WOMEN STAYING IN STEM PROFESSIONS LONG-TERM: A MOTIVATION MODEL

A dissertation submitted

by

MEGAN GEBHARDT COATESWORTH

February, 2015

to

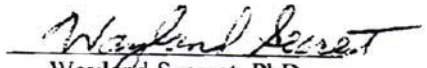
School of Organizational Leadership

UNIVERSITY OF THE ROCKIES

Upon the recommendation of the Faculty and the approval of the Board of Trustees, this dissertation is hereby accepted in partial fulfillment of the requirements for the degree of

DOCTOR OF PSYCHOLOGY

Approved by:



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Women staying in STEM professions long-term: A motivation model

by

Megan Gebhardt Coatesworth

Abstract

This qualitative grounded theory study sought to identify what motivates women to stay in or return to science, technology, engineering, and math professions (STEM) long-term, leading to a motivation model. Twenty women, each having a minimum of 10 years of experience in STEM professions, participated in the study. Four of the 20 participants had a career path where they left the STEM workplace for more than 26 weeks and then returned. The results of this study suggested that there may be five themes related to motivating factors for women who stay in STEM professions long term: a) interest in STEM is the constant as individual needs and priorities change, b) direct manager influence on development is critical c) performance-based workplace policies and culture are continuously sought, d) moving towards a no-bias workplace remains important, and e) the career growth path at life's crossroads remains a challenge. While this study's results suggested that some bias does still exist in the STEM workplace, as previously documented. The results suggested that an equitable workplace does not yet exist regarding career growth opportunities. As career growth is one of the motivating factors for women in STEM and environments for career growth opportunities vary in the workplace, this study's results also suggested that career growth opportunities continue to be a barrier for women in STEM.

Keywords: women, science, engineering, math, technology, STEM, career, motivation, qualitative analysis, grounded theory, career growth, modern workplace

DEDICATION

To my husband, Jon. Thank you for your love and unwavering support.

ACKNOWLEDGEMENTS

I would like to thank the women in STEM professions who openly shared their experiences with me and contributed to this dissertation. It is my hope that this work, created in part by your collective stories and insights, will help provoke thought for future generations.

I would like to express my sincere appreciation for my Dissertation Chair, Dr. Wayland Secrest, for the countless hours of review, counsel, and encouragement over the past two and a half years. Your coaching throughout helped me to stay focused and I sincerely appreciated your guidance as I crossed each milestone. I would also like to thank my Dissertation Committee members, Dr. Lani Robbins and Dr. Irene Stein, also for your countless hours of review and counsel, and for your genuine enthusiasm for this study.

I would also like to thank my family and friends who supported me throughout this journey. Your ongoing interest and enthusiasm energized me as I reached the various milestones. I treasure you all.

Last, to my husband Jon. I am lost for words that could begin to capture how grateful I am for you. Thank you very much for not just carrying me through this, but for making it fun along the way. You are my steady reminder as to what is important. I love you.

Megan Gebhardt Coatesworth

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CHAPTER I: INTRODUCTION

The purpose of this qualitative grounded theory study was to identify what motivates women to stay in or return to science, technology, engineering, and math professions (STEM), leading to a motivation model. As illustrated in the literature review, research has been done on related topics, particularly why women leave STEM professions. Why women stay long term remained largely unanswered prior to this study.

General Statement

Men outnumber women in STEM professions, both at the university level and in the workplace (Szelenyi & Inkelas, 2011; Thilmany, 2008). Careers in STEM range from technical niche professions to broader leadership roles. Some examples include: research, engineering, computer programming, physical sciences, life sciences, or design. Despite more women entering the workforce in STEM professions, trends show that women leave STEM professions early in their careers at higher rates than men (Fouad, Singh, Fitzpatrick, & Liu, 2012; Thilmany, 2008).

A study released in 2008 and supported by science, engineering, and technology companies showed that 52% of women between the ages of 35-40 in science, engineering, and technology professions left the workplace (Thilmany, 2008). Women exit STEM professions at a higher rate than men, comparable to other professions (Hunt, 2010). The higher ratio of males versus females in a given workplace has a direct correlation to the number of women who exit versus men (Hunt, 2010). Women in engineering professions leave at the highest rate, primarily because of the wage gap in comparison to their male counterparts (Hunt, 2010). Preston (2004) argued that the loss of STEM professionals is *wasteful,* citing that the social investment in training this workforce does not have an

adequate return, if there continues to be a high percentage of men and women who leave at some point during their university or early in their professional workplace careers.

Numerous programs are in place to recruit girls to enroll in science, engineering, and technology educational programs. Many U.S. government-sponsored programs sought to find answers on how to best recruit and retain women in STEM professions. Some of the more commonly referenced government programs and research projects include ADVANCE, WISE, WiSER, RAISE, The Engineer 2020 Project, Beyond Bias and Barriers, BEST, The Quiet Crisis, Rise Above the Gathering Storm, and The STEM Workforce Data Project to name a few (Jolly, 2009; Lincoln, Pincus, Koster, & Leboy, 2012; Mavriplis et al., 2010). The urgency of identifying solutions to improving the recruitment and retention of women in STEM fields is expressed in each of these programs or projects. Despite gains in STEM university and industry settings, the full impact of these programs has not been quantified (Jolly, 2009; Lincoln, Pincus, Koster, & Leboy, 2012; Mavriplis et al., 2010). Further research in this area is needed to uncover what factors contribute to women persisting in STEM professions.

According to the U.S. workforce statistics available from the U.S. Census Bureau from 2006-2010, women are 47.2% of the U.S. workforce. As the United States transitioned from a manufacturing economy to a knowledge worker economy from 1950 to 2000, the STEM workforce grew exponentially (Lowell, 2010). Since 2001, the number of professionals entering STEM fields is in a marked decline, predicted to fall short of forecasted demand (Lowell, 2010).

According to the *National Science Foundation 2010 Report on Women, Minorities, and Persons with Disabilities in Science and Engineering*, women make up only 28% of the

science and engineering workforce in the United States. Women continue to be underrepresented in STEM professions (Rosenthal, London, Sheri, & Lobel, 2011). STEM fields do not attract women equally across the growing demographic of eligible college students (Morganson et al., 2010). Women with the highest level of degrees in their fields represent approximately 38 percent of the science and engineering workforce (National Science Foundation 2010 Report on Women [NSF Report], 2012). Higher representation of women occurs in life sciences and social sciences, with women achieving equity in these fields at approximately 52% of the workforce (NSF Report, 2012).

Other science, engineering, math, and computer field workforce statistics show women in the minority (NSF Report, 2012). Science, math, and computer fields are 26% women, and engineering is only 13% (NSF, 2012). The U.S. National Science Foundation and the European Commission suggested that the lack of women in these skilled professions negatively impacts economic growth, both because of the sheer numbers of STEM professionals (men or women) required by industry to remain competitive and because of theories that diversity spurs innovation (as cited in Thilmany, 2008).

The number of graduates decreased since the 1980s in the physical sciences and engineering, where global competition for talent is intensifying (Varma, 2010). The United States is competitive in the world STEM markets, but is in danger of losing this advantage, especially in the ever growing information technology market. This loss of competitiveness is largely because the virtual nature of the information technology (IT) profession lends itself to performing these services by anyone, anywhere in the world (Varma, 2010). Encouraging more women to explore careers in STEM professions, and subsequently stay in them, may help the United States address the growing concern of interest in STEM professions.

Jonsen, Tatli, Ozbilgin, and Bell (2013) suggested that without a diverse workforce with equal opportunities, society may not realize the greatest benefits. Grosvold (2011) echoed this sentiment and emphasized the ethics of equal access to professions. While the Equal Pay Act of 1963 and the Civil Rights Acts of 1964 drove equal opportunity for entry into the workplace, no legal measures since had a major impact on the success of women in the U.S. workforce, and corporations themselves have rarely made diversity and inclusion a performance accountability of leadership (Jonsen et al., 2013). Some corporations do institute programs to retain women, but the culture of the *Old Boys* and now *New Boys* networks prevails, according to studies performed in the 1980s and late 1990s, suggesting that male discriminatory attitudes towards female executives still exist despite societal advances (Baumgartner & Scheinder, 2010).

There is a stigma in the U.S. workplace for any worker that takes a career break (Hewett, 2007). Linear careers are the norm in most organizations, a dated perspective that goes back centuries (Pringle & Dixon, 2003). Paid work is equated with a career, where men were typically the workers, and women's careers are framed with the bias of how men's careers have been historically (Pringle & Dixon, 2003). The studies on non-linear careers tend to be focused on the whole of the female workforce or to higher-income earners (Hewlett, 2007).

For the purposes of this study, a non-linear career includes the definition as a career, where the participant left the STEM workplace for more than 26 weeks and then returned to continue working in a STEM field. Reasons for leaving can vary and can be personal or professional. Most women have underestimated the effort required to re-enter the workforce at the same or higher level (Hewett, 2007). The career cost of leaving is likely never

regained upon re-entry (Hewett, 2007). More than one third of women have worked part-time during some part of their career to balance work and family, 25% have worked reduced hours, and 16% have declined a promotion (Hewett, 2007). Reasons women want to return are interest in what they do, financial needs, wishing to contribute to society, and a desire to recapture part of their identity (Hewett, 2007). Women who have non-linear careers have added barriers to overcome if they are going to persist in their careers.

Statement of Problem

Although physically violent forms of sexism have generally diminished because of the legal requirements in the workplace, covert sexism remains a prominent barrier for women in general in the workplace (Malcolm & Malcolm, 2011). If emerging female STEM professionals are immediately met by an environment with insurmountable barriers, then the system that propels careers for these individuals is bound to fail. Barriers related to salary and career advancement opportunities have remained consistent challenges for women in the workplace for decades (Brawner, Camacho, Lord, Long, & Ohland, 2012; Giles, Ski, & Vrdoljak, 2009; Lincoln et al., 2012; Powell, 1992; Preston, 2004; Rhea, 1996).

Understanding how to motivate women to stay in or return to STEM professions creates a problem for workplace human resources (HR) professionals and managers in STEM fields, as there is little research to suggest solutions in avoiding voluntary turnover of women STEM professionals. Studies have indicated that once women graduate and enter the workforce, barriers in a male-dominated work culture are some of the main causes of why women leave STEM fields (Fouad, Singh, Fitzpatrick, & Lui, 2012; Thilmany, 2008). The general problem is that women who enter the workforce in STEM professions encounter many barriers (Fouad, Singh, Fitzpatrick, & Liu, 2012; Thilmany, 2008). The specific

problem is that the barriers in STEM, including lack of mentoring, lack of access to career advancement channels, and lack of effective policies to promote work/life balance, especially for childcare, has been generally from the perspective of women who have left STEM professions (Glass & Minnotte, 2010; Kerr et al., 2012; Powell, 1992; Preston, 2004). A knowledge gap exists as to what motivates some women to *stay* in STEM professions.

Some publications offer hypothetical preventive solutions regarding what might help women overcome barriers in STEM professions (Fouad, Singh, Fitzpatrick, & Liu, 2012). One study has compared and contrasted why women in engineering professions leave versus stay (Fouad, Fitzpatrick, & Liu, 2011). Fouad, Fitzpatrick, and Liu (2011) focused their study on engineers, not across STEM professions, and their sample did not include women who leave and return. This study looks across STEM professions.

Purpose of the Study

The purpose of this qualitative grounded theory study was to develop a theory on what motivates women to stay in STEM careers long-term, leading to a motivation model for women in the STEM workplace. The study included women who have stayed in STEM professions for more than 10 years, including women who have returned to STEM professions following a career break. This study used a constructivist approach to grounded theory, using semi-structured interviews with women in STEM professions in the continental United States. Interviewing women who have remained motivated in their STEM professions provides insight to the theory or phenomenon as to why they stay or return.

Importance of the Study

The U.S. science and engineering workforce is critical to the United States in remaining competitive as a global economy and sustaining the capability to continue

technical and innovative advancements (Cordero, Porter, Israel, & Brown, 2010; Fouad, Fitzpatick, & Liu, 2011; Fouad, Singh, Fitzpatrick, & Liu, 2012; Hira, 2010; Lowell, 2010; Preston, 2004; Servon & Visser, 2011; Thilmany, 2008; Varma & Freehill, 2010). The U.S. Government established well-funded initiatives and enacted legislation to emphasize the importance of STEM careers in the United States. For example, the National Science and Technology Council (NSTC), established in the U.S. by Presidential Executive Order in 1993, has a committee dedicated to STEM Education (National Science and Technology Council [NSTC], 2013).

Another example is The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act. COMPETES was signed in 2010 to reinforce the government's commitment to STEM education and improvements in the STEM workforce (NSTC, 2011). An interagency committee for the COMPETES Act found that overall, 250 distinct federal investments were catalogued and estimated to cost the U.S. taxpayer $3.4 billion in funding marked for 2010 alone (NSTC, 2011).

Several stakeholder groups may benefit from this study on why women stay in and return to STEM professions. Using this study's results, HR professionals may leverage findings to institute cultural change programs by adapting workplace factors that typically contribute to turnover. This study may also benefit organizations, adding knowledge to more effective work policies related to work motivation because better provisions can be made for job enrichment, work incentives, increased productivity, job satisfaction, and the reduction of absenteeism and tardiness (Friedman & Lackey, 1991).

By understanding what contributes to the sustained engagement of women in STEM professions, leaders will be better equipped to understand the changes that are needed to develop this sub-section of the U.S. workforce. Law makers may be encouraged to champion policy change that further enables women to succeed in the workplace, providing a platform for more skilled workers in STEM professions and, in turn, paving the future for maintaining international competitiveness in this field of study. Women in STEM professions, both current and future, might benefit most by simply providing tangible role models in a profession, where the lack of female role models is cited as one of the biggest barriers to career success (Sealy & Singh, 2009). While laws can be passed and policies can be instituted in private practice, both the individual embarking on the journey and those that help in their professional development need the tools to equip them for career success.

Since STEM occupations are considered high-contributors to global competitiveness, the U.S. society may see some indirect benefits of women staying in STEM professions (Hira, 2010; Varma, 2010). Women in STEM professions may benefit the most from this research, as they will have tangible examples to aid them in overcoming career barriers. By researching perspectives from women who have successfully dealt with the obstacles highlighted in STEM professions, potential solutions may be discovered, encouraging more women to persist in STEM professions.

These insights may be beneficial for workforce diversity strategies to incorporate practical methods to minimize turnover and target specific engagement areas. Over time, these changes may impact an overall cultural change in these industries, providing an underlying foundation for women to have a better chance at success in the workplace. These findings may also equip women in STEM careers with useful guidelines for professional

growth. The women who participated in this research may become role models. Their perspectives may offer guidance in navigating a potentially hostile workplace culture and thriving in a male dominated environment.

Theoretical Framework

Human motivation has been studied for decades (Locke, 1976; Nebel, 1978; Steers, Mowday, & Shapiro, 2004). Motivation is discussed in this research in relation to a worker persisting in STEM professions and, conversely, the motivation to leave the profession. There are numerous published studies on why workers leave employers (Baumgartner & Schneider, 2010; Fouad, Fitzpatrick, & Liu, 2011; Gill, 2012; Hira, 2010; Lambert & Hogan, 2009). Science and engineering professions tend to be more volatile, as the very nature of these specialties is that the rate of change is fast and vulnerability to downturns in these sectors is high (Hira, 2010).

Several contemporary workplace motivation theories are mentioned here and further described in detail in Chapter II. Herzberg's two-factor theory of motivation separates extrinsic and intrinsic factors (Furham, Eracleous, & Chamorro-Premuzic, 2009; Robbins & Judge, 2009), expectancy-value theory considers competency beliefs and values in motivation (Jones et al., 2010; Matusovich et al., 2010), and the premise of equity theory suggested that individuals are motivated to eliminate inequities compared to their peers (Robbins & Judge, 2009). Other theories include goal-setting theory, based on performance and feedback (Robbins & Judge, 2009), self-efficacy theory indicating that with self-efficacy boosted by positive feedback, the worker will be motivated to perform better (Robbins & Judge, 2009) and Maslow's (1964) Theory of a Hierarchy of Needs which suggests that only

upon fulfilling the lower needs of security, safety, and belonging, can a person realize growth, or self-actualization.

