursued STEM as a major. Luisa and Alice each faced a common barrier their freshman year in college with respect to being successful in mathematics related coursework. Each left high school a year early and while they never had to study or do much in high school they found the level of work much different in college and felt largely unprepared. Both describe attending college their senior year in high school as a mistake.

**Identity with math and science.** In Zeldin and Parjares (2000) the importance of social persuasion and vicarious experiences as a critical source of self-efficacy is discussed. In that study, which included women currently in science, technology, engineering and mathematics (STEM) careers, the women recalled these experiences more so than personal accomplishment. This result is in contradiction to the women in this study who vividly remember academic accomplishments but to a lesser degree recall any social persuasions or vicarious experiences. Jeanie, who completed a BS degree in Spanish and Rosa who almost completed her BS had the greatest number of vicarious experiences related to mathematics and science and verbal encouragement from family.

During their high school years Rosa, Luisa, Angie and Alice each excelled in mathematics and science and passively progressed through their coursework. Each of these form women lacked the vicarious experiences needed to develop a science, technology, engineering and mathematics (STEM) identity. As non-traditional learners each made an active choice
grounded in childhood personal accomplishment but influenced largely by vicarious experiences in their post k-12 years that enabled them to identify with STEM. It was the connection between their interest and personal goals of a work life balance that ultimately led them each of the participants to choose STEM.

Rosa talked of how she always loved science and was good at mathematics and science. She did science projects in high school she was really excited about. This seemed to provide a way for her to connect with the science but there didn’t seem to be any experiences that led to her strongly connecting to science as a career. While her parents didn’t specifically push or encourage her in mathematics and science there was a strong sense as to the importance of education. It wasn’t until she took science as an adult that she realized her calling. As a dentist Rosa’s father was a role model of sorts although his interest in the fashion world had a strong influence on her. Rosa’s mother had a Bachelor of Fine Arts, which she tried to dissuade Rosa from pursuing.

Alice describes the moment she realized she was good in math as being “when I got a 92 on my math Course 3 regents” (interview 1).

Jeanie was the only participant who developed a strong science, technology, engineering, and mathematics (STEM) identity during her k-12 years. This seems largely due to the significant amount of time she spent in the doctor’s office with nothing to do. Her father also wanted to be a surgeon but was unable to achieve that goal. Jeanie remembers always wanting to be a doctor. As I was listening to her story I remembered always wanting to be a nurse. It was my great uncle who said to me you can be so much more, you should be a doctor. Those words stuck with me throughout high school and were a large part of my motivation to do well in
ADULT WOMEN IN STEM MAJORS

mathematics and science. Table 4 summarizes the experiences of each participant that influenced their choice of major.

Table 4
Experiences that Influenced Choice of Major and Persistence

<table>
<thead>
<tr>
<th>Actor</th>
<th>Pre college+</th>
<th>Pre college -</th>
<th>College +</th>
<th>College -</th>
<th>In between +</th>
<th>In between -</th>
<th>CSE +</th>
<th>CSE -</th>
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<tbody>
<tr>
<td>Angie</td>
<td>I, PA, PPM</td>
<td>NF, NT, NPS, FR, NVE</td>
<td>PS</td>
<td>T</td>
<td>PAW</td>
<td>FS, MS, PAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeanie</td>
<td>I, PA, PPM, PPF, VE</td>
<td>H, NT, NPA</td>
<td>H</td>
<td>PAW</td>
<td>VE</td>
<td>FS, PAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alice</td>
<td>I, PA, PPF</td>
<td>NM, NPS, L, NPA, NVE</td>
<td>M</td>
<td>PAW</td>
<td>NWL, VE</td>
<td>FS, MS, PAM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rosa</td>
<td>I, PA, PPM, PPF, VE</td>
<td>NPA, NT, NPS</td>
<td>M</td>
<td>PAW</td>
<td>NWL, VE</td>
<td>FS, MS, PAM</td>
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<td></td>
</tr>
<tr>
<td>Luisa</td>
<td>I, PA, PPM</td>
<td>NF, NVE</td>
<td>NT, NPS, IS</td>
<td>PAW</td>
<td>D</td>
<td>PAM</td>
<td>NT, NPA</td>
<td></td>
</tr>
</tbody>
</table>

Motivation: money (M), interest (I), helping others (HO), bored (B), STEM experience (EX); STEM success (PA)
+ experience: math/science PA; positive teacher (PT); positive mother (PM); positive father (PF); STEM vicarious experience (VE); faculty support (FS); peer support (PS), personal accomplishment in major (PAM), spouse support (SS), mentor support (MS)
-experience: negative teacher (NT); negative parent mother (NM); negative parent father (NF); personal accomplishment work (PAW); finances (F); poor grade in math/science (NPA); poor grades (NPA); no faculty support (NFS); no peer support (NPS); lack of direction (L); frustrations (FR); gender (G), health (H), isolation (IS), tragedy (T), divorce (D), negative work life balance (NWL), negative vicarious experience NVE
Areas that influence choice and persistence

Their Path. Angie found Physics by way of a failed study abroad in Lebanon. Luisa started as an engineering major only to find she felt isolated, unable to feel a connection to her peers or the idea of being an engineer. Years later a divorce drove her to return to school and rediscover her passion. Alice found mathematics only after a several failed attempts at college and a personal experience that enabled her to embrace her desire to teach mathematics and create better mathematics experiences for others. Jeanie found a path to being a physician’s assistant
via several failed attempts at medical school and a short career as a Spanish translator in a hospital. A loss of a scholarship and years of long hours as a sommelier led Rosa to return to school. A chance encounter with a friend and a positive learning experience in a science class led Rosa to rediscover her passion for science and see it as a viable career.

When describing her current major Rosa states, “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 1).

Table 5 gives an overview of the path each of the participants in my study took to returning to school to study science, technology, engineering and mathematics (STEM). A detailed outline of the path each participant took can be seen in the Appendix G.

<table>
<thead>
<tr>
<th>Actor</th>
<th>College major</th>
<th>Graduate major</th>
<th>Reason left</th>
<th>Motivation to return</th>
<th>CSE major</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie</td>
<td>Business</td>
<td>N</td>
<td>Tragedy</td>
<td>M, WL, HO</td>
<td>Physics</td>
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</tr>
<tr>
<td>Jeanie</td>
<td>Spanish</td>
<td>Y</td>
<td>None</td>
<td>WL, HO</td>
<td>None</td>
<td>PA</td>
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<td>Alice</td>
<td>Computer</td>
<td>N</td>
<td>Money</td>
<td>WL, HO</td>
<td>Math</td>
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<td>Rosa</td>
<td>BFA</td>
<td>N</td>
<td>Money</td>
<td>M, WL, HO</td>
<td>LS</td>
<td>PR, BSN</td>
</tr>
<tr>
<td>Luisa</td>
<td>Engineer</td>
<td>N</td>
<td>Lost</td>
<td>M</td>
<td>IS</td>
<td>Money</td>
</tr>
</tbody>
</table>

LS=life science; IS=information systems; PR=pharmaceutical research; BSN=bachelor in nursing
Motivation: money, interest, helping others, bored, STEM experience; PA STEM in past + experience: math/science PA; positive teacher; positive parent; faculty support; peer support -experience: negative teacher; negative parent; finances; poor grade in math/science; poor grades; faculty support; peer support; lack of direction; frustrations; gender
Areas that influence choice and persistence
Prior success in HS math and science; desire to make a difference; Path:
Work Life Balance