Motivation for women in the workplace has historically been characterized using models involving a workplace that is predominantly male (Smith, Santucci, Xu, Cox, & Henderson, 2012). Career paths are different in the early 2000s than they were in the 1960s, when the Civil Rights movement aided broader female participation in the workforce (Sullivan & Baruch, 2009). A career in the 1960s was often with one company, moving up that company's hierarchy, and the career path was defined by a predominantly male workforce (Sullivan & Baruch, 2009).

Women's careers have historically been expected to model men's, which led to judgments against women if their development did not mirror men's (Smith et al., 2012). Pas, Peters, Doorewaard, Eisinga, and Lagro-Janssen (2014) referred to the ideology of the worker as gendered, suggesting that long hours, a willingness to relocate, work overtime or be on call, are characteristics of the ideal worker, and are easier met by males because of the lesser pressures society places on males in their private lives. Marques (2011) described the task of comparing male and female career success paths directly as tricky, as males tend to enter a fast track in their careers earlier, while women are more likely to begin their career fast track stage later in life.

Fouad, Fitzpatrick, and Liu (2011) performed a qualitative study of current and former female engineers to compare and contrast the factors for leaving or persisting in these professions. The study found that women who persisted with the profession often sacrificed career advancement for family obligations. Although a number of human resources policies have provided some progressive guidelines, the workplace culture remains gender-based

(Smith et al., 2012). The work-life balance human resources initiatives common in the workplace today continue to perpetuate the ideal worker male stereotypes and tend to weaken the perception of a career motivated woman (Pas et al., 2014).

Research Questions

Research questions for grounded theory should "reflect a problem-centered perspective of those experiencing a phenomenon and be sufficiently broad to allow for the flexible nature of the research method" (Birks & Mills, 2011, p. 21). The research questions for this study were: (R1) *What motivates women in STEM professions to stay in their profession long term?* and (R2) *What motivates women with non-linear careers in STEM professions to return to their profession after at least a 6 month break from their profession?*

As there is little research on why women persist in science, technology, engineering, and math professions, a quantitative research design may be limiting. There may potentially be many layers and dimensions as to why women stay in STEM professions. A qualitative grounded theory study was used to try to uncover insights and develop theory on why some women do stay or return.

This study sought to generate a theory of motivation, possibly depicted as a model, using the constructivist approach to apply grounded theory for why women stay in STEM professions long-term (Charmaz, 2006). In constructivism, experiences of multiple people are explored according to his or her own reality, and then interwoven to find theory emerging, or being constructed, from the data (Charmaz, 2006). The constructivist approach assumes individuals can have differing motivations for staying in STEM professions long-term and that an individual's motivation may be influenced by their environment. The theory for this study was developed from the start of data collection, and the researcher fine-tuned

interviewing and sampling to continuously sample more specifically for the theory emerging from the data (Charmaz, 2006).

Overview of Research Design

A qualitative study was performed using grounded theory. Grounded theory methodology is a strong way to build theories, because the analysis is grounded in the data (Birks & Mills, 2011; Charmaz, 2006; Glaser & Strauss, 1967; Urquhart, 2013). "Grounded theory is the most widely used and popular qualitative research methodology across a wide range of disciplines and subject areas" (Bryant & Charmaz, 2010, p. 1).

The study sample was drawn from a population of women who studied a STEM field and have worked in science, engineering, technology or math professions for at least 10 years in the United States. Some participants had non-linear careers, where they left their profession at some time, for a period of at least 26 weeks, and subsequently decided to return to the profession. Grounded theory methodology calls for the researcher to acknowledge when data saturation has occurred, or when there are no new emerging concepts or categories coming from the interview data (Birks & Mills, 2011; Urquhart, 2013). For the purposes of this study, the researcher anticipated a sample between 12 and 20 participants. The final sample was 20 participants. The interviews were approximately 45-60 minutes.

Definition of Terms

The following terms are defined to help the reader understand the context of each term in this study:

- Engineering Professions: Engineering managers, surveyors, aerospace engineers, civil engineers, computer and hardware engineers, electrical engineers, industrial

engineers, mechanical engineers, drafters, and engineering technicians (U.S. Census Bureau, 2012).

- Full-time worker: Full-time, year-round workers are all people 16 years old and over who usually worked 35 hours or more per week for 50-52 weeks in the past 12 months (U.S. Census Bureau, 2012).
- Involuntary Turnover: Turnover initiated by the organization, often among people who would prefer to stay (Noe, Hollenbeck, Gerhart, & Wright, 2010).
- Job Experience: The relationships, problems, demands, tasks, and other features that employees face in their jobs (Noe et al., 2010).
- Job Motivation: The processes that account for an individual's intensity, direction, and persistence of effort toward attaining a career goal (Robbins & Judge, 2009).
- Job Satisfaction: A pleasurable feeling that results from the perception that one's job fulfills or allows for the fulfillment of one's important job values (Noe et al., 2010).
- Motivation: The dynamic internal force that impels human behavior in a particular direction (Friedman & Lackey, 1991, p. 7).
- Non-linear Career: A career where the participant left the STEM workplace for more than 26 weeks and then returned to continue working in a STEM field. Reasons for leaving can vary and can be personal or professional. The researcher chose twenty-six weeks, because it is the maximum amount of time allowed under the most universal criteria for leave in the workplace, The Family Medical Leave Act.
- Science, Technology Engineering, and Math (STEM): STEM is and often used interchangeably with Science, Engineering, and Technology (SET) and "science and engineering." The 2012 U.S. Department of Education, National Center for

Education Statistics report which published results on entrance and persistence in STEM fields targeted students beginning bachelor degrees between 2003 and 2009 in mathematics, sciences (physical and biological / life), biological / life sciences, engineering / technologies, and computer/information sciences majors. Medical professionals are often not included in estimates of the scientific and engineering fields (National Science Board [NSF], 2010) and are therefore excluded from this study.

- Science Professions: Life scientists, physical scientists, social scientists, natural science managers, scientific research and development services (U.S. Census Bureau, 2011).
- Technology Professions: Computer systems design and related services, computer specialists, software publishers, computer and peripheral equipment manufacturing, Internet service providers, data processing, hosting, and related services, Internet publishing and broadcasting (U.S. Census Bureau, 2011).
- Voluntary Turnover: Turnover initiated by employees, often whom the company would prefer to keep (Noe et al., 2010).

Assumptions, Delimitations, and Limitations

An assumption in this study was that data on what motivates women to stay in STEM professions long-term can be gleaned from coded interviews to develop theory. Another assumption was that all participants will answer the questions honestly and completely during the interviews. Motivation theories in the workplace have historically used male dominated workplace models and this study assumed that there may be different motivational factors for women.

A delimitation of this study was that the participants in the study were volunteers and were all female. The participants may not fully represent the norm for all STEM professions. A larger and more professionally diversified group size may provide more insight into strategies for women. A study that compares women advancing in other professions, for example, may provide commonalities and differences with women in other careers and the strategies they have found to overcome organizational barriers.

Another delimitation of this study was that the data is confined to perceptions of women who have stayed in or returned to STEM professions. Perceptions may vary from other professionals such as the participant's managers, mentors, or co-workers. Findings may not be applicable across generations, as factors related to voluntary turnover are sometimes driven by societal expectations.

Having worked in engineering for 18 years, the researcher likely has some unconscious and conscious biases from her workplace experience. The literature review conducted for this study and summarized in Chapter II may also impart some bias. Literature reviews are often performed before starting the research, but are not necessarily complete (Urquhart, 2013). Once the coding process began and theory began to emerge, the researcher performed additional literature reviews to further investigate the resulting theory (Urquhart, 2013). It is important not to let the literature review bias the study analysis by force-fitting the data into an existing theory (Urquhart, 2013).

Summary

This study sought to understand what motivates women to stay in STEM professions long term, using a qualitative grounded theory study. As most previous work on why women are motivated to stay in or leave STEM professions focuses more on why women leave, there

is a knowledge gap as to the reasons why they stay long-term, including why women return to the profession after a career break. The results of this study may serve multiple stakeholders such as HR professionals, managers, employers, and, most of all the women in STEM professions themselves.

Four more chapters follow. Chapter II is a comprehensive review of the literature on women in STEM professions. In Chapter II, the primary topic discussed is the gap in the literature related to a model for motivation for women to stay in STEM professions long term and clarifies how this study will fill this gap in the literature. In Chapter III, the topics discussed include the research design and specific details of how the study was conducted. The remaining chapters focus on the actual research conducted for this study. Chapter IV includes the research results, followed by Chapter V which is an interpretation of the research findings.

CHAPTER II: LITERATURE REVIEW

A literature review was conducted to reveal the gaps in the existing literature and to provide background as to how this study might provide knowledge for those gaps (Charmaz, 2006). Glaser and Straus (1967), the originators of grounded theory, argued that a literature review contaminates the theory from being purely built from the data. Glaser acknowledged in later works that knowledge of existing codes from previous theories can help the researcher discover the subtleties in new theories emerging from the data (Charmaz, 2006). Urquhart (2013) reinforced the use of literature reviews indicating their helpfulness in studies using grounded theory as a means to "densify emerging theory" (p. 7). By altering sampling and data collection during the research and applying constant comparison analysis, this research limited the influence of the literature on the theory, safeguarding the essence of constructivist grounded theory in letting the theory be constructed from the data. As the theory or phenomenon emerges from the data in grounded theory methodology, additional literature reviews during the analysis of the procedure results are common, particularly if the study results prove not relevant to the initial literature review (Birks & Mills, 2011; Urquhart, 2013).

The most relevant studies from the literature search were chosen and examined critically. As the U.S. government has funded, and continues to fund, studies related to recruiting women into STEM professions and the barriers to progress, the majority of published works include a focus toward the academic years and / or why women leave STEM professions. While these previous studies offer valuable insight in correcting our actions, they provide only partial solutions for the modern STEM professions and women

professionals. A limited body of knowledge exists regarding what contributes to women's motivation to stay in STEM professions.

The goal of this literature review is to summarize the history of barriers for women in STEM and provide background as to the importance of STEM professions internationally and in the United States. There is also a focused section on three groups in the literature that are most relevant to this study: women at the university level studying to become STEM professionals, STEM faculty, and women in the STEM workforce. Also included in this discussion are some considerations from the literature for overcoming barriers in the STEM profession. Finally, as this study seeks to develop theory in the framework of motivation, a summary of employee motivation, turnover, and retention is included.

Search Strategy

The search strategy for this study started with establishing a literature review components outline, which guided the keywords used in search databases. Keywords included, but were not limited to *science, engineering, technology, math, women, STEM, workforce, employee, turnover, motivation,* and *satisfaction*. Searches included the ProQuest, ERIC, EBSCOHOST, and SAGE databases. Google Scholar was also leveraged to search for information. Sources of information included peer-reviewed journal articles, books, government statistics, theses and dissertations. Over 250 sources, dating from the 1950s to the present, were identified with relevant material. The majority were published within the last 5 years. Sources cited before 1970 are considered seminal works.

Older sources were included to provide the reader a perspective of the longevity and history of the topic. RefWorks was leveraged to help identify duplicate material. A subset of

the sources retrieved, as listed in the references section of this dissertation, was identified as the most relevant sources for this study and provide the foundation of the literature review.

History on Barriers for Women in STEM

Many examples of barriers for women in STEM in the literature exist, some consistently cited over time. Some barriers cited more recently have emphasized primary contributors to women leaving careers STEM fields permanently. Some barriers apply to STEM fields in general, for both men and women. For example, trying to keep skills sharpened to stay current with the high pace of technology change is a barrier for anyone in STEM professions (Hira, 2010). Another general barrier is the evolution of business models, including downsizing and outsourcing, to stay competitive in a global business environment for women in STEM professions (Hira, 2010; Preston, 2004; Rhea, 1996). These types of barriers are arguably barriers for many professions. Women in STEM professions seemingly face much more over their academic and industry careers.

The most commonly cited barriers include workplace recognition barriers (Glass & Minnotte, 2010; Lincoln et al., 2012; Thilmany, 2010); workplace culture barriers (Beddoes & Borrego, 2011; Bystydzienski & Bird, 2006; Cheryan, 2012; Deemer, Thoman, Chase, & Smith, 2014; Glass & Minnotte, 2010; Kerr et al., 2012; Leslie, McClure, & Oaxaca, 1998; Lincoln et al., 2012; Malcolm & Malcolm, 2011; Marques, 2011; McLaren, 2009; Powell, 1992; Thilmany, 2008; Washburn, 2007); self-efficacy barriers (Cordero et al., 2010; Deemer et al., 2014; Jones, Paretti, Hein, & Knott (2010); Leslie et al., 1998); career fit (Barber, 1995; Giles et al. 2009; Preston, 2004); and social system bias (Barber, 1995; Matusovich et al. 2010). Many of these barriers are rooted in early stereotypes (Ambrose, Dunkle, Lazarus,

Nair, & Harkus, 1997). While modern legislation has helped facilitate some positive changes, these barriers still exist in the workplace (Etzkowitz, 2008).

Early Stereotypes

In the early 19th century, science fields had a hierarchy: white men were at the top, then white women, followed by other races and ethnicities at the bottom (Ambrose et al., 1997). When the 20th century brought more military-related demands for engineering and technology professionals, white men were still positioned at the top of this hierarchy (Ambrose et al., 1997). Today, some progress was made for equal rights for women and other minorities in the workforce during the civil rights movement. Over 200 years of cultural stigma in scientific professions has not gone away completely, and the remnants of this archaic way of looking at the capabilities of men versus women remain woven into the fabric of workplace cultures.

Doors Opened by Equal Rights Legislation

The Civil Rights Act of 1964 and the enactment of Title IX in 1972 fostered notable differences in the workforce (Etzkowitz, 2008). The Civil Rights Act of 1964 prohibits discrimination on the basis of race, color, religion, sex or national origin. Title IX in 1972 protects from discrimination based on sex in education programs and activities that receive federal assistance (U.S. Department of Labor Report, 2011). Women's attendance at the college level increased steadily since the early 1970s, in no small part to this legislation. Today, more than half of the students enrolled in U.S. colleges are women (Morganson et al., 2010).

While Title IX certainly helped to break down some barriers, many of the same barriers may still exist. In the 110thth Congress in 2007, both the U.S. House of

Representatives and Senate signed resolutions to celebrate Title IX, reinforcing the need to uphold it (Congressional Record Daily 110thth Congress, 2007). The House resolution stated that a need remains to bring visibility to Title IX, because women continue to earn less for work than men with the same educational background, and girls face substantial barriers in pursuing high-STEM fields.

Workplace Recognition Barriers

The Matilda Effect, The Matthew Effect, and The Athena Factors include the description of overt and covert discrimination towards women in STEM fields. The Matilda Effect is the under-recognition of women in science with the same credentials as their male peers (Lincoln et al., 2012). The Matthew Effect referred to male over-recognition in science fields or enhancing an already large reputation for a male in science through repeated reference of their work, for example (Lincoln et al., 2012). The Athena Factor was comprised of 5 *antigens* found in private industry following a study called the Athena Project that identified challenges for women in reaching higher levels of management (Thilmany, 2010). Studies found that women remained in STEM fields feel like *tokens of diversity* in their positions or are *ghettoize*, meaning they reach leadership levels, but have the least perceived importance or rank on the leadership team (Glass & Minnotte, 2010; Lincoln et al., 2012).

Workplace Culture Barriers

A heavy emphasis on the challenges for women in the masculine cultures rooted in STEM fields exists (Beddoes & Borrego, 2011; Espinosa, 2011; Gilbert, 2009; Glass & Minnotte, 2010; Johns, 2008; Kerr et al., 2012; Servon & Visser, 2011; Washburn, 2007). One of the challenges that this culture perpetuated for women is the lack of access to

information and invitations into informal networks in the workplace (Glass & Minnotte, 2010; Kerr et al., 2012). The implicit biases and the stereotypes projected on women stemming and fostered by this masculine culture continued to reduce opportunities for women in STEM and create a hostile environment for those motivated to stay long-term (Beddoes & Borrego, 2011; Bystydzienski & Bird, 2006; Cheryan, 2012; Deemer et al., 2014; Glass & Minnotte, 2010; Kerr et al., 2012; Leslie et al., 1998; Lincoln et al., 2012; Malcolm & Malcolm, 2011; Marques, 2011; McLaren, 2009; Powell, 1992; Thilmany, 2008; Washburn, 2007).