Independent of where they were in the family life cycle each of my participants mentioned a work life balance as being a priority for them. Jeanie, who hopes to have children in the near future, has been struggling with how she will balance her desire to work in the medical field with her need to have quality time with her family since she was a young girl. She believes she has finally found her answer in a career as a physician’s assistant. Alice, now a newlywed, sees teaching as a way to have a career that meets her professional needs and still be able to start a family and have balance in her life. Rosa, doesn’t have children nor does she plan to, but would like a work life balance that enables to be home in the evenings and weekends and spend time with friends, family and her husband. Angie is still at the point in her life where she can’t even begin to imagine having children or what it might be like to balance a career and a family. She sees how difficult it is to balance school and work and can’t imagine how she would ever fit children into the mix. She plans to finish her PhD first and then think about children. She sees her current career as impossible with respect to balancing a family and unsure what the future holds.

I am not ready to have children. I am too busy. Almost every one of my friends has at least one child…all you do is take care of you children. It is difficult being a mother. Kids are getting used to both parents working…I am not sure in my current career it is not fair to kids. It doesn’t seem fair to work more than 40 hours a week or get sent away. They make you have plans in place to hand kids off to someone else whenever you are in the military. So, for a mother it seems like it would be a huge challenge. If I were a civilian it would be easy…as a PhD or a professor I don’t think I will ever have
time for kids…it just seems like a daunting task to take care of a child and be success.

That is why I know I am not ready (Angie, Interview 3).

Rosa mentioned the number of hours and stress of her current job numerous times during our three interviews. A better work life balance is one of her primary motivators for returning to school at this time. “I feel if science interests me then I can at least walk out and get a job that is a little more daytime and scheduled. I feel like weekends and holidays should apply to me. I feel like weekends should apply to me. I worked that way before and I liked it much better” (interview 2).

Rosa describes her decision to return to school in journal 2,

I think I had a few "aha moments" during my 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. And in both positions I was positive that I had reached the apex of what I could do in the industry. There was nowhere to go.

Rosa reflects on what balancing work and life means to her,

Well my mom and dad always worked, both my parents worked. And my step parents worked. So it wasn’t like I had the parent at home who is the nurturer and a parent who is the earner. I think that, since I am not planning on having kids I sort of have less of that battle. I feel guilty that the cat is a little bit ignored” (interview 2).

I expected that the women who chose to return to study science, technology, engineering and mathematics (STEM) did so because they had either a new found connection to STEM and
ADULT WOMEN IN STEM MAJORS

wanted to make a difference through research or that they wanted access to higher paying jobs. Luisa and Rosa were driven by money and are each looking at entering STEM fields. Luisa sees a STEM degree as access to six figure jobs. Her children are primarily grown and in college and for her having enough money to support her family needs to be at the top of her list. Rosa doesn’t plan on having children and is looking for a steady paycheck where she won’t have to worry about paying bills. Future studies should look at the perception women have of traditional STEM careers with respect to a work life balance and whether this is a perceived or actual barrier. Studies should include a diverse population of women in order to better understand the influence of the stage of family life cycle the women are in.

The Power to Make a Difference

The desire to find meaning in their chosen career was repeatedly mentioned by all women in my study. Each of the women described what was meaningful to them as the power to make a difference in the lives of others. This desire was also seen in their interactions with their peers in team assignments and online discussions. I heard Alice consistently reach out to her peers and offer her time and words of support and encouragement. Angie reached out to her peers in a voice that reminded me of my own voice when responding to students. I heard Jeanie be a cheerleader for her team mates as they developed their final team project.

When talking about outcome expectations each of the women in the study talked of wanting to make a difference and how that was what was missing from their current career. Alice and Angie want to make a difference in the educational experiences of future students. They want to be that North Start that they didn’t have and hope to save others from the same mistakes they see themselves as having made. Jeanie wants to make a difference in the health care of others. She talked of how rewarding it is to save a life or just provide that needed comfort or
reassurance. Rosa can hardly wait to start researching new drugs and looks forward to being part of a new discovery that will change the lives of many.
Chapter 6 Conclusions

Contributions to Practice

The K-12 Years

All of the women in my study mentioned successful childhood mathematics and science experiences as a source of belief in their ability to be successful in studying science, technology, engineering or mathematics (STEM). What they were lacking was the guidance of a role model and STEM experiences that would have resulted in their development of a STEM identity, STEM related goals and outcome expectations. None of the women in my study remembered a mathematics or science teacher reaching out to them or suggesting they pursue science, technology, engineering or mathematics (STEM). 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 they created. Rosa recalled science class as 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 STEM.

None of the participants recalled a negative classroom environment or being treated any differently due to their gender. They also did not voice any concerns about being considered “nerdy” and didn’t recall having any negative, preconceived notions about what it would be like to work in a science, technology, engineering and mathematics (STEM) career. It seemed more to be a general lack of knowledge of what STEM careers were available to them and a lack of STEM identity. 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
ADULT WOMEN IN STEM MAJORS

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 an interest in studying STEM.

This suggests it may be beneficial for schools to increase awareness of the wide range of science, technology, engineering and mathematics (STEM) careers a woman can pursue. Rather than only having female engineers come in to talk with students include professions women may connect to and be unaware. 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 chemicals used in make-up and soaps.

All the participants in the study voiced a need to have a work life balance as a priority. This suggests that schools should look at educating women as to 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 goals.

All the participants mentioned what they perceived as a lack of direction, advice or guidance from their high school counseling office. 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 recall just doing well in mathematics and science and therefore were “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. Both feel they were not academically or emotionally ready. They perceive this decision as the reason they were not successful in college the first time. This suggests schools should more carefully assess the
ADULT WOMEN IN STEM MAJORS

process of selecting and recommending students attend college their senior year. Schools should also look at spending more time talking with students, 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 Traditional College Student

The role of GPA first year in college is supported in this study. Both Luisa and Alice had failed attempts to enter college as high school seniors. While they always had good grades in HS they were not prepared for college and ended up dropping out. Rosa tells of how a first term of bad grades “woke her up”. All the women in the study have had a high GPA since returning to school and have persisted. Ushers and Pajares (2009) discuss the impact a B can have on an A student versus 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. While Luisa did reach out to faculty and her peers she was unable to find a role model or any feeling of connection. Studies support the benefits of science, technology, engineering and mathematics (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 asked, or found a peer support group, she may have persisted. This suggests colleges should step in 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 mentions feeling alone, overwhelmed and suffering from a loss of belief in academic abilities.
None of the participants mentioned any gender related issues or a negative classroom environment.

**The Non-Traditional College Student**

All of the students mentioned the critical role their mentor played in the academic choices they made and their ability to persist. A mentor’s role is different than that of a traditional advisor. A mentor sees their role as more than giving advice on selecting courses. A mentor works closely with the students discussing personal and professional goals, learning about their personal lives, the support system they have and barriers they may face. A mentor guides the student through the process taking all these factors into account. They have an in-depth understanding of their mentees and what they need to be successful. This suggests traditional colleges may want to look at the role advisors play and think about how they can reshape this role into more of a mentor. This relationship may better provide the guidance and support female students need. Luisa, Rosa, and Alice all recalled a situation where 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.

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 recall situations where they faced personal obstacles during their course and reached out to their instructors for support. Both recall the understanding and support they received from their instructors as critical in their ability to meet the needs of their family and complete their coursework. This suggests that colleges need to be sensitive to the unique needs of non-traditional students and provide professional development for instructors.
Alice and Luisa both mention negative instructor experiences that almost resulted in them dropping out and positive instructor experiences that kept them persisting. Both mentioned difficulties with the mathematics software that is required of them and felt this was more of a barrier than the content. They each felt that the student feedback surveys were inadequate and no one at the college reads them nor listened to their complaints. This 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 their voice is being heard.