Self-Efficacy Barriers

One factor related to recruiting women in STEM and their persistence through the university years is low self-efficacy compared to their male peers (Deemer et al., 2014; Leslie et al., 1998). Self-efficacy is specific to a capability, unlike self-esteem more associated with feelings of self-worth. Having math self-efficacy is particularly helpful for women pursuing STEM careers (Cordero et al., 2010). Jones et al. (2010) found that men had higher competency or self-efficacy beliefs than women.

Career Fit

Another barrier cited as contributing to women leaving early in their professional careers is career fit (Preston, 2004). Giles et al. (2009) found that *interest in the topic* was critical to success for women in science and engineering. It seems imperative that the recruitment of women in STEM therefore is not done so blindly, but for consideration of intrinsic factors that motivate an individual and lead to a good career fit. However it is important to acknowledge that although the ideal state may be that women and men choose

careers based on interest, societal factors remain or exist that strongly influence these interests, starting from childhood (Barber, 1995).

Social System Bias Barriers

Matusovich et al. (2010) emphasized the social system of peers, faculty members, and family support as part of the equation in increasing the potential for persisting and achieving a degree. The U.S. society is image-driven and filled with gender stereotypes (Matusovich et al., 2010). Many existing government-sponsored programs exist that try to expose young girls and women to STEM fields deliberately, to overcome some of these societal barriers (Matusovich et al., 2010). Unfortunately, these programs may do women a disservice in some ways, because they may lure young girls and young women into a fantasy (Matusovich et al., 2010). These programs somewhat deceptively leave out the details of the known challenges they would encounter in the androcentric culture of the STEM workplace, where gender stereotypes are magnified (Matusovich et. al, 2010). In the absence of corrections to the current gender stereotypes and masculine culture, women who enter STEM professions will likely have to assimilate and, over time, will potentially lose part of their identities (Barber, 1995).

Additional Barriers for Women in Non-linear Careers

STEM work cultures have been particularly inflexible to anything that does not fit into the traditionally long work weeks heralded in these professions (Tomlinson, Olsen, Neff, Purdam, & Mehta, 2005). Non-linear careers are a risk to achieving one's goals, which can be another threat to positive self-efficacy (Schilling, 20012). Overcompensating further, women returning to work in science and technology fields underutilize their training when seeking jobs to re-enter the workforce (Tomlinson et al., 2005).

The wage gap for men and women is an increased problem for those returning to careers. In 2010, 26.6% of women worked part-time compared to 13.4 % of men (U.S. Department of Labor Report, 2011). The earnings gap worsens for full-time working moms. Full-time working mothers in the U.S. earned 72% of what full-time working fathers did in 2010 (U.S. Department of Labor, 2011).

Thirty-seven percent of women and 43% percent of women with children leave their career at some point (Hewlett, 2007). When women do leave, over 93% want to return to their careers, but only 74% ultimately do and only about half of those women return to the workplace full-time (Hewlett, 2007). Those who return to work part-time instead of full-time, experience a 16% lower salary for the same type of job for working less hours (Tomlinson et al., 2005). Not surprisingly, the wage gap that starts in the beginning of one's career rises exponentially throughout, as percentage increases and bonuses are based on the compounding compensation increases. The U.S. Department of Labor's Report: *Women's Employment During the Recovery* (2011) provided some staggering projections on the wage gap effect over time. If, for example a man at age 25 earns $6,000 more annually than a woman at the same age, the earnings gap grows to $28,000 by age 35 and $379,000 by age 65. Wage inequity can be severe over the span of a career.

International Emphasis on STEM Professions

STEM government initiatives absorb a lot of attention, time, and tax-payer-funded resources. Hira (2010) argued that U.S. policy action addressing STEM field concerns have been too singularly focused, not allowing for the broader contributing factors and conflicts of interests that often result. Hira (2010) and Preston (2004) called for the U.S. government to mobilize for change. Other advanced western countries such as Australia, England, Sweden,

New Zealand, and Canada also have efforts to increase recruitment and retention of women in STEM (Giles et al., 2009; Preston, 2004).

These countries expanded their higher education systems in STEM at a time when the U.S. system struggled to expand (Giles et al., 2009; Varma & Freehill, 2010). Sweden is perhaps the most aggressive in their national policies in general, which require employers to balance the numbers of men and women in the workforce (Preston, 2004). Sweden's government also enforces what seems to be a progressive family-friendly workplace, requiring 12 months of maternity and paternity leave to be offered to employees, more than any other country (Preston, 2004).

China and India challenge all countries in another way. Their STEM related industries evolved as global leaders in high technology, manufacturing, and IT sectors respectively, claiming sections or whole parts of these industries once strongholds in the United States (Varma & Freehill, 2010).

The notion of a pipeline is referenced often in STEM literature (Espinosa, 2011; Glass & Minnotte, 2010; Lincoln et al., 2012; Servon &Visser, 2011). The phrase STEM pipeline described the journey of recruiting and retaining women in STEM fields starting with grammar school, to include efforts to expose young girls to STEM fields as potential career choices. The pipeline then moves to the university years and finally to the workplace. The leaky pipeline, a well documented phrase meant to represent the junctures, where the highest numbers of candidates moving through the pipeline drop out (Glass & Minnotte, 2010; Mavriplis et al., 2010; Servon & Visser, 2011). The logic of a pipeline concludes that increasing the amount of women recruited into STEM professions will result in more women receiving STEM field degrees and subsequently pursuing work in these fields (Lincoln et al.,

2012). The pipeline notion, however, has not been realized (Glass & Minnotte, 2010; Mavriplis et al., 2010; Servon & Visser, 2011).

STEM Workforce Outlook

STEM professions constitute a minority of the U.S. workforce with only 5% of U.S. workers participating in STEM professions (Lowell, 2010). The supply and demand of the STEM workforce shifted since the 1960s because of various factors such as globalization, worker attrition, and the rise of technology, but still remains a critical part of the U.S. competitive advantage (Giles et al., 2009; Hira, 2010; Jolly, 2009; Lowell, 2010; Preston, 2004; Varma & Freehill, 2010; Washburn, 2007).

General Population Workforce

The U.S. Bureau of Labor Statistics report, *Labor Force Projections to 2020: A More Slowly Growing Workplace*, indicated that the participation of women in the overall workforce was on a steep climb from the 1960s to the 1990s, increasing from approximately 37% participation to 57% participation, and peaking in 1999 at 60%. The percentage of women in the workforce has been declining since dropping to 58.6% (U.S. Bureau of Labor Statistics, 2008). Women 25-54 years of age saw a peak percentage of 76.7% in 2000, declining to 75.2% today (U.S. Bureau of Labor Statistics, 2008).

Male workforce participation has been on a continuously downward trend as well, since the 1960s, decreasing from 84% participation in 1960 to 71% today. Projections show a continuing decrease. Men 25-54 years of age have a workforce participation rate of 89.3%. Thus, for the prime-age men and women, women have almost 15% fewer participants in the workforce (U.S. Bureau of Labor Statistics, 2008). The number of women in the workforce is not expected to increase in the near-term projections. Although the gap between the

percentage of women and men in the overall workforce decreased, women continue to be underrepresented in the workforce.

STEM Workforce Supply and Demand

The number of STEM degrees and advanced degrees fluctuates. Although the number of STEM degrees awarded in the United States increased across the broad spectrum of STEM professions, there has been a decrease in the physical sciences and engineering and, more recently, in computer science (Varma & Freehill, 2010). The supply and demand for STEM professions changes over time, as new industries emerge and some older technologies and methods become obsolete (Rhea, 1996). The STEM workforce grew more than three times the rate of the overall U.S. workforce from 1950 to 2000 (Lowell, 2010). An alarming drop in the STEM workforce from 2000-2006 caught the attention of the highest office in the United States. The STEM workforce was a topic of interest in the George W. Bush presidency in the early 2000s, where President Bush launched several campaigns supporting STEM fields (Varma & Freehill, 2006). The interest continues into the Obama presidency. President Obama launched a campaign in 2009, *Educate to Innovate,* which calls for an expansion of STEM education and career opportunities for women interested in STEM careers.

One reason for this labor shortage in STEM professions is that men, who make up the bulk of staff in these professions historically, indicated a marked decline in pursuing STEM professions since the 1980s (Preston, 2004). Knowledge loss is a growing concern for the future of STEM professions, as the Baby Boomer generation reaches retirement age (Giles et al., 2009). It is estimated that the STEM workforce will have a 50% attrition rate between 2012 and 2017 (Washburn, 2007).

There were many other environmental factors contributing to drop in demand. One is that the U.S. United States became more service, and less, manufacturing focused. Computers went mainstream, creating other job specializations (Hira, 2010; Lowell, 2010). Globalization is also a key factor in supply and demand for STEM professions, providing a platform for engineering and science industries to move toward service industries (Jolly, 2009; Varma & Freehill, 2010). The United States, overall, did not retain its competitiveness in some of these industries.

Groups Studied in the Literature

The existing literature related to women in STEM professions largely focuses on four population groups: girls and boys of grade school and high school age; students studying STEM fields at the university level; STEM faculty; and STEM professionals in private industry (Ambrose et al., 1997; Cordero et al., 2010; Hewlett, 2007; Lee, 2012; Powell, 1992). Only women in the workplace will be interviewed for this study. The literature review largely focuses on students studying STEM fields at the university level, STEM faculty, and STEM professionals in private industry as these groups are most relevant to the STEM workplace experience.

University Students Studying in STEM fields

Studies related to students in STEM professions clarified that, based on math testing scores, women and men have an equal academic chance at succeeding in STEM professions (Cordero et al., 2010). Despite the testing scores, self-efficacy in math and science is higher for men than women (Cordero et al., 2010). Since self-persuasion in belief perseverance affects self-efficacy, women in STEM fields would benefit from external positive influences such as mentors and social networks that help persuade them to believe in their capabilities

(Cordero et al., 2010). Lee (2012) explored what factors influence choices in education and career paths using stereotypical images of STEM career settings. Women's motivation in this study was not affected by the stereotypical male images (Lee, 2012). The study participants in Cordero et al. (2010) and Lee (2012) were students.

Faculty Specializing in STEM

Some studies exist that largely consist of women in academic STEM fields (Ambrose et al., 1992). Common themes for these women contributing to staying in the profession were personal influences in their lives such as family members and a genuine interest in their field of study (Ambrose et al., 1992). Other themes contributing to their success were a) mentors, b) professional networks, c) having a hobby or an outlet outside of work, and for some, d) the supportive environment that all-female schools provided. Discrimination was a common obstacle (Ambrose et al., 1992). This study was conducted in 1992. Because it is highly probable that that academic and working environment in 1992 was a different environment than when this dissertation was published, the studies are not duplicative.

Professionals in STEM Industries

Studies on professional women in STEM included executive level women and also for the engineering profession. Powell (1992) cited two primary strategies for executive level women: impression management (acting like a man) and finding a pocket of sanity (finding a place they could be themselves while assimilating to the norms of the profession). Marques (2011) cited strategies for high-achieving women such as over-delivering, taking stretch assignments, and establishing a reputation of competence. Marques' study focused on women in engineering only. A high-level of competence in technical acumen is very important to move into higher level positions (Marques, 2011; Powell, 1992). The participants in Powell (1992) and Marques (2011) were all upper level, executive

management, where the study for this dissertation research includes women in STEM at any level of the organization. It is important to understand what motivates women in STEM at any level in the organization, particularly in lower management levels, as not every person defines career success as achieving a position in the C-suite and, conversely, organizations require engaged employees at every level of the organization in order to be most profitable.

Some studies focused on a specific STEM profession. Themes that were factors in one study that addressed women in engineering persisting included a) coping skills for workplace inequities and workplace culture, b) support from family, c) having a personal interest in engineering work, and d) taking advantage of family-friendly workplace policies (Fouad, Fitzpatrick, & Liu, 2011). Those that persisted said that they did make compromises in career advancements, especially management opportunities, to take care of their families. Fouad, Fitzpatrick, and Liu (2011) focused on engineering only. All of the above studies in this section either focused on women at senior levels or in a single STEM profession. This current dissertation research focused on women in STEM at any level of the organization and across all STEM professions.

Extrinsic Considerations in Removing Barriers for Women in STEM

Society

Societal shifts in how STEM professionals are perceived could help minimize bias in the STEM workplace. Beddoes and Borrego (2011) suggested that future research on science and engineering fields should include gender theories which may help to deconstruct the masculine culture and the stereotypes that are an integral part of the science and engineering professions cultures. Washburn (2007) suggested that using the media to promote expanded

interests in STEM careers could help broaden the views of these professions and create more social support for individuals in them.

The U.S. government is in the best position to shift policies and other variables in the overall STEM system in the United States (Hira, 2010). Instead, the U.S. government has a tendency to address only a very small part of the problem (Hira, 2010). The U.S. federal government's enactment of both the Civil Rights Act of 1964 and Title IX in 1972 helped minimize overt sexism, as previously noted. One of the overt discrimination barriers still documented in literature is wage inequity (Barber, 1995; Brawner et al., 2012). Barber (1995) and Brawner et al. (2012) suggested that a U.S. federal tax incentive may help remove wage discrimination in private industry.

The U.S. Federal government's Office of Federal Contract Compliance Programs (OFCCP) established federal wage compliance to ensure that equal pay acts were instituted in the government (U.S. Department of Labor, 2011). U.S. taxpayers fund 200 new compliance officers in the U.S. federal government to review compensation fairness in the federal government and provide recommendations to resolve any cases uncovered (U.S. Department of Labor, 2011). The government has not committed to leveraging these 200 new compliance officers to take on the role of compliance for private industry (U.S. Department of Labor, 2011). Equal pay then, for women in the private sector, is either up to industry to become fair and more transparent in compensation or up to women themselves to stand up for themselves.

Government, industry, and society in general have a role in improving environments for sex-segregated occupations (McIlwee & Robinson, 1992). The concepts of strengthening Affirmative Action, redefining work-family relationships, and changing power relations

focus require more change (McIlwee & Robinson, 1992). Changes require not just improvements, but changing the game entirely for women in STEM professions, largely by reinvigorating the feminist movement in the modern day context (McIlwee & Robinson, 1992).

Industry

Industry has the longest list of improvements proposed in the literature. Two solutions to help overcome barriers, instituting mentoring programs and better work-life balance policies, have been part of the checklist of improvements for decades (Glass & Minnotte, 2010; Kerr et al., 2012; Marques, 2011; McLaren, 2009; Powell, 1992; Preston, 2004). No documented evidence exists in the literature reviewed on this topic to prove that mentoring or plans to improve work-life balance have been of value in keeping women in STEM fields, although many women in studies cite mentoring has helping them in their professional lives (Glass & Minnotte, 2010; Kerr et al., 2012; Marques, 2011; McLaren, 2009; Powell, 1992; Preston, 2004).

With regard to work-life balance policies that offer flexible hours, workplace cultures have to have the stigma against flexible arrangements removed before any policies have a chance at being successful (Hewlett, 2007). Some more progressive workplace policies that acknowledge instituting more equity, include more targeted career development for women and leadership development for the managers that work for them (McLaren, 2009). The latter would be a victory for women in STEM, as it moves away from the 'blame the victim' tactics that are often a part of proposed solutions.

Diversity programs have increasingly been introduced in the workplace and have been expected to have a positive effect on STEM fields, potentially providing a platform to

address the underlying problems of stereotypes and implicit bias in the workplace (Barber, 1995; Beasely & Fisher, 2012; Ibison & Bailey, 2009; Servon & Visser, 2011). If companies plan to attract the best combination of talent, they arguably should recruit and retain a diverse workforce (Ibison & Baily, 2009). Having more women in the STEM workforce will potentially help prevent other women from leaving and may increase the number of women in STEM professions over time (Drury, Siy, & Cheryan, 2011).

Heilbronner (2013) highlighted that motivational behaviors include the influence by both internal and external factors. While the environment where one works is important, an individual's self-efficacy is also important (Heilbronner, 2013). The focus on the individual is important to consider in motivation for organizations. If organizations focused only on improving or changing the extrinsic factors, they would miss the importance of individual differences, and the personalities and their values that contribute to them (Furnham et al., 2009).