**Contributions to Theory**

**Social Cognitive Career Theory**

The question driving me was why some women choose to study science, technology, engineering and mathematics (STEM) and hold a belief they can be successful where 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 while others don’t. What experiences did they have in their lives that gave them that inner strength and drive? After a review of the literature I found social cognitive theory (SCCT) to be the right 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 right 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 of the five women in my study influenced their self-efficacy, interests, goals, expected outcomes and how the support system they had (or didn’t have) and perceived and actual barriers impacted their choice to study science, technology, engineering and mathematics (STEM).
A theme that emerged, that I felt the theory didn’t address was the strong need to have meaning in their lives and help others. Previous research supports the idea that success in mathematics and sciences 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 was true but the additional piece driving their interest was the need for meaning in what they were doing.

Another theme that emerged was resilience. 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. I believe that resilience is a significant part of what drives the belief in their ability to successfully return to the university to study science, technology, engineering and mathematics (STEM) and pursue a career in this field. For Alice and Angie family experiences negatively influenced their personal accomplishment. For Alice an abusive relationship with her mother and Angie with her father resulted in their just giving up and not caring about academics. Yet even though they weren’t trying, they did well in mathematics and science which has led to a strong belief in their academic abilities beyond their k-12 years. This suggests further studies are warranted on the connection between overcoming barriers, resilience and the influence on self-efficacy.

Social cognitive career theory (SCCT) suggests an indirect pathway from self-efficacy to choice through interest and outcome expectations. Previous research supports the importance of personal accomplishment and vicarious experiences in predicting the choice to study science, technology, engineering and mathematics (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. The choice to study or not study STEM seemed to be driven by vicarious experiences in childhood and adulthood, but four of the women lacked the experiences needed to
ADULT WOMEN IN STEM MAJORS

develop a STEM identity the first time they went to college. Alice and Luisa chose to study STEM the first time they attended college largely due to 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. 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. The results of my study support the importance of childhood personal accomplishment in a non-traditional female student’s choice to study STEM. 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 warranted on the role of work life balance and meaning in a woman’s choice to study STEM. Since none of the women in my study had small children further research is needed on populations of married and single women with small children.

None of the women in my study identified gender as a barrier in the classroom or had a perception of science, technology, engineering and mathematics (STEM) as a “man’s” world. In a study by Parjares on the path men take to choosing STEM I discovered several attributes in the women in my study that were similar to the men in the Pajares study. Hughes (2010) performed a study that compared female stayers and leavers within STEM during the college years. She discovered that the stayers saw gender as a biological, not cultural difference. The leavers struggled with gender stereotypes. She suggests that current feminist theories such as Harding (1997) and Lemke (2002) support the idea that for women to be successful in STEM they need to take on masculine gender behaviors. While the women in my study stressed the need to find
meaning and make a difference they never associated this as a female trait. While parts of their personality closely matched what normally might be associated as masculine 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? While 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 only see gender as a biological, not cultural, difference.

**Contributions to Policy**

While the focus of this study was not on policy initiative related to encouraging more women to study science, technology, engineering and mathematics (STEM) there is a significant amount of research currently underway that draws upon funds provided by private, state and federal initiatives. SUNY recently received a $2.95 million NSF grant to expand the education pipeline with STEM mentoring across NY. The intent of the grant is to create programs in high need low resource areas. One of the key pieces of this grant that connects to a finding in this study is the focus on mentor training. It will be interesting to see the results on the effectiveness of this program.

The STEM (science, technology, engineering and mathematics) Education Coalition (http://www.stemedcoalition.org/2012/04/02/coalition-issues-core-policy-principles-for-2012/) recently created their Core Policy Principles for 2012. These principles are used to drive state and federal policy related to STEM and education. One of the initiatives they support is community colleges better preparing students for further STEM education. Part of this preparation should include addressing early intervention when students are struggling, study groups, support networks and mentors.
Many policies are directed at the problem of American students being outperformed in science, technology, engineering and mathematics (STEM) and the low numbers of the American population that pursues STEM. While many policies are being put into place that 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. This can be done by providing women of all ages access to women in a wide range of STEM careers. In addition, more policies should be directed at the ever increasing non-traditional female student population. Most programs directed at women in STEM are seen in middle and high school and on traditional campuses. More of a focus should be made on researching the effectiveness of these programs with non-traditional female students.