Intrinsic Considerations for Overcoming Barriers

STEM fields will continue to work within male-dominated work environments for the foreseeable future. The extrinsic barriers will not go away overnight. Some scholars acknowledged this, suggesting that in addition to participating in the workplace solutions, women could work on a few personal skills to help them survive and persist in STEM fields (Kerr et al., 2012; Khanin, Turel, & Mahto, 2012; Morganson et al., 2010).

Developing good coping skills for job stressors is one suggestion (Morganson et al., 2010). Coping skills are good skills for anyone to have, in any career. Coping mechanisms help employees stay, and are useful to develop as a transportable skill (Kerr et al., 2012; Khanin, Turel, & Mahto, 2012; Morganson et al., 2010). Kerr et al. (2012) argued that

perceived status or power in any environment can be a motivator or de-motivator to persist, as the psychology of a person's perceived status may or may not help those overcome barriers or stressors.

Other strategies proposed by Marques (2011) included emphasis on over-delivering, building a reputation for being competent and assertive, and having a career development plan that those in positions to help you get there know about. Part of maintaining competence is to maintain currency with industry knowledge and skills, either through internal or external courses or industry conferences (Preston, 2004). Maintaining a level of current industry knowledge helps scientists and engineers continue to develop the skills required to stay current and maintain professional licenses (Preston, 2004).

Knowing oneself and one's values is another suggestion, helping to ensure that the STEM fields are a good fit for an individual from the onset. Matusovich et al. (2010) concluded that college students who persisted simply had strong interest in engineering itself, whereas those that had entered engineering because of an outside influence or because of simply being good at math were less likely to persist. Matusovich et al. (2010) suggested that if a person has a strong interest in engineering, they will have a higher rate of persisting, despite challenges. Jones et al. (2010) emphasized that these interests are better predictors of persistence than competency beliefs.

Employee Motivation, Retention, and Turnover

Motivation for Individuals

Human behavior and motivation theories have been emerging for centuries (Locke, 1976; Nebel, 1978; Steers et al., 2004). Freud (1927) explained motivation through instinct theory, suggesting that unconscious thought, or instincts, motivated behavior (as cited in

Nebel, 1978). Philosophers such as Locke (1789), Mill (1869), and Bentham (1689) all developed theories that are in some way grounded in the principle that human beings seek a balance of experiencing more pleasure than pain (Nebel, 1978; Steers et al., 2004). Psychologists Thorndike, Woodworth, and Hull (1943) later developed drive theories, which suggested the motivation of humans was based on their past experiences (Steers et al., 2004). Later, cognitive theories emerged, focused on an individual's expectation of future events (Nebel, 1978).

Motivation in Groups

A major influencer in industrial psychology and understanding group motivation was Elton Mayo, who performed the Hawthorne studies from 1927 to 1932 (Robbins & Judge, 2009). One of the significant discoveries in the Hawthorne studies was the increased motivation and productivity of a small group of women, sectioned from the rest of the group and made to feel as if they were elite, compared to the other workers (Robbins & Judge, 2009). Notably, women were absent less for sickness and personal reasons in this perceived elite group (Robbins & Judge, 2009).

Another discovery was that group norms, established informally by the group and not by any other sets of controls, drove performance motivation (Robbins & Judge, 2009). The Hawthorne Studies previously verified the significance of social factors in workers' level of satisfaction, and that social norms of efficiency had a more significant effect than capability (Etzioni, 1964). Communications across the hierarchy, particularly in attending to the social needs of the worker, are also an important factor in employee motivation (Etzioni, 1964).

Katz and Kahn (1966) cautioned that organizational approaches to management should not completely reject the concept of formal structure for an organization. Referred to

as the *structuralist approach*, with roots in the structure-conduct-performance paradigm, a synchronized effort to ensure that individuals and organizations are in sync with each other is also important (Etzioni, 1964). Latham (2009) suggested that increasing job satisfaction is an outcome of good job performance. Regardless of organizational structure, minimizing dissatisfaction across the group is a key to organizational motivation and performance (Etzioni, 1964).

Contemporary Workplace Motivation Theories

Herzberg's (1959) work in two-factor theory motivation suggested that there are extrinsic and intrinsic factors related to job satisfaction and motivation respectively (as cited in Furnham et al., 2009). The extrinsic factors include *hygiene factors* such as salary, working conditions, and relationships with other employees (Furham et al., 2009). The intrinsic factors or 'motivators' relate to the individual's job such as achievement, development, and recognition (Furham et al., 2009). Despite the importance of money in jobs, money can feel controlling rather than a reward, particularly if not tied to performance (Latham, 2009).

Expectancy-value theory was proposed during the 1970s, but remains relevant in the modern workplace. The theory indicated that competency beliefs and values are drivers to making choices to engage in activities (Jones et al., 2010; Matusovich et al., 2010). People internalize the question of their ability and desire to participate (Jones et al., 2010; Matusovich et al., 2010).

Equity theory, which suggests that individuals compare their rewards with others and seek to eliminate the inequities, is another contemporary theory (Robbins & Judge, 2009). Equity theory contends that individuals will compare to others, both inside and outside of

their companies (Robbins & Judge, 2009). Through this comparison, they assess the fairness of their current state (Robbins & Judge, 2009).

Reinforcement theory, alternatively, is based in behavioristic theory (Robbins & Judge, 2009). Reinforcement theory suggests that the environment, not the individual, has the most influence in employee motivation (Robbins & Judge, 2009). An individual will repeat behaviors that are positive for them (Robbins & Judge, 2009).

Goal-setting theory, based on setting a goal, or a challenge, and performance feedback, complements self-efficacy theory, because goal-setting theory is instrumental in helping individuals set and reach goals. Self-efficacy is elevated, assuming the performance feedback is positive (Robbins & Judge, 2009). Goal-setting, especially setting specific goals, is important in terms of employee motivation (Latham, 2009).

Latham (2009) cautioned, however, to understand the balance between ability and motivation in expecting outcomes. "Performance is the product of ability and motivation" (Latham. 2009, p. 49). Latham suggested that although motivation and ability link to performance, a person has to have at least some ability to move forward with a task before he or she can be completely motivated to reach certain goals. Alternatively, if an individual realizes he or she has the ability to do something well, they are more apt to continue doing it (Latham, 2009).

Maslow's (1964) book, *Motivation and Personality*, suggested that the binding principle for human motivation is the higher motive emerges once the lower needs have been gratified. Self-actualization is "the ongoing actualization of potentials, capacities, and talents, as fulfillment of a mission, as a fuller knowledge of, and acceptance of, the person's own intrinsic nature, and as an unceasing trend toward unity, integration or synergy within

the person" (Maslow, 1964, p. 25). People have to first satisfy the needs of physiological, safety, belonging, and self-esteem before reaching self-actualization (Maslow, 1964). Maslow described growth as a "rewarding and exciting process, where the fulfillment of yearnings and ambitions is whetted by, rather than gratified by the experience" (p. 30). The growth process for someone primarily motivated by self-actualization is continuous.

It is important to understand that the first four layers of physiological, safety, belonging, and self-esteem can only be satisfied with considerable influence and in some cases, even dependence from others (Maslow, 1964). Latham (2009) brought a modern view on Maslow's Hierarchy of Needs and the links to the workplace, focusing on the link to employee performance and growth. There are needs that must be met in a certain order, to deliver the highest performance outcome: a) physiological (food, water, shelter), b) security (insurances), c) belonging (feeling like part of something, acceptance by a team), d) self-esteem (confidence, respect for and respected by), e) self-actualization (desire to feel fulfilled, to maximize potential) (Latham, 2009). Latham (2009) offered some ways employers can contribute to helping employees meet Maslow's Hierarchy of Needs, such as providing access to healthy food, helping ensure employees know the expectations related to keeping their job, team-building, praise for good work, and helping employees explore how to grow professionally.

Motivation of Women in the Workplace

Balancing career success with decisions to delay building a family are real issues confronting women, and upward mobility comes at a cost, for some, such as having a partner or having children (Smith et al., 2012). The desire to be the ideal mother, ideal wife, and ideal professional perpetuates a feeling of failure for some highly-educated career women as they struggle to balance being everything to everyone (Pas et al., 2014). Women internalize

all of these roles, and in trying to gain approval from society, the workplace, and their private social circle, they place a demand of energy on themselves that has proven difficult to sustain (Pas et al., 2014). Smith et al. (2012) suggested that the workplace should accept that society still places the primary responsibility of parenting and home responsibilities on women and advocated not necessarily for equality for women in the workplace, but equity for women in the workplace. Creating a fair workplace that takes into consideration the pressures on women, is what is important if organizations are going to engage women long-term.

Pas et al. (2014) suggested that highly-educated career women should not be mislabeled as less motivated to advance in their careers simply because they are also balancing a family. Perhaps a women's personal definition of advancing in her career is different from the traditional, male-shaped rise through the hierarchy view. London (1983) discussed three dimensions of career motivation: career centrality, career insight, and career ambition.

Pas et al. (2014) summarized these definitions as follows: "Career centrality is the importance of a career in one's life, career insight is the degree to which one makes strategic plans to obtain career goals, (and) career ambition is the will to achieve a higher position in the field" (p. 9). The definition of career success, from an organizational and societal perspective, is often a combination of career insight and career ambition (Pas et al., 2014). The individual, then, is left to balance career centrality based on their personal situation, which, more often than not, changes over time (Pas et al., 2014). All three are factors in motivation. Career success for the organization and career success for the individual are defined differently by both parties. How best to motivate and retain employees is not a *one-size-fits-all* task.

Retention

Retention closely links to job satisfaction. Noe et al. (2010) suggested that values and perception are important factors in job satisfaction, emphasizing that job satisfaction is unique to each individual. Everyone is different. While customizing the workplace to meet the ideals of every individual is probably not practical, understanding what is important to individuals, or groups of individuals that share similar values, may help companies motivate and retain talented employees.

For example, life events and personal desires may outweigh professional advancement at a given time in an individual's lifespan. Being employed in an interesting job may be important to the individual, but advancement may not be. This strategy goes against the typical hierarchical progression that is assumed in some motivation and retention policies. Another way of viewing company policies on career paths may be to view rewards based on an individual's value to the company. If employability is more important to the individual than career advancement, and the individual's skills are valuable to the company, exposure to other roles within the company may be a win for the worker and for the company in retaining key talent (Sullivan & Baruch, 2009). In time, these types of retention practices may also change the cultural perception that motivation directly relates to a linear trajectory up the company hierarchy.

Noe et al. (2010) proposed that while not unique to individuals, there are several practices that may help improve working conditions in general, and provide a satisfactory environment. An employee's identification with a job is a contributor to motivation, and a sense of belonging is a contributor to identifying with a job (Katz & Kahn, 1966). Katz and Kahn (1966) noted that an individual's sense of belonging to a group and a sense of being

important to the organization resulted in decreased turnover and absenteeism. Workplace safety, personality fit, task complexity, management support, organizational culture, compensation and benefits are all important factors in employee retention (Noe et al., 2010). When employees are dissatisfied with these factors, they often leave. Turnover is the term used to describe employee voluntary exits from a company.

Katz and Kahn (1966) noted that rewards are motivational only if they link to the desired behaviors, resulting in an individual's desire to continue increasing performance. Random rewards are received more positively by employees, particularly more experienced employees who tend to show more satisfaction when rewards are granted on an intermittent schedule (Latham, 2009). Rewards for system benefits given collectively and rewards for individuals are different, received with different levels of appreciation depending on the individual's needs (Katz & Kahn, 1966). System benefits include salary, health benefits, and cost of living increases (Katz & Kahn, 1966). Individual benefits, such as bonuses or promotions, are based on individual merit (Katz & Kahn, 1966).

These benefits do not necessarily have to be in the form of money. Social rewards, for example a higher title or a bigger office, are just as important in some respects than simply pay itself (Etzioni, 1964). Friedman and Lackey (1991) emphasized that extrinsic rewards importance to the worker such as perks, prizes, and bonuses are often inflated and suggested that incentives that increase a worker's control over their lives, such as time off or flex-time arrangement, contribute far more to worker satisfaction.

Flex-time, or flexible work policies aid workers in achieving work-life balance. These policies may include flexible working hours, paid leave for family or personal matters, working from home (telecommuting), or other similar practices. Exercising a flexible work

policy is often at the approval of an individual's manager, leaving workers subject to the social expectations of the manager they work for, which often times leaves the worker with very little flexibility (Gill, 2012).

No industry-wide evidence exists that flexible work policies help retain women in STEM professions, although some companies with flexible work policies have been highlighted as good places to work in general. In April 2013, a Catalyst research center interviewed 726 MBA graduates, both men and women, from 20 Fortune 500 companies to determine the importance of flexible work arrangements for high potentials in the workplace (Catalyst, 2013). Flexible work arrangements are more valued by women than men according to the study conclusions (Catalyst, 2013).

One particularly attractive flexible work policy for women is telecommuting (Catalyst, 2013). Women are almost twice as likely as men to use telecommuting during their careers (Catalyst, 2013). The women who do opt to telecommute often consciously downsize their aspirations in the workplace because although their work policy may document telecommuting as an acceptable way of working, men and women who telecommute are not typically rewarded equally when compared with those who work a traditional work week at the office (Catalyst, 2013).

External social support, for families with two full-time working professionals, also seems critical to career longevity and work-life balance (Baumgartner & Scheinder, 2010). The correlation between external support, work-life balance, and career longevity could prove important, as high levels of organizational commitment have been linked to women who also have high levels of social support (Baumgartner & Scheinder, 2010).

Turnover

Lambert and Hogan (2009) suggested that the work environment is very important in shaping people's job satisfaction and organizational commitment. Baumgartner and Schneider (2010) noted that although women progress professionally at the lower levels within an organization, progress becomes somewhat halted at the upper levels, in turn, increasing turnover. Understanding what factors contribute to voluntary turnover in the workforce, and more specifically, in the female workforce, is important background for this dissertation study.

There are two types of turnover, voluntary turnover and involuntary turnover. Both are important to business because they cost companies money. There are many causes of voluntary turnover, both external and internal to organizations. External factors may include, for example, a growing economy where the availability of jobs is high or increasing, a change in personal circumstance, relocation, and many others. Internal factors closely link to job satisfaction attributes such as reward and recognition (Furnham, et al., 2009; Lee, 2012).

Most employers actively manage ways to help prevent turnover because turnover has direct and indirect costs to business (Lambert & Hogan, 2009). Direct costs include recruiting, testing, training, and costs to backfill positions with temporary staff or overtime (Lambert & Hogan, 2009). Knowledge loss, inexperienced staff, and sometimes decreased morale are some of the indirect costs common to and associated with turnover (Lambert & Hogan, 2009). Age is also a factor in turnover, especially in STEM professions, as many STEM workers feel age discrimination is practiced in these professions and is a very real deterrent to staying long-term (Hira, 2010). Turnover rates are higher for women, especially in the earlier stages of their careers (Lee, 2012). However, the differences as to why men and

women leave the workplace are not substantially different, although women are more likely than men to leave their jobs for family-related reasons (Lambert & Hogan, 2009; Lee, 2012).

Turnover intent closely associates with the level of interest in one's career (Morganson et al., 2010). There is a paradox related to women's satisfaction in the workplace. Women consistently show higher job satisfaction than men overall, yet also have increased voluntary turnover rates (Lee, 2012). Lee also noted that higher women turnover rates may be a root cause of inequities of the workplace, as the biases related to the value of investing in women become self-fulfilling. Lee also suggested that higher satisfaction rates could merely be a consequence mirroring the fact that the proportions of women that do stay are satisfied.

Barclay, Stoltz, and Chung (2011) proposed that job insecurity and workplace bullying are social factors that contribute to a worker's motivation for voluntary turnover. Barclay et al. also cited factors that link to attitude and perceived control. Barclay et al. suggested factors such as a worker feeling a lack of identity with the career they are presently in, and having the confidence to explore a different career that better fits their present interests and life responsibilities contribute to motivation.

Latham (2009) noted the importance of minimizing demotivation by ensuring people feel fairly treated in the workplace. It is a mistake for organizations to assume that removing a symptom, rather than a cause of a de-motivator, will help, as if the cause persists, another symptom will surface (McClelland, 1984). When people feel like they have been treated unfairly, they begin to have a lack of trust in their workplace (Latham, 2009). Organizations can create trust by being transparent about the distribution of wages, applying company policies consistently, and taking into account employee feedback (Latham, 2009).

The psychological contract between an employee and the workplace takes into account very basic human needs and desires such as being treated with dignity and offering growth (Latham, 2009). Breaking this contract can be extremely demotivating because of the impact of distrust and violating the basic psychological contract, most likely ending in an employee's decision to leave the company (Latham, 2009). Latham (2009) emphasized that keeping psychological contracts with employees was critical to minimizing employee turnover.

Summary

Addressing barriers in STEM professions is clearly still an area of opportunity for research. The problems facing women in STEM fields are certainly bigger than any one person, institution, or company. U.S. Federal legislation helped progress equality in education and in the workforce. STEM professions benefit from these laws as they help open doors to male-dominated environments. It is what happens once women are in the STEM university and workplace environment that remains troublesome.

Many government-sponsored studies have been conducted on attracting girls and young women into STEM professions and the University environment. Today, women represent more than half of the college population and entry of women into the university system is increasing, the percentage of women in STEM professions in the workplace remains small compared to their male counterparts. Non-profits, businesses, and universities have further explored why women leave STEM professions. Over the past 15-20 years, there is a marked shift in the literature, emphasizing the responsibility of private industry to address the deeply rooted cultural and structural barriers to women in STEM fields. The workplace is keen to advertise equal opportunities, flexibility workplace policies and

environments that welcome diversity and inclusion, but the application of these programs seems inconsistent at best for women in STEM professions.

The barriers for women in STEM seem fairly consistent over time, with new barriers being added as societal norms seemingly are outpaced by the growth of women in the workplace. Discovering new insights into overcoming these barriers for the women working in STEM is important in addressing retention and motivation and reducing turnover. Arguably, the current workplace motivation models do not address the problems for women in STEM professions, as no evidence exists that any model has addressed how to effectively keep women from leaving STEM professions.

The vast majority of the limited amount of published works related to women who are staying in STEM is over 25 years old. The topics covered in the overall body of knowledge in the published literature addresses what keeps women from pursuing and staying in STEM professions. This study is an opportunity to fill the knowledge void that exists today regarding what motivates women to stay in STEM professions. Using the methods described in Chapter III, this study sought to discover a theory and develop a model related to the motivation of women in STEM professions.

CHAPTER III: METHODS & RATIONALE

The purpose of this chapter is to introduce the research methodology for this qualitative grounded theory study regarding what motivates women to stay in or return to STEM professions long-term. The applicability of grounded theory and a constructivist approach for this study are discussed. The research plan, including the methodology, study participants, procedures followed and analysis method, are also primary components of this chapter. Grounded theory methodology tends to be fluid, as some components of the study, such as the interview questions, may be altered during the study (Birks & Mills, 2011). Trustworthiness and ethics are also highlighted as key principles of this research study.

Research Questions

This study sought to build a theory in answer to the research questions: (R1) *What motivates women in STEM professions to stay in their profession long term?* and (R2) *What motivates women with non-linear careers in STEM professions to return to their profession after at least a 6 month break from their profession?* Glaser and Strauss (1967) discussed the emergence of theory throughout the research process. The researcher remained the same throughout this research study.

Methodology Selected

When seeking an explanation of a phenomenon by relying on the perception of a person's experience in a given situation, a qualitative study is applicable (Stake, 2010). This qualitative study was performed using grounded theory methodology. "Grounded theory is a respected qualitative way of moving from individual knowledge to collective knowledge" (Stake, 2010, p. 17). Introduced to the research community in the 1960s, grounded theory is "the discovery of theory from data" (Glaser & Strauss, 1967, p. 1). Glaser and Straus (1967)

created a methodology where theory could emerge by methodically coding interviews with terms that succinctly and conceptually summarized each phrase, line, or even word.

Grounded Theory Methodology

Charmaz (2006) explained that "grounded theory contains both positivist and constructivist inclinations" (p. 127). Birks and Mills (2011) and Charmaz described the positivist philosophical position as a view that comes from the human experience with complete objectivity, understanding a human's perception is imperfect. Birks and Mills and Charmaz described the constructivist philosophical position as a view that comes from the human experience relative to their paradigm, influenced by society, culture, or other external influences.

The way which the research methodology is designed depends on the researcher's philosophical position (Urquart, 2013). The philosophy epistemology connects to how the researcher assumes the knowledge for theory building will be obtained (Birks & Mills, 2011; Charmaz, 2006; Urquart, 2013). "Critical researchers look at knowledge as grounded in social and historical practices" (Urquart, 2013, p. 59). Urquart (2013) provided a succinct summary of research philosophy epistemology as "positivist researchers work in a deductive way to discover unilateral, causal relationships and interpretive (constructivists) researchers study phenomena and aim to construct interpretations of practices and meanings" (p. 59). This study was conducted using grounded theory with a constructivist approach. Interpretive grounded theory, which the constructivist tradition is a part of, aims to: "conceptualize the studied phenomenon to understand it in abstract terms, articulate theoretical claims, acknowledge subjectivity in theorizing, and offer an imaginative interpretation" (Charmaz, 2006, p. 127). This research study sought to conceptualize the phenomenon of each

participant's experience, to understand in abstract terms built through coding the data from interviews, and build a theory based on the interpretation of the their shared experiences.

In this study using constructive grounded theory, emphasis was placed on a phenomenon and the reflective nature of the research as the theory evolves (Charmaz, 2006). Reflecting on the evolving theory throughout the research study was important in guiding changes in interview questions during the study to uncover more details of the theories that emerged. The researcher needed to be keenly aware of the subtleties in the data to uncover the distinct differences and similarities (Charmaz, 2006). The resulting theory is the researcher's interpretation of the data, consistent with constructivist grounded theory (Charmaz, 2006).

The Sage Handbook of Grounded Theory by Bryant and Charmaz (2007) formed the basis for this study, outlining the tenets of grounded theory methodology used in this research study. Bryant and Charmaz (2007) outlined tenets such as coding, generating memos, analyzing data as it is generated to build theory, selecting core categories from coding, and generating theory. Together, the procedural steps used in applied grounded theory methodology aided the researcher in continually seeing the data through a fresh lens to foster the potential for new theory to emerge from the data (Charmaz, 2006).

The Researcher

The researcher worked in engineering for 18 years and holds a Bachelor of Science in Civil Engineering and a Master of Science in Geotechnical Engineering. The researcher has interviewed multiple people with intent to hire during her career. The researcher's skills include training in listening skills as a part of corporate training and a qualitative research

course at the University of the Rockies. Since 2008, she has been responsible for corporate communications, supporting internal engagement and external awareness of key initiatives.

Study Participants

The sample was drawn from a population of women who studied a STEM field and have worked in science, technology, engineering, and math professions for at least 10 years in the United States. Women could be working full- or part-time. There was no age limitation. All participants had to be fluent in the English language, but English did not have to be their native language. Female professionals with a college level degree in science, computer science, engineering, math or related subject, who continued their careers in a related profession, were the target population to participate. Career examples included, but are not limited to, research, engineering, computer programming, physical sciences, life sciences and design.

Participants were recruited through the researcher's existing professional networks, the Association for Women in Computing (AWC), the Association for Women in Science (AWIS), the Association for Women in Mathematics (AWM), and the Society of Women Engineers (SWE). No participant had a direct relationship with the researcher that represented a conflict of interest, such as a reporting relationship, contract, or any relationship with the researcher that may have imparted bias on the research study. The researcher emailed contacts in her professional network using the Email to Potential Participants in Appendix A and asking for leads to women that fit the criteria. The researcher also contacted the AWC, the AWIS, AWM, and SWE via phone to request assistance from these organizations and permission to post the Email to Potential Participants in Appendix A on their website, within a blog, or other suggested mechanism for

communication to the association's members. AWC, AWIS, AWM and SWE all have long standing associations with women in STEM profession. SWE was founded in 1950 and AWC, AWIS and AWM were all founded in the 1970s. The researcher is not a member of nor actively involved in any of these associations.

The women were asked to respond to a brief demographic questionnaire, as shown in Appendix B, via email to help the researcher select participants and document the level of candidate diversity in the study. For the first group of interviews, four participants were selected based on the first three questions only. One of these four participants was a woman with a non-linear career. The participant sampling pool was limited to those participants solicited for this research as defined in this study. An informed consent form, as shown in Appendix C, was required for each participant prior to participating. The researcher anticipated approximately 12-20 participants for this study. The final number of participants was 20, as determined by saturation.

Data Collection

This study used an interviewing method, found in Appendix D, where both the interviewer and the interview questions were the instrumentation used. Memos were used to capture any research thoughts during and after each interview. All transcribed interviews and associated memos were uploaded to NVivo 10. The interviews began with open-ended questions about the participants' initial interest in STEM professions and their initial career interests in general. More intensive questions followed, with the intent to gather data with more depth on motivation (Charmaz, 2006). The interview concluded with more open-ended questions, framed to invite more depth regarding motivation of the participants to stay in a STEM profession.

Procedures Followed

Interviews were conducted over the telephone only. Both the researcher and the participant were in a separate, private room. As part of the interview introduction, the researcher confirmed that the participant was in a room with a closed door. The interviews were recorded electronically using a conference recording service and an Olympus WS-803 Voice Recorder™. The conference recording service signed a non-disclosure form, found in Appendix E, prior to recording any interviews. No interview was conducted without confirming the written and verbal informed consent of the participants. Each participant interview took place in a single interview session. Each interview was transcribed by professional transcriptionist. The transcriptionist signed a non-disclosure form, found in Appendix E, prior to transcribing the interviews.

Grounded theory allows for discovering the phenomenon during the research process (Charmaz, 2006). Since the theory or phenomenon emerges from the data, it is possible that some interview questions may be added, or that the proposed interview questions will be modified during the research study (Birks & Mills, 2011; Charmaz, 2006; Urquhart, 2013). As some initial themes surfaced during the first four interviews, or subsequent interviews, the researcher added clarifying questions or points to subsequent interviews in an effort to explore more on the topic or gap that emerged. Appendix B includes the additional questions added. Previous interviews were not re-conducted using the new clarifying questions or points.

The transcribed interviews were sent to the interviewees for review once. While each interviewee had the right to strike any interview content, this practice was not encouraged. The interviewee was also asked if there is anything she would like to add upon reflection.

Following the endorsement of the participant, edits were made as necessary to the transcription, including capturing any reflective thoughts following the interview. Participants were not part of the writing or editing of the actual analysis and results, as no one participant had access to any other interview. The participants were not equipped to provide any insight into how the group of individuals collectively may have similar or different perspectives.

In their seminal work, Glaser and Strauss (1967) discussed the concept of saturation, where the researcher starts to realize that for a given subject, no new categories emerge from the code; therefore nothing more to add to the emerging theories. It was possible that saturation could be reached during the interview process conducted as part of this research. Once saturation is reached, where no new data emerged, the theory or phenomenon is said to be grounded in the data (Charmaz, 2006; Urquhart, 2013). Saturation was reached in this study after the 20th interview.

Memo writing happened regularly throughout the study (Birks & Mills, 2011; Charmaz, 2006; Glaser & Strauss, 1967; Urquhart, 2013). Both memo writing and constant comparative analysis help minimize bias, because both activities are reflective, which aids objectivity throughout the study (Birks & Mills). Memos in particular serve to remind the researcher of his or her thoughts and help the researcher separate thoughts that the researcher might impose on the theory versus theory that emerges from the data (Birks & Mills, 2011). Memos included topics such as thoughts or concerns related to the study, interpretation of relevant books and papers, reflections on the quality of the process, and thoughts on emerging codes, categories, and the theories.

Data Analysis

Transcripts and coding included completion in the order of the interviews conducted; in batches of four at a time, allowing the researcher to reflect and edit the interview questions as theories began to emerge from the data. Coding was used to aid the researcher in understanding the perspectives of the participants and in analyzing their combined experiences. Codes were created during the research process, based on the data, for the purposes of analyzing the data (Urquhart, 2013). Coding was conducted both manually and using computer assisted qualitative data analysis software (CAQDAS).

Coding the transcriptions, or breaking them down into meaningful and manageable *chunks* of data, was a critical part of the data analysis. Coding used in grounded theory was instrumental in focusing the interview analysis on the experience of the participants in a structured way. Coding helped to prevent the interviewer overemphasizing the importance of any one aspect early in the study and helped ensure a thorough analysis of the entire interview (Charmaz, 2006; Stake, 2010).

The process of analyzing, reanalyzing, and comparing new data to existing data is known as constant comparison (Birks & Mills, 2011; Urquhart, 2013). As each phase of coding began, it was important to continue reviewing the data in previous phases so that connections were constantly being made until saturation occurred. Coding terminology used for this dissertation was adopted from Urquhart (2013) who terms the three coding phases open, selective, and theoretical.

Open Coding

Open coding is the phase when each line of transcribed interview text is coded line by line (Urquhart, 2013). Line-by-line coding is a critical part of grounded theory methods

(Birks & Mills, 2011; Charmaz, 2006; Glaser & Strauss, 1967; Urquhart, 2013). It is what its name reflects, where coding each line of the transcribed interviews by using a few words to describe the data, as suggested by Urquhart (2013), Birks and Mills (2011) and Charmaz (2006). This method of coding helped the researcher focus in-depth on every interview. This method also helped instill the discipline of grounded theory where the theory the emerged from the data itself. Coding line by line in open coding typically results in many codes (Birks & Mills, 2011; Urquhart, 2013).

Selective Coding

Selective coding begins to occur when there are no new open codes, or when codes relate only to the core categories that begin to emerge (Urquhart, 2013). In general, the terms *categories* and *constructs* are interchangeable across the grounded theory methods (Birks & Mills, 2011; Urquhart, 2013). Some selective codes may emerge more often than others. Sometimes a single selective code becomes a prominent theme, or a theoretical code (Birks & Mills, 2011; Urquhart, 2013).

In selective coding, the researcher strives to find categories emerging, but will hopefully not have as many selective codes as open codes. Urguhart (2013) suggested revisiting the selective code categories if too many selective codes emerged from the original coding. Reinforcing that coding is an iterative process, Urguhart suggested that the researcher review selective codes to see if selective code names best represent the open codes or selective codes identified. Urguhart also suggested that looking at the selective code attributes and potential relationships can help the researcher distinguish between open, selective, and theoretical codes.

Theoretical Coding

Division among grounded theorists exists regarding when exactly theoretical sampling begins. Charmaz (2006) asserted that theoretical sampling begins after categories emerge. Birks and Mills (2011) argued that theoretical sampling can begin during open coding, as the initial data starts to reveal concepts that begin to signal potential theories or explanations of phenomenon. Theoretical coding occurs when the codes and categories that emerged during open coding and selective coding are compared, and relationships are found between the codes or categories (Urquhart, 2013). The theory or phenomenon emerges from these relationships. All of the coding is iterative. New codes should be constantly compared to existing data to determine if new categories emerge and whether or not these new categories are densifying. Memos are important to the theoretical coding process and should be included in constant comparative analysis.

NVivo Use

A computer assisted qualitative data analysis software, NVivo 10, was used to aid in the data management and analysis process. The software was also used to query key words for comparison with manually coded categories and themes. NVivo 10 was not used as a primary coding source and was only used in the context of solidifying data analysis. The research process was led by the researcher, not by supporting software (Bryant & Charmaz, 2010). Software was useful as a repository and for sorting through data (Bryant & Charmaz, 2010).

One of the most important tenets of grounded theory is constant comparative analysis (Birks & Mills, 2013; Charmaz, 2006; Glaser & Strauss, 1967; Urquhart, 2013). The systematic checks built with constant comparative analysis helps to ensure that all theories are explored (Bryan & Charmaz, 2010). In constant comparative analysis, no distinct

conclusions are drawn from individual sets of data but alternatively, new data from each interview is compared iteratively with existing interview data and with an open mind (Birks & Mills, 2013).

Constant comparative analysis helps ensure that the theory continues to evolve throughout the research, resulting in rich meaning (Birks & Mills, 2013). "It is the constant comparison of different conceptual levels of data analysis that drives theoretical sampling and the ongoing generation or collection of data" (Birks & Mills, 2013, p. 95). The discipline of systematically coding and analyzing with constant comparison aided the generation of theory (Glaser & Strauss, 1967). For example, one way constant comparative analysis was used in this research was to compare similarities and differences within an individual participant's response throughout all of the questions, compare similarities and differences across participant responses for one question, and to compare similarities and differences in the codes and categories that emerge.