**Conclusion**

In conclusion, I explored the influence the lived experiences of the five non-traditional female students in my study had on their self-efficacy, interests, goals, outcome expectations and choice to return to the university to study science, technology, engineering and mathematics (STEM). I also explored the role supports and perceived and actual barriers played in their ability to persist. Results of my study suggest that childhood experiences and academic accomplishments had a lasting influence on the choices the women in my study made when returning to the university to study STEM. The STEM related personal accomplishments of their childhood continued to drive their belief in their ability to be successful studying STEM. The childhood experiences they had and the barriers they overcame were a source of strength for them and I believe gave them the resilience to persevere and successfully complete their studies. The women in my study mentioned meaning and the need to make a difference as critical to their
choice to study STEM. Results of this study can inform families, administrators, business leaders and policy makers as they try to increase a woman’s ability to identify with STEM and see how it can fit not just with their interests and career goals but personal goals as well. This will be good for our society as it will increase the earning power of women, the diversity of people who are working and creating policy related to STEM, and our competitiveness within a global business market.

My study has resulted in a lot of personal reflection on the choices I have made in 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 now teach which enables me to have a life work balance I otherwise couldn't. I feel passionately about women pursuing science, technology, engineering and mathematics (STEM). I tell my children, don't close any doors. I believe that having a STEM background opens doors and even if you are not in a field of that nature you still use what you learned about the thought process, the problem solving, and analytical skills. It is better to have that background and have choices than not. Yet, this does not answer the question, “Can women have it all”?
Appendix A

Recruitment Letter STEM

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
Fax: (518) 442-5008
Email: patrice.torcivia@gmail.com
Recruitment Letter non-STEM

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
Fax: (518) 442-5008
Email: patrice.torcivia@gmail.com
Appendix B
(adapted from Ashby-Scott, 2005)

Consent Form SMT Participants

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, 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 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
ADULT WOMEN IN STEM MAJORS

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
ADULT WOMEN IN STEM MAJORS

_____ 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
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
ADULT WOMEN IN STEM MAJORS

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 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)
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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 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.
ADULT WOMEN IN STEM MAJORS

**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, 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 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.
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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.

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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.

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Participant’s Signature            Date

___________________________________            ____________
Participants’ Printed Name            Date

Consent for:

(Please initial your choices below: adapted from Uzner Smith, 2010))

Interviews

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Audio recording of interviews

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Appendix C

Interview Protocol 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 our 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
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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 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/socio-economic:** Think back to a time where you faced an academic challenge 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/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 – pre-college 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 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 that was 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?
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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 either 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 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 classroom 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 you 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 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?
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. GE: 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 purse 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 laced 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, support provided by the 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 be 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, 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

What types of interactions take place in the online classroom? (I will tally using chart at found at end of Appendix E)

a. (VP) Who offers 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) Who uses the student lounge or ask a question area? How frequently, for what and who replies?

c. (PA) How active is each student in the online classroom? Who posts the most? Who writes the most extensive posts? Which student to student interactions are most frequent?

d. (barriers) Who interacts most frequently with whom? Does a student seem to choose the same people all the time to respond to and if so what are the characteristics of the people.

e. (barriers) What is the frequency of female to female and female to male interactions online?

f. (barriers) How frequently and timely is the student in posting to the discussion?