Trustworthiness

Qualitative research trustworthiness and validity depends on what the researcher sees and hears. Lincoln and Guba (1985) noted that credibility, transferability, dependability, and confirmability are important in establishing trustworthiness. One of the ways to ensure credibility and transferability is to ensure that those interviewed have the experience to discuss the phenomenon the researcher seeks to explore (Lincoln & Guba, 1985). Vignettes from the interviews were used to illustrate key themes for this study, which also served as support for the results of the study (Leedy & Ormrod, 2013). One way to establish confirmability is to ensure no researcher bias. It is important to interpret what the data tells

the researcher in an unbiased way. Transcribing entire interviews and manually coding them helped ensure a deep understanding of the interview content and participant intent.

The use of constant comparative analysis ensured that systematic comparisons were made and that this research demonstrates the links between the analysis and resulting theories (Charmaz, 2006). Constant comparative analysis was also critical in lending credibility to the theories that emerge from the data as the researcher will be able to specifically highlight those codes and categories that had the analytical weight to be used in developing the theory (Charmaz, 2006). Demonstrating saturation was also a factor in ensuring that the data gathered includes data sufficient to provide credibility to the theory claimed (Charmaz, 2006). Transferability was limited in this research study as this study seeks to explore a unique topic.

The research must be accessible to aid trustworthiness (Yin, 2011). While the data for this research will be accessible for 5 years following the study, all transcripts and recordings will thereafter be disposed of. The unavailability of the data after 5 years, causes a potential limitation to the trustworthiness and credibility of this study in the future.

Another potential limitation of this study was conducting the interviews by phone versus in person. Birks and Mills (2011) noted that the researcher should increase attention to verbal communication to try to overcome the impact of missing non-verbal cues. To maintain consistency all interviews, the interviews were all conducted the same way, on the telephone, even if proximity to the interviewee allowed for an in-person interview.

Introducing bias to the phenomenon or theory that emerges from this study was minimized in several ways. Yin (2011) suggested to set clear rules and follow them to help minimize bias in research. This researcher had a set of clear rules and several controls to

help ensure following of the rules took place. Using conference call recordings and a digital audio recorder to capture the interviews prevented the researcher from adding to or excluding any data from the participants' interviews. Manually coding the interviews using grounded theory methodology helped ensure objective interpretation of the data, which also helped to minimize bias. The use of memos also helped the researcher stay accountable to the theory that emerged by aiding reflection and helping during the research process (Birks & Mills, 2011).

Ethical Concerns

The researcher ensured ethics remained a top priority throughout the study. Following the methods as outlined in this chapter was paramount in ensuring the validity and reliability of the study. All participants were above the age of 18 and gave the required informed consent.

The informed consent form, read to each participant prior to the interview, is shown in Appendix C. The letter of Informed Consent follows U.S. federal guidelines, as outlined by Frankfort-Nachmias and Nachmias (2008) including, "a fair explanation of procedures, description of risks reasonably to be expected, a description of benefits reasonably to be expected, an offer of inquiry regarding the procedures, and an instruction that the person is free to withdraw" (p. 75). The risks to human subjects associated with this study were minimal. All participants were over 18 years of age, and did not demonstrate any impaired mental capacity, as determined by their ability to perform the positions that they hold in the workplace. Meeting these criteria qualified them as participants in this study. Additionally, all recorded materials will be erased after 5 years, following final approval by the research committee, minimizing any future risk of confidentiality breach for the participant.

Summary

The goal of this chapter was to outline the research method used to answer the research questions. A discussion on the procedure, study participants, data collection, and interview questions outlined the specifics of how the study was conducted and who participated in the study. The procedure was designed to provide data to develop theory on what motivates women to stay in STEM professions, leading to a motivation model. All study participants contributed to this theory by sharing their experiences in the STEM workplace and their perspectives of what helped them stay motivated to stay long-term. The interview questions included structure to promote data collection that drew out the details in the participants' experience related to motivation. As constructivist grounded theory methodology was used in this research study, a discussion on coding, memos, and constant comparative analysis, critical to data analysis, was also included. This chapter also contained background on the researcher, the ethics that were a foundational element of this study, and information on trustworthiness and credibility of the study. The goal of Chapter IV is to provide the study results and demonstrate that the methodology described in Chapter III was followed.

CHAPTER IV: NARRATIVE DATA ANALYSIS & RESULTS

This chapter contains the results of the analysis regarding the grounded theory methodology study conducted to answer the research questions: (R1) *What motivates women in STEM professions to stay in their profession long term?* and (R2) *What motivates women with non-linear careers in STEM professions to return to their profession after at least a 6 month break from their profession?* This chapter also includes discussion that the analysis conducted was consistent with grounded theory methodology and how the analysis ties back to the research questions. Additionally, this chapter includes sample demographics, using tables to complement the summary.

In the Data Collection and Data and Analysis Sections of this chapter, the process used to distill over 200 pages of transcripts from the 20 individual interviews conducted and uncover the codes and themes that lead to the resultant theory is described in detail. There were three levels of analysis, open coding, selective coding, and theoretical coding. At each level of analysis, constant comparison was used to distill the data further, until themes emerged from the data. Included in the chapter are tables and graphics used to present detailed code and theme data, as well as graphics and vignettes from the individual interviews used to emphasize key themes and the resultant theory.

Sample

Twenty participants were interviewed for this study. Appendix F indicates the participant demographics that represent minimum requirements sought as described in Chapter III. All four STEM professions include representation in the sample, with seven (35%) engineering, five (25%) math, four (20%) technology, and four (20%) science professionals. Three engineer participants and one science participant had non-linear career

paths, as defined in this dissertation as a career path, where the participant left the STEM workplace for more than 26 weeks and then returned to continue working in a STEM field.

The total years in STEM professions varied among the 20 participants sampled. Those participants with over 30 years of experience represented 30% of the sample size. Those participants with 10-15 years, 15-20 years, and 25-30 years of experience represented 20% of the sample size each, with the group having 20-25 years of experience representing 10% of the sample size.

Ten participants or 50% of the sample size were employed in the private sector. The remaining half of the participant sample either worked for the public sector (25%) or declined to answer (25%). Company size also varied among participants. Nine of the 20 participants sampled were from companies with over 50,000 employees. The next largest sample population by company size was 20% of participants from companies with 50-999 employees. All other company sizes were 10% or less (see Appendix F).

Seventeen of the 20 participants shared their race information, with 100% of those 17 being White, non-Hispanic. The ages of the participants varied. Participants who were 60 years or older represented 10% of the sample, 35% were between 51 and 60, 20% were between the ages of 41-50. The 31-40 age group was also 20% of the sample and 15% of the participants declined to answer. Graphic displays of demographics on company size, work status, age, and industry sector are in Appendix F.

Data Collection

The 20 research interviews with women currently employed in STEM professions served as the primary source of research data. The demographic questionnaires served as supporting research data. After every four interviews, the batch of four interviews was coded

manually and reviewed for emerging themes. Following this method, the researcher ensured grounded theory methodology was embedded throughout the data collection part of the research process. See Appendix D for the original interview protocol and the subsequent interview question changes through the course of the study that emerged from open coding.

Data and Analysis

All interviews were coded manually during open coding. The interviews were analyzed in batches of 4 participants, allowing analysis time before moving on to additional participants. The researcher coded each batch and analyzed for categories or themes. Questions or clarifying questions were added to the interview method following the completion of the eight interviews, or second interview batch. Details of additional questions and from open coding analysis throughout the interview process are in Appendix D.

Transcripts were uploaded into computer software, NVivo 10, for further analysis. Each interview was coded again manually using the software and then compared to the manual coding initially completed during the interview collection. Coding the interviews again, having all 20 interviews to compare, aided constant comparative analysis techniques critical to grounded theory methodology and helping the researcher to remain consistent in emphasizing key points during coding. The open coding results included 42 codes from manual coding, as shown in Appendix G. Figure 1 includes the summary of the data and analysis process for open, selective, and theoretical coding.

In the next analysis phase, selective coding, the researcher searched to find categories emerging from the similarities in the open codes. Using mind-mapping software, the researcher took all the vignettes and the open codes and mapped them into a mind-map.

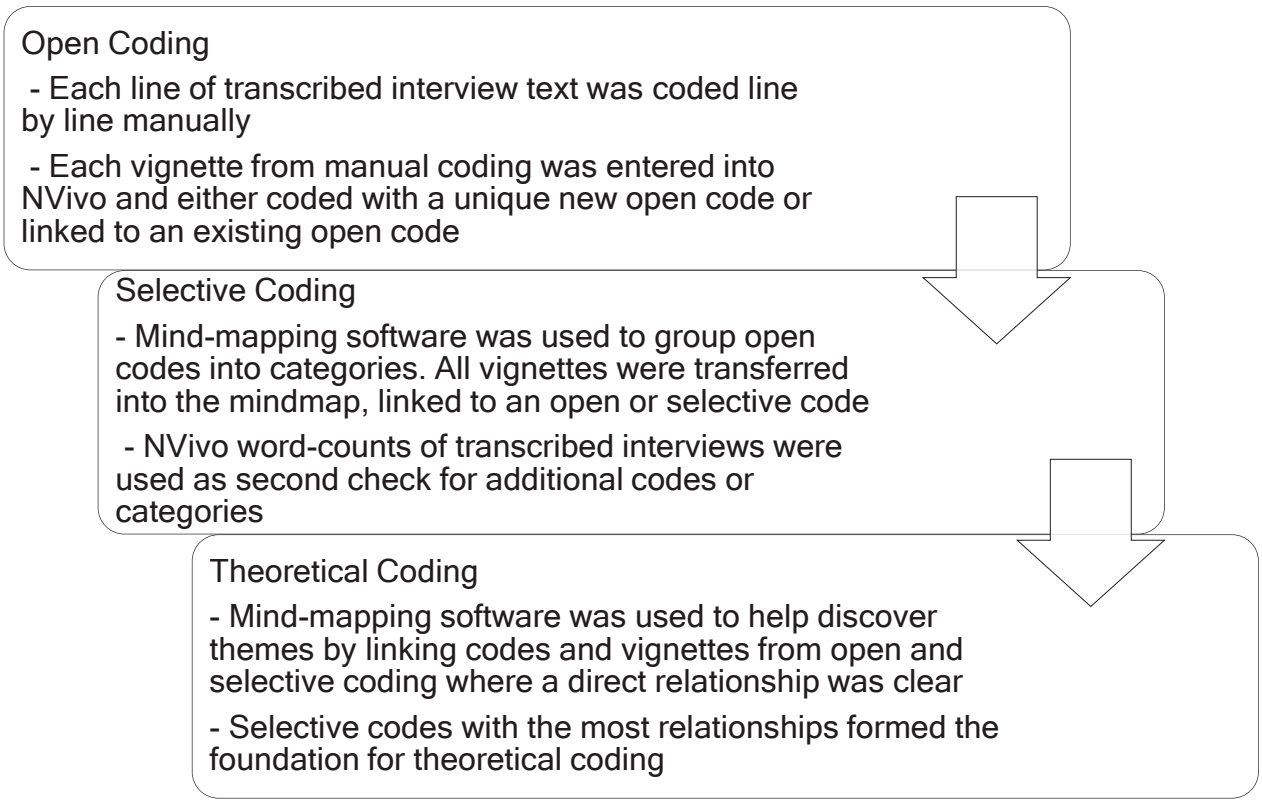


***Figure 1*. Data and Analysis Process.**

Using NVivo 10 software, the researcher used word-count queries and source code data as another tool in discovering selective codes from the data. In analyzing the depth of codes, or the quantity of vignettes assigned to a group of code, or grouping of open codes, selective codes emerged from the data. For the purposes of this study, the researcher defined *depth* as having 10 or more vignettes assigned to a code.

Theoretical coding resulted from further comparing the relationships both within and across the open codes and selective codes. The researcher used mind-mapping software to aid this analysis. Relationships across the selective codes were analyzed across the mind-map. When building the mind-map, each time a vignette linked directly to a code, the researcher reviewed that vignette for relationships with other codes. If there was a relationship, the

researcher connected the codes with an arrow. The selective codes with the most relationships formed the start of theoretical coding.

Adhering to grounded theory methodology, some questions were asked of some participants but not of others. Constant comparison was exercised to ensure that additional weight was not added on a per code basis only. For example, every participant was asked questions regarding what they enjoyed most about being a STEM professional, but not every participant was asked questions about the importance of technology to the workplace culture. The latter was a question only asked of participants 9 through 20, since technology began to emerge as a code after the first eight participant interviews were complete. The paragraph section headers that follow indicate the selective codes that emerged. There were three distinctions in the selective codes: individual-centric codes, workplace-centric codes, and individual and workplace dependent codes.

Individual-Centric Codes

Career fit. Career fit is an umbrella term used in this dissertation to describe opportunities for being challenged, problem solving, achievement, having variety in work, continuously learning, and opportunities to be creative. Over 15 open codes were assigned to the umbrella term of career fit. 100% of participants mentioned at least three of these descriptors for the umbrella term of *career fit*.

Two participants notably capture the essence of what the participants shared when asked what they enjoy about the STEM profession they have chosen. One enthusiastically shared her interests in her profession.

I really liked math. And I always liked word problems. I love the technical aspects of being an engineer. I love trouble shooting. I love the technical aspect of troubleshooting and fixing a problem. (Participant 7)

Another participant shared the multi-faceted aspects of what she likes about STEM professions, expanding the emphasis to exposure to various industries.

So there's always something new coming up. And lots of problems to solve. And as the industries have been changing and as policies change, (you know), there's a need for new data. And so there's a challenge in how we collect it. (Participant 19)

Some participants shared further detail as to what they like in their chosen STEM profession. An example of this follows for each of the science, technology, engineering, and math participants.

When asked what she enjoys about being in the sciences, one participant excitedly spoke of what it is like to discover a solution to a problem with her team. Problem solving, a challenge, and creativity are central to her answer. She describes how the problem solving as a team adds to the excitement of her work.

I like hands-on bench work and that's what I like. So if we are doing a scale up of a certain protein and it needs to be, it's not soluble at a certain temperature then we get to fool around with it. So, so there's a little bit of creativity with that. And then when you finally get it, you're part of a team and everybody gets excited. (Participant 12)

A technology professional discussed the creativity, challenge, learning, and problem solving aspects of writing new code. She emphasizes that while she enjoys this challenge and creating, the participant also enjoys seeing how her work contributes to business changes.

I liked writing code. I like the fact that my job is never the same every single day.

> My job constantly shifts. Every day's a new challenge….I also like the way that technology has allowed process to evolve and how we've been able to take something that would take a really long time to do it without technology. And be able to kind of transform it so that it operates more efficiently, more effectively. (Participant 6)

An engineer described some of her considerations when taking a different position within her company and reflected on what she really likes about operations. She emphasized problem solving, particularly under the challenge of time constraints, as something she likes. Similar to Participant 6, Participant 4 is also motivated by the change that her work creates for the business.

> I really like the hand's on activity. So I like the startup aspect when you can do testing in the field of equipment. I like working in operations where you're like close to the product. I like to be where the action is…. It's energizing to kind of have that. Again it kind of comes back to impact, just being close to the action, and realizing that what you do matters. (Participant 4)

A math professional shared her interest in learning, problem solving, and data analysis, indicating that she finds it hard to believe she gets paid for something she enjoys so much. She described at length her desire to analyze data and the energy that she gets from her analysis and discoveries.

> I absolutely loved the idea of problem solving and data analytics. I mean anything in life, it doesn't have to do with work, I mean if I can put it into a spreadsheet, there's this never ending desire for me to sit down with the data … having someone to pay you, to give you the time to sit with data for hours, and look at it from many different aspects, has always been a wonder to me. I am addicted to learning. (Participant 18)

Priority is family. Over 10 vignettes were assigned to this open code, elevating to a selective code. The participant responses when talking about family priorities were largely about having a flexible schedule. Participants were not shy about their choices, often expressing pride in their choices, especially choices made when their children were young. The women made adjustments to their career schedule to ensure they spent time with their children. Participant 15 discussed how she approached her work schedule when she came back from maternity leave so that the schedule helped her align her priorities and responsibilities at home and at work.

> When I had my daughter and came back from maternity leave. And the first thing I did when I came back is started working four 10-hour days instead of 5 days. So that I could have one day other than the weekend when I was running around doing grocery shopping and other things just have one day of the week at home. When I could just spend with my daughter, and make sure we had that kind of bonding time. (Participant 15)

Participant 6 emphasized a similar sentiment about flexibility in the workplace and workplace policies, that she found supportive in attaining work-life balance. The workplace policies included options for nursing at work and flex-time.

> I just had a baby very recently. My organization has been extremely supportive of allowing me to continue nursing….They've also been very flexible with time off. So if I need to take time off, my kid's sick, or if I need to work off because my kids are sick or I need to take them to a doctor's appointment or something like that, they've been very flexible about that. (Participant 6)

Another participant went to work part time after having kids and remained part-time for the rest of her career.

> I went part time after I had kids. So I appreciated the fact that I could do technical work part time. It was priority for me was for somebody to be home with the kids. If I only had the choice of full or no time, I would have probably gone to no time. And that would of course impacted me financially, but that probably would have been my decision. (Participant 8)

One participant, who notably was in a senior position at the time of this interview, shared that she made sacrifices early in her career to be with her children.

> I haven't taken some roles, and I haven't applied for certain roles because I knew it would have, I wouldn't have as much time with my kids. And I wouldn't get to go to any of their extra school activities or do anything. (Participant 3)

Self-efficacy and self-confidence. There were over 15 open codes within this selective code. One of the self-efficacy open codes was *expressed having a niche*, with more than 10 vignettes, and the second open code was *expressed believing in capabilities*, with more than 15 vignettes assigned. There were over 10 of which were linked to the open code *expressed confidence throughout career*. Additional codes included assignment to *expressed maturing into confidence*.

One of the ways a participant expressed having a niche was developing a specialty in a certain aspect of her profession. Participant 17 specialized in (technical specialty name) which, the participant emphasized, is a niche for women in STEM.

I do (technical specialty name) and I have a couple guys working for me. I run my own company. So I, a women in (technical specialty name) is an anomaly. Because there's not a lot of women that do that. (Participant 17)

Other women expressed believing in their capabilities in a more general sense, without notation of a specialized niche. One participant talked about entering a new industry under a mentor and the confidence she had in her data modeling skills in this industry. She referenced the weight she feels her capabilities have in sustaining her in this field. She suggests that the niche capability she affords her confidence.

That part (the data modeling) came (you know), it just came very easily…Presenting to a room of 20 people …And to feel like you know the answers. So I, I don't know, the amount of stimulation that comes from being well prepared and having done thorough research in particular areas, I'm assuming it will sustain me all the way till the end in terms of keeping me in what I do for a living. (Participant 18)

Some participants talked about their belief in their capabilities in terms of achievement, where even if something was an unknown, they knew they could figure it out. This vignette relates to both self-efficacy and self-confidence.

I think part of it (you know), I don't like not being able to do something. So I think that was definitely a motivator in the beginning that, okay, (you know), I can do anything I set my mind to. (Participant 5)

The participants spoke about having confidence in different ways, but with each example of having confidence throughout their career, it was evident that their confidence came from within. Participant 11 said this directly and emphasizes that all positions are a little different and one has to adapt to the environment with the confidence one finds within.

> I think your confidence has to come from within. You need to be confident with yourself and your abilities. And I think that's what provides that confidence and ability to adjust to whatever that environment is. (Participant 11)

Some participants talked about how they dealt with changes imposed on them through organizational restructuring and other business changes that affected their careers. Participant 12 spoke about a specific example, where although she was scared, she had the confidence to take the risk on secondment position where she would be in a position that was considered a leap for her. Participant 12 explained that the company offered these opportunities, but it is up to the individual to take the risk.

> So one of the things that <my company> offers every once in a while is they have something called a secondment where you can go into a different department and try a different job. And it was really, really, scary and I really didn't want to do it. But I knew I had to. So again I just made the leap. And again now I'm visible….And the secondment was the best thing I ever did. (Participant 12)

While all participants expressed confidence in themselves at the time of being interviewed, some participants indicated their lack of confidence in their career early on. Confidence was something they built and something that got stronger over the years.

> I think that might be something that I've grown into also. I probably wouldn't have been as maybe not as vocal about it early on. But I think (you know) you know what is right for you, and you just have to be strong enough to make that decision. (Participant 20)

Workplace-Centric Codes

Direct managers. Over 15 vignettes were assigned to this open code, elevating the code to a selective code. Several participants discussed the importance of managers in being supportive in finding opportunities for further growth.

> I think your direct manager really has the ability to influence at least here what projects the group gets assigned and then more importantly what projects you get assigned. I've really been (you know), lucky or fortunate that I've worked for people that have said, hey (you know) what? I'll give you this opportunity and if you do a good job then that will open doors to try this, this or this. (Participant 4)

Other participants discussed the key role of the manager in setting the tone for a flexible, performance-based work culture.

> I basically, with the exception of a two-year stint in there, worked for the same boss since I started. And he's just, he's a great man. He's very family-centered. (you know) He's always been there when I've had issues. And (you know) he understands that my family comes first. (Participant 5)

Some participants discussed the bias a manager's perspective could have on their own views of the workplace and of themselves, good or bad. Participant 13 discussed how one manager helped encourage her to go into management, while another said that management was out of reach for her. She spoke about the negative influence the first manager had on her, particularly because she was in the beginning stages of her career. She actively sought other positions and her new manager was very supportive of her career aspirations into management.

I think the manager that I had at the time was so supportive and really believed in me so that helped a lot. In the past I'd had a lot of managers that would say things like (you know) I can't really see you being a manager… So you kind of internalize that and kind of believe what they're saying even though maybe initially you thought something different…I think having somebody else that I respected a lot that saw that in me and encouraged me to do it that was a big part of it. (Participant 13)

Performance-based policies. The open code *recognition and reward* had 15 vignettes. Some of the vignettes were evidence of fair rewards system, where as some vignettes leaned more towards a lack of evidence.

One participant enthusiastically endorsed performance-based policies.

I love being in a performance-based platform. (Participant 14)

One participant shared more detail as to how the performance based systems work in terms of compensation and retention.

You get a number. You get ranked every year at the end of the year. And if you haven't met those goals then your ranking is low. So not only is your bonus really low but chances are if you're ranked low 2 or 3 years, you're not going to be there the fourth year. (Participant 12)

Performance-based culture. More than 10 vignettes were assigned to the open code of flexibility. Flexibility / predictability included citation by more than 10 participants as being part of a culture that cared more about performance (getting the work done on time and to a quality standard) than being at the office for a set period of time every day. There are two general ways that the participants described flexibility. One way was the flexibility that certain roles provided, where they did not necessarily have to be at the office to perform their

job. These women emphasized the importance of having a generally predictable schedule for their 40-hour or more job was important to them. Other women preferred flexibility in terms of job structure, such as being able to work part-time or having a flexible schedule beyond the typical 5 days a week, 8-5 schedule a day work week.

One participant described her considerations in her job role when she became a parent and her observations of different company cultures in her experience. She shared that she was not looking for less hours. She was looking for a different schedule of hours so that she could balance her new priorities and responsibilities as a parent. The participant also shared that the culture of the company was something she would pay attention to if looking for a career change, as the family focused culture of her current company is very important to her.

> I was like, well I'm not going to start a family and have to be at a job site at 5 o'clock in the morning….That's when I took the office position of being an <role> before I became pregnant ...The company I work for now is less than twenty employees. So it's very family oriented and family focus….And I think that's definitely been a contributor to things that I would seek out if I were to ever change careers or change companies. (Participant 7)

Another participant echoed the concept that flexibility in some respects is earned, as when you have to get something done, you are trusted to put in the extra hours. In return, one's manager may be flexible during the times when you have a commitment to attend during working hours.

> I've been fairly lucky throughout my career in that I've never really had a boss who stood there and said oh well you're supposed to be in a 9:00 and here it is 9:01….But they knew that when push came to shove if something had to be done, I would be

here to do it. And I think that they appreciated that. And in turn, (you know), gave me a fair amount of flexibility. (Participant 19)

One participant described that she did not really enjoy her job that much at a certain time in her career, but because her part-time work schedule helped her balance her family responsibilities, she stayed. The flexibility was very important to her family and this benefit outweighed the negative aspects of her job.

> The job share I really, I stuck with it because of that flexibility. So I was 3 days a week. And eventually what I was able to do was I went in 4 days a week…I went in Monday through Thursday and left every day at three… that flexibility meant everything to our family. I feel like I was really lucky. (Participant 11)

Individual and Workplace Dependent Codes

Influence of changes for the individual and in the workplace over time. The open codes of *technology advances and how the workplace is affected* and *changes in workplace culture–not hostile now* combined to emerge to this selective code, having over 15 vignettes assigned to the two combined open codes. Also, over 10 vignettes included assignment to the open code *what motivates me has changed over time*.

For some participants, no noted change for motivation existed along the journey. These participants still say that the problem solving, analysis, and technical work is what they enjoy.

> I do still enjoy analysis but that's actually one thing about switching from (career type) to consulting; that's, that was important for me to make sure that I still enjoyed analysis. Because as you go up the ranks in a (career type) company, you start doing less and less analysis and more and more sitting in meetings. (Participant 15)

For others, the motivators changed over time. One of the factors that helped Participant 6 stay motivated was in adjusting her approach over time, as she began to put more ownership on her own values rather than reacting to others. She described how early in her career, she expressed feeling like building her credibility took effort. As her career progressed, she spent less energy on having to prove herself. She has more confidence in her work and her motivation now is more intrinsic.

> I think, early in my career there was definitely a lot of camaraderie. I think in a way, at least for me, I think that that was almost a driver for me, because I felt like I had something to prove early in my career. Now at, later in my career… I feel like I just have to ensure that I'm making myself accountable…and what I feel is right really drives me. (Participant 6)

Several participants noted the advances in technology in enabling flexibility for both men and women. They cited fairly recent changes such as companies providing laptops and people generally having good Internet connections in their homes, as enabling the virtual workplace.

> I've been in the workplace 18 years. So we certainly had computers when I started, but companies didn't hand out laptops back then. We had desktops. So I wasn't working from home ever, (you know)? My work was on the computer, but my computer wasn't with me. So I did not work from home for the first probably five years of my career. (Participant 15)

One participant mentioned the opportunity that a flexible work environment offered to men too. The flexible environment has helped both men and women who are caretakers.

I think men tend to be more (you know) it's okay for them to say I'm going to work from home today, you know? My child is sick and my wife needs to go into work. I've heard that many times, you know? So I like that aspect of it too. (Participant 20)

When asking one participant about the flexibility of work culture, she quickly emphasized that flexibility, although existing today, did not always exist in the workplace.

I wouldn't say flexibility. That didn't exist until the last couple of years. I mean I think that, (you know), the millennial generation and working from home; I mean that is a new concept… I had to take a vacation day every time my kids were sick. (Participant 3)

Reputation as a credible professional. Over 10 vignettes included assignment to the related *reputation* and *credibility* codes, elevating to a category and selective code. The first vignette below includes the description of a personal journey in discovering the multi-faceted elements of building a good reputation, emphasizing that building a reputation is not just about performing well, but having others know about your performance.

I've obviously struggled in the beginning trying to get recognition for the fact that I was competent and, and capable, and working at an appropriate level. And I think that's a challenge for a lot of people starting out in a technical career. I thought that my management should be psychic and should know exactly what's happening, and everybody else should be psychic and know what I'm doing...I looked around and realized that the people who were really being successful were the ones that weren't just coming in heads down doing their work and leaving, and they were getting involved in the community. They were talking to people… I kind of looked around …and then tried to mimic some of that. (Participant 13)

Another participant emphasized the need to be credible, even in a situation where you've made a mistake. By being brave enough to admit your mistake, the participant emphasized that one creates trust, essential to building a good reputation.

> And so you start building your reputation and (you know) you start to learn it's very simple. If I do something wrong, they're going, people are going to tell 11 people I messed up. If I do something right I'll be lucky if they tell one person. So that's why your reputation is so important … really want to make sure if you do something wrong, you immediately address it. (Participant 17)

Growth and advancement. More than 15 vignettes were assigned to the selective code of growth and advancement. This selective code is an umbrella term used in this dissertation to capture participants' views on *evidence of advancement opportunities, lack of evidence for advancement opportunities, investment via training is available, lateral moves are good capability building,* and other general perceptions of growth or barriers to growth in the workplace.

One participant's perspective was that growth was not necessarily advancement, but learning something new.

> Looking for a different opportunity, in some cases it was even potentially like a lateral move. So it wasn't necessarily a promotional opportunity. But in some cases it was a chance to get just a different experience at the same level. (Participant 12)

As participants shared their career journey, where several cited evidence of attaining senior level positions.

> I started out at <the company> which is now part of <the company> and worked as an actual individual contributor. And then I moved into a management role. And I've

been managing people for the last, oh, wow, since <year>. I will be the < a senior role in her next position>. (Participant 3)

Other participants simply stated directly that they have opportunities to grow and that there were no barriers that they saw.

I feel like I've been given plenty of opportunities, that's for sure. I don't feel like there's any, anything stopping me from having opportunities. (Participant 13)

Some participants cited something specific about their career journey that gave them the perspective that no glass ceiling existed. One referenced her own success to reinforce her point.

The first, of the three companies that I worked at, two out of the three including the first one 18 years ago had women as the <most senior role>. It's like typically the top role <in that specialty>. So I came into my first job with a female <in the most senior role> and never had any impressions that there were any barriers for women from that perspective. I've been here now with, in this location with my current company for six years. I'm now <in a senior role>. (Participant 15)

Several participants interviewed in this study worked at some time as a part-time worker or managed part-time workers that were women. While those participants who worked part-time did not feel that the company limited their growth or advancement, they did acknowledge that their choice to go part-time had some career implications.

One participant indicated that she was not chosen for some projects because of her part-time status. She reinforced that being a part-time employee was her choice. She noted that if she wanted to advance, the opportunity was there, if she wanted to go full time. Overall, though, this participant expressed a lot of satisfaction with her career and what her

career offered her life. She referred to the cost of being part-time. This participant also emphasized her gratitude to the company, for allowing the part-time working arrangement for technical work.

> Sometimes I think I wasn't given the most cutting edge projects because I couldn't travel. That was I thought the cost, I mean I was okay with that because I'm the one who made the decision to go part time…. I feel indebted to them and more loyal to them because of the support that I, to let me be able to still work, be pretty technical and only be part time. I think if I had been looking to be promoted the first thing my supervisor would have said to me was you need to go full time. It was my choice. (Participant 8)

Another participant's perspective was that if an employee was performing well and they deserved a promotion, that the part-time versus full-time aspect should not be a factor. Growth and advancement should not be limited for the part-time worker, in her opinion.

> I was kind of disappointed that <my line management> wanted to write her off for this promotion just based on her working the (part-time) workweek. And not being open to just what her skills and abilities were. (Participant 4)

NVivo Analysis Results

A word frequency query was also conducted in NVivo 10 on the group of 20 interviews, holistically following the manual coding to check for any additional themes. Word frequency queries were performed at different ranges to see if any differences existed regarding queries that search for the exact same word, queries that searched for similar word groups, and a search frequency in between these two extremes. Table 1 indicates the results of the word frequency query. With the exception of the words: *number, work,* and *change*,

the word query search resulted in modifiers. The word *change* was the second most frequently referenced word type in the query search for similar word groups, behind the word *really*. A total of nine Selective Codes emerged from the manual and NVivo analysis as shown in Table 2.