g. (VP) How frequently and to who does the instructor reply in the discussion area or e-mail directly about a discussion response? How frequently and to who does the instructor reach out to when a student 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 each student in my study?
ADULT WOMEN IN STEM MAJORS

a. (VE) When a student needs help who specifically do they turn to and what kind of response do they get?

b. (PA) In discussion responses does the student 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 student challenge what others have said by referencing their post and asking a question about it such as “that is a really interesting idea but how 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 student 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 student receive? Who are they from, where in the course and how does the student react? What type of feedback does the student get from the instructor? Does the instructor use words of encouragement?

f. (PH) Does the student 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
ADULT WOMEN IN STEM MAJORS

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 student experience any negativity in the responses of other students or
reply in a negative way to other students? Does the student 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?
Table 1
Table of students in study, number of posts and total number of posts initiated by each student

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<tr>
<th>Student Name</th>
<th>Total posts by student</th>
<th>Total threads initiated by student</th>
<th>Total late posts</th>
<th>Total # discussions participated in by student</th>
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Table 2
Table of Response Rate by gender and student

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<th>Total responses in entire course</th>
<th>Total number male students</th>
<th>Total number of male posts</th>
<th>Avg # posts by male students</th>
<th>Total number of female students</th>
<th>Total number of female posts</th>
<th>Avg # posts made by female students</th>
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Table 3
Gender participation in each Observation

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<th>Total posts</th>
<th>Avg # posts per male student</th>
<th>Total female students participating</th>
<th>Total posts</th>
<th>Avg. # posts per female student</th>
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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: ________________________


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 ___________

13. Do you have children? Yes_____ No_____


ADULT WOMEN IN STEM MAJORS

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

__________________________________________________________________________

__________________________________________________________________________

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.)?

__________________________________________________________________________
4. What honors organizations were you involved in (e.g. NHS (national honor society))?  
____________________________________________________________________________

5. What extracurricular activities were you involved in (Band, athletics, student government, science or mathematics related, etc.)?  
____________________________________________________________________________

6. What after-school, summer, and/or mentoring programs did you attend (Boys Club, Girl Scouts, Bridge, etc.)?  
____________________________________________________________________________

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): ________________________________________________
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?  
____________________________________________________________________________

2. How many credits did you complete prior to enrolling at ESC? ________

3. What mathematics courses did you take prior to enrolling at ESC?
ADULT WOMEN IN STEM MAJORS

(Please give course, year, and grade earned.)

___________________________________________

___________________________________________

___________________________________________

4. What mathematics courses have you taken/are you currently taking at ESC?
(Please give course, year, and grade earned.)

______________________________________________________________________________

5. Have you received any awards/citations while attending ESC? If so, please list them.

______________________________________________________________________________

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

______________________________________________________________________________

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?

___________________________________________________________________
___________________________________________________________________

___________________________________________________________________
## Path to STEM of the Participants

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>PA</th>
<th>VE</th>
<th>VP</th>
<th>PSY</th>
<th>interest</th>
<th>goals</th>
<th>Outcome expectation</th>
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<td>BSLS; BSN</td>
<td>M; HO. WL</td>
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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 HS; mixed messages from parents
**College**: motivation for college major: waitlisted at MIT; accepted at USC: BFA

1q Obstacle 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
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<tr>
<th>Life Stage</th>
<th>PA</th>
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<th>VP</th>
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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)
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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
Life Stage | PA | VE | VP | PSY | interest | goals | Outcome expectations
--- | --- | --- | --- | --- | --- | --- | ---
Jeanie
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 | | |

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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
Jeanie

high PK

high math/science grades

positive from mom
positive from dad
nothing from teachers

interest in math

continues to get high math grades 6-12

Lack of guidance practical connections lots of time in dr office did not fulfill dream of being dr.

no gender family stress

critical event chance meeting with PA

choice to return to school

learning experiences advanced math sequence large school lack of useful guidance no simple learning experience that seemed to influence poor in art and history always wanted to take challenging math courses

personal inputs white female bright father wanted to be a dr mother health issues third in family to attend college socio economic school size?

support did overcome barriers pre-college to college successfully completes BS in Spanish no college extracurriculars due to health resilience got her moving forward interest in science from young age

high SE

switches from pre-med to Spanish

told by counselor she will never get in to med school

applies but does not get in to med school

works in hospital as translator

VE-no direction continues connection with healthcare

PA-work accomplishments

high SE

interest in PA school

support

overcome barriers as adult

persists

disability sister financial issues-grants personal health issues

choice

high PK

high math/science grades

positive from mom positive from dad nothing from teachers

interest in math

continues to get high math grades 6-12

Lack of guidance practical connections lots of time in dr office did not fulfill dream of being dr.

no gender family stress

critical event chance meeting with PA

choice to return to school

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interest in PA school

support

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persists

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PA-work accomplishments

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interest in PA school

support

overcome barriers as adult

persists

disability sister financial issues-grants personal health issues

choice
### Luisa

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>PA</th>
<th>VE</th>
<th>VP</th>
<th>PSY</th>
<th>interest</th>
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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
ADULT WOMEN IN STEM MAJORS

Luisa

- High PA leads to high SE
- Positive from mom, nothing from dad, nothing from teachers
- Math major, teacher
- High outcome expectation
- Choice to return to school
- Supports mentor, peer good instructors
- Overcome barriers as adult
- Personal inputs: white, female, bright, father on school board, mother a teacher, healthy
- Advanced math sequence, lack of useful guidance, no single learning experience that seemed to influence
- Sick father, poor instructors, difficult software, isolation, lack of tutors
- No father, no mother, no family support
- Critical event: boyfriend, daughter, work-related promotion to teach
- Interest in teaching, high SE
- No gender
- Lack of guidance, no practical connections, role model, shop owner, no peer influence, no sports or clubs
- Financial issues (barrier)
- Drops out a second time
- Divorce creates need for new career (money) returns to school
- Choice
- VP-career, VP-work related, PA-work accomplishments
- No son, no daughter
- Not overcame barriers pre-college to college, no one there, no satellite
- Lack of parental involvement, abusive mom, dad didn't know what to do
- No one at school reached out to say hey you are smart, you can go somewhere with this
- No programs, resilience get her moving forward
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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
ADULT WOMEN IN STEM MAJORS

Alice

- High PA
  - High math grades
  - SAT 7th grade
  - Negative from mom
  - Nothing from dad
  - Positive only from Physics teacher
  - Interest in math
  - Math major
  - Teacher
  - Learning experiences
  - Advanced math sequence
  - Large school
  - Lack of useful guidance
  - No single learning experience
  - Female
  - Bright
  - Father on school board
  - Mother a teacher
  - Healthy

- High SE
  - Critical event
  - Abusive mom
  - VP
  - PA
  - Family stress
  - Poor grades
  - No gender drugs
  - Poor peer influence
  - No sports or clubs
  - Lack of guidance
  - No practical connections
  - Role model-Physics teacher

- Low PA
  - Low SE
  - Poor grades
  - Feel unprepared
  - Low PA
  - Realization that need better career
  - Money
  - Returns to school
  - Choice
  - Financial issues (barrier)

- Choice
  - Drops out a second time
  - Critical event
  - Boyfriend-daughter
  - Work-related
  - Promotion to teach
  - Projected loss of job
  - Interests in teaching
  - High SE
  - VP-work related
  - PA-work accomplishments

- Support did not overcome barriers pre-college to college
  - Nobody there
  - No mentor
  - Lack of parental involvement-abusive mom,
  - Dad who didn't know what to do
  - No one at school reached out to say hey you are smart
  - You can go somewhere with this
  - No programs
  - Resiliency gets her moving forward

- Overcome barriers as adult
  - Sick father
  - Poor instructors
  - Difficult software
  - Isolation
  - Lack of tutors
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