Table 1

NVivo Word Query

Exact Query	Between Exact and Similar	Similar Query
Know	Know	Really
Like	Work	Change
Just	Like	Work
Really	Think	Number
Think	Just	Think

Table 2

Selective Coding Results

Individual Centric Codes	Workplace Centric Codes	Individual and Workplace Dependent Codes
Career fit	Direct managers	Reputation as a credible professional
Priority is family	Performance-based policies (rewards)	Growth and advancement
Self-efficacy and self confidence	Performance-based culture (flexibility)	Influence of changes for individual and in workplace over time

Theoretical Coding Summary of Results

Five motivating factor themes emerged from the mind-mapping and NVivo analysis. The themes resulted from the theoretical coding. The researcher used mind-mapping software to further understand relationships both within the open codes and across the selective codes and aid theoretical code discovery. Relationships across the selective codes were analyzed across the mind-map. The selective codes with the most relationships formed the start of theoretical coding. The motivating factor themes that resulted from theoretical coding included: *a) Interest in STEM is the constant as individual needs and priorities change, b) Direct manager influence on development is critical, c) Performance-based workplace policies and culture are continuously sought, d) Moving towards a no-bias workplace remains important, and e) The career growth path at life's crossroads remains a challenge.*

The themes are a result of reviewing the relationships in open and selective coding. The first two themes focused on the individuals who make a key difference, the participant and their manager. The themes have a direct tie to the selective codes of career fit and direct manager. The primary difference between the selective code and the themes is the dimension of time and the emphasis on individual needs. The last three themes are also a result of selective coding with a more direct tie to the overall workplace.

Performance-based policies and culture emerged in both open and selective coding and carried through here as a theme to emphasize their importance throughout the career journey. The fourth and fifth themes are a resultant a multiple relationships and concepts within those relationships. For example, for the fourth theme, the concept of bias emerged as important, looking at relationships that impacted reputation, credibility, culture, and opportunities for advancement.

The last theme summarized many relationships across open and selective codes. The concept of being challenged continuously was strongly emphasized in open coding and was captured in the umbrella term of career fit during selective coding. During constant comparison, it became evident that creating this challenge throughout the career for participants was inconsistent, particularly as the participants started families. More discussion follows on each theme on the next pages.

Interest in STEM is the Constant as Individual Needs and Priorities Change

Career fit was the only code that had a 100% response rate, indicating that for all participants throughout their career, their genuine interest in STEM was key to motivating them to stay. Career fit is essential and related solely to the individual's interests. Top individual needs cited by participants included having a challenging career related to math and science and the ability to meet family priorities, balanced with work priorities.

A dichotomy emerged with roughly half of the participants interviewed. Throughout the interviews, participants often cited that their self-efficacy and self-confidence also contributed to their success. All women expressed having self-efficacy, either through sharing that they had a niche or sharing that they believed in their capabilities. The inference was that this self-efficacy was throughout their career. However, approximately half of the women indicated confidence throughout their career, with the other half explaining that they matured into the confidence they have today. All women expressed having confidence in themselves in the present day.

Family is priority for participants. Most participants shared that the *caretaker* identity is prominent in their lives. Most heralded their spouses as supportive partners, but they still shaped their careers to meet their needs at home. Over 15 vignettes had content

where the participant expressed their individual needs as a primary component of a decision they made or sought to make.

Influence of changes for individual and in workplace over time had over 15 vignettes and is therefore a key to consider in theoretical coding. The code most closely links to individual needs and priorities over time, particularly during drastic caretaker responsibility changes for women, in becoming a partner, mother, or when aiding with elderly parental care. One participant discussed that what motivated her throughout her career was different at every stage. She emphasized her responsibilities at home changing as she grew in her career.

> I think it's different at every age. At <company) there were a lot of young people and I enjoyed the people that I worked with. Eventually with a family and a mortgage and (you know) you kind of feel like even if you didn't like your job you'd sort of be stuck there, because now you need to produce and you need to get paid. (Participant 12)

One participant shared the struggle she had in maintaining her individuality as she juggled work and family, implying the importance for women to ensure that they maintain who they are as individuals.

> I think sometimes women throughout their career can lose their own individuality or maybe suppress that based on environmental factors, family factors, things such as that. So for me I think just re-finding the individuality of, I never truly lose myself. (Participant 14)

Having a trusting relationship with one's direct manager, so that one feels understood and heard, was emphasized by a few participants. This point is mentioned here, as it is just

as important for the individual to understand their needs and wants and have the confidence to voice them to their manager, as it is for the manager to listen and help support those needs. Participant 20 best illustrated this point.

> I've had just great bosses who I can really talk to, I can really tell them what my needs and wants and everything are, you know? . . . I tell them what I want. And I find that they work for me to get those new opportunities and those new challenges and I just really trust, I trust them. I've just been really lucky. (Participant 20)

Direct Manager Influence on Development is Critical

Managers, the data suggested, have both a *present day* and a *future growth component* to their relationship with employees. The data suggested that it is critical for managers to help equip employees' everyday needs to help them balance work and home as much as the employee's role and the workplace environment will permit. Participants cited their direct managers repeatedly, as essential to helping them grow or helping them gain exposure to new opportunities. The emphasis on the influence of the direct manager as a motivating factor was clearly in terms of moving towards the future.

Direct managers were specifically cited as being great coaches to those participants that struggled with confidence early in their careers. Some participants referenced how their manager helped them build their capabilities and reputation.

> I had a manager very early on who was a female in the IT area, and (you know) the IT area tends to be mostly male dominated field. And so I had this one manager who she definitely served as a mentor to me. She definitely took the time, invested, to make sure I understood things. She also made sure that I knew people, too, that I made the personal connections to people in the organization. (Participant 6)

Others shared that their managers helped them leverage their good reputations as top performers to move into different roles within the organization.

> And if you are a, if you're a top performer and you kind of make clear what your one to 2 year and 2 to 5 year and maybe even longer term goals are, I've really had managers that will work with me to kind of get where I want to go. (Participant 4)

One participant discussed how her managers worked with her during life changes in her career and opened up options for her that she did not know existed. This participant emphasized the point that individual have to communicate their needs to their managers so that the managers could work with them to shape their positions.

> When I lived in <State Name> and I wanted to work part time because my husband was going back to school. And my first thought was I'm going to have to quit because I worked at a plant and they didn't have any part time engineers, you know? … I went into my boss and I told him what I had decided I needed to do. And he said well we don't want you to do that right now… Would you consider part time? And I said I had no idea that was an option, you know? And so we talked about it and I was able to work 3 days a week. (Participant 20)

Performance-Based Workplace Policies and Culture are Continuously Sought

Participants indicated that compensation was a factor in staying in STEM long-term, particularly as the participants reached stages later in their career. Several participants agreed that they valued the performance-based evaluation system in their workplace. One participant cited her company development plan when asked about policies that aid growth, leading to more opportunities for jobs with more compensation.

> Our company has a pretty good like employee development plan, process. (Participant 4)

A few participants talked about the importance culture played as they have matured in their careers. The participants mentioned that they were naïve to the importance of culture early. Several participants mentioned not liking politically driven cultures. Participant 19 articulated this sentiment well.

> I think at this point I would be interested in the culture. That's really interesting that you mentioned that because when I first started (you know), I didn't think anything about work cultures … I certainly didn't think that they could be different; (you know) it just seems to me an office was an office. But yeah I certainly would want to be in a place where you could work collaboratively with others. (Participant 19)

Several participants shared that workplace politics were a barrier to gaining a top performance rating. Performance-based policies with barriers are not necessarily a de-satisfier. Although participants often shared their dislike for politics, workplace politics was not cited as a cause for leaving. Some flexibility in interpretation of workplace policies, as they apply to recognition and rewards, seems tolerable but not necessarily ideal. For all workplace policies, the availability of the policy was one aspect. The other aspect was the employee taking advantage of all of what the policy had to offer to improve their opportunities for growth.

As discussed previously, the hostile environment that women historically met in STEM professions is not generally the environment that women in STEM face in the workplace today. Some bias does still exist. This topic will be discussed in the next motivating factor theme, *Moving Towards a No-Bias Workplace Remains Important*. The two themes are separated as while the participants generally cited fair workplace policies and

culture, there was some variability in participant responses related to the workplace environment when discussing building a credible reputation.

Moving Towards a No-Bias Workplace Remains Important

All participants were asked if they experienced gender-based hostility in their workplace today. The majority of women rejected the notion that they work in a hostile environment today. There were generally three answers to the question on the existence of a hostile environment: a) they had never experienced a hostile environment throughout their career, b) hostile environments use to exist but do not today, and c) hostile environments still exist in pockets in the workplace or in specific industries.

There is evidence in the data for this research that the workplace changed in the last 20 years. The broad bias towards women in STEM in the past hindered women STEM professionals, particularly their credibility. Reputation connects to credibility. Although all participants expressed self-efficacy, believing in their capabilities, throughout their career, they were conscious of their credibility as professionals. Having a credible reputation is based on another's judgment of your capabilities. Some participants, when discussing the existence of hostile environments of the past or the hostile environments that still exist in the early 2000s in pockets of the workplace, shared stories of how their credibility, at times, was diminished simply because of their gender. As hostile environments still exist in pockets in STEM professions, and reputation is essential to being considered for growth opportunities, it is considered core to keeping women in STEM professions.

Many participants talked positively about their work environment and expressed no hostility throughout their career. Participant 1 shared that she thought her workplace has been very progressive in that sense, citing the emphasis on work-life balance before it

became a norm for companies to consider. She also cited how supportive her workplace was with regard to flexibility, especially when she had children.

> But I've never had a, I've never had a problem with feeling like, oh, I was being discriminated against, because I'm a lady… I mean never have had that feeling at all. Especially in the office that I'm in, the people that were here, everybody's very helpful and supportive. I mean never, ever have had an issue, (you know). If your kid gets sick at school and you need to leave, everybody's like yeah, fine, whatever, (you know), as long as you get your work done, we don't care when you do it, how you do it… I mean everybody's always, and so as far as the work life balance it's been phenomenal. (Participant 1)

Participant 12 simply rejected the notion that her gender plays a role for her or other women she works with.

> I don't really feel like I've seen women held back just because they're women. (Participant 12)

One participant cited that perspectives of women changed during her career. Her perspective is that competence, above gender, is viewed more today. She implied that view was not always the case in the earlier years of her career. She also shared that she thought it would be hard to stay in the profession if the environment had not shifted as it has, where women are more respected.

> There were some men that didn't like females or didn't think females could do the job. Much more 25 years ago than do it now. I think that there's a lot more respect given to women whether it's me after being there a long time or even new graduates when we hire a new graduate. We look for competence, and I don't believe that the

gender, that gender is an issue at all. There were things that happened early on that maybe if they were still happening as far as that went with (you know), real male dominant opinions that would have been hard to stay with for a long time. (Participant 8)

Other participants cited the male / female bias as a factor existing in certain industries or certain pockets of jobs. One participant shared her perspective on a company she worked with, citing the existence of an *old boy's network*. This participant shared that she did not even realize what a bad experience it was until she left and had another company experience to compare to.

I would say I hated working at <company name>. It was a horrible place to work for a woman…. If I were to have the opportunity to influence some 20-something-year-old who got her first job at <company name>, I might say hey look, this looks great on your resume. Stay there, get the training that you can, learn what you need and get out of there… it's an old boy's network. It's a man's world there. It is unfair…And I don't even know that I realized it while I was there. (Participant 18)

One participant acknowledged that sometimes she encounters a client with bias because of her gender. This participant did not internalize these occurrences as her performance review had never been impacted. Her manager was very supportive of her decisions to work with her peers on shifting clients when she encountered bias. She also implied that the biased clients are not the majority, they are the minority.

There's been certain customers where there's just not a connection. They don't want to deal with a female… I've been able to in maturity just step back and be like you

know what? This just isn't a fit…and just go to my peers. And be like, hey, do you want to take over this account because I'm just not getting anywhere. (Participant 5)

One participant broke the biased group down to an age group. She shared that the majority of men that she worked with had no bias because she was female. The exception was a group of men that were older than her by 10-15 years, who, she felt, were not as open to her.

> I used to explain to people that in my career men that I've had success with are either older men that see me as their daughter and want me to succeed or men of my own age that see me as an equal because they've seen women in their field. And then there's this group that are like 10 or 15 years older than me that don't want me here. (Participant 7)

The Career Growth Path at Life's Crossroads Remains a Challenge

This theme captures the sentiment that many participants expressed as they described their career journey. The participants emphasized that continuously challenging them in their respective professions through growth opportunities was essential to them staying in STEM professions. The participants also emphasized that as their personal responsibilities grew, particularly with having families, it was essential that they had good career options.

The participants acknowledged that their family and career choices impacted their ability to move up the corporate ladder at the same pace as some of their peers, but expressed no dissatisfaction with the workplace, despite implying their personal career sacrifices. There were four participants who expressed being limited in their career options at times in their career as they balanced family. Three out of 4 of these participants also worked part-time. While they did not fault the company, they did position their family work-life balance

choices as career sacrifices. One participant expressed working in a biased environment early in their career, particularly during child bearing years. She emphasized having to work harder to eliminate the negative bias that being a mother carried in the workplace at that time. She also mentioned having a paid maternity leave, albeit a shorter amount of time than the unpaid time under the Family Medical Leave Act.

> I had a lot of limitations…I only had 6 to 8 weeks paid time off. And I think that now it's more accepting to take a nice long maternity leave…When we had our kids 23 years ago, we worked even harder so that no one would have ever said, oh, she had a, she became a mother now and she's not going to be committed. (Participant 3)

A workplace that offers a challenging job with variety, and where growth opportunities are apparent, is essential for motivation to stay with a company. The exception to the rule is when family priorities (young kids, being sole wage earner) trump the individual needs. Whereas performance-based culture and performance-based salaries seem a little more transparent now, career growth seemed still like a struggle. Participants were generally satisfied with their success, but some of the growth aspects seems to be a guess. For example, as this relates to reputation, some cited navigating politics as a barrier. Those who made the choice to go part-time often spoke of the assumed career growth options limiters, whether in the form of lack of promotions or lack of the best projects. Still others emphasized the changes in their schedules they made when having children. This theme had the most variable data. Everyone talked about the importance of growth, but no clear recipe seems to exist. Women STEM professionals ideally want to be employed in a challenging job while ensuring their priorities as a parent and spouse are met. They want to continuously grow.

Additional Data Collected

Non-Linear Participants

Four of the 20 participants had non-linear careers. A non-linear career path is defined in this study as a career path where the participant left the STEM workplace for more than 26 weeks and then returned to continue working in a STEM field. As this data set is small, future research may be required to further validate the data collected in this study.

Three of the four participants left and came back because of deciding to stay home with children. All three of these participants were engineers. All three transitioned as part-time workers at some stage as part of easing their transitions. The fourth participant lost her position as result of downsizing and took 6 months off before returning to work. She was in science and was full-time her entire career.

There were no differences in what motivates linear participants versus non-linear participants. The responses of non-linear participants reflected the selective codes and theoretical codes with regards to motivation to stay in STEM. As with all of the study participants, the non-linear participants emphasized family priorities. The non-linear participants did emphasize workplace policies, relationships with their direct manager, and staying connected to their network as factors that helped ease their transition back.

Two participants that left and came back emphasized their priorities and values they shared with their husbands in having one parent at home when the children were young. One of these engineering professionals left and came back twice, the second time being away for seven years before returning to work full-time.

They both emphasized their satisfaction with their life and shared a common-spirited sentiment that women can have a challenging STEM career and be fulfilled as a parent too.

Similar to linear participants, the participants acknowledged that their family and career choices impacted their ability to move up the corporate ladder at the same pace as some of their peers, but expressed no dissatisfaction despite expressing making career sacrifices. They saw their career sacrifices as choices they made because they wanted to, not because the opportunity was not there.

> (you know) I think it's good to see the girl, (you know) the young girls coming up through the ranks and you hear people want to have it all. You can have it all. But sometimes you have to put things on a scale of priorities. You can have all of it but maybe not a hundred percent of all of the time, you know? And my 100% may be a lot different than another person's hundred percent. And balancing and making sure that you stay happy and (you know) that not everything's going to work right all the same time. Women need to understand that you can set the balance depending on the situations in your life and your interest. (Participant 9)

Another non-linear participant shared her perspective on opportunities with work and balancing home priorities.

> The whole thing about glass ceilings and all that. I just, in my personal situation I didn't see it. I feel like the reason I didn't move up as fast as others, (you know) men my age, is because I made the choice to stay at home and be with my kids. Which I'll never regret. You just have to make the right decision for you at the time. And we are smart women, and we can make opportunities. (Participant 20)

Participant # 4 shared that there was really no question that she would come back to work after having children either time. She mentioned that her support structure at home helped with the decision.

I thought I would definitely come back to work. I just, I like it. But if I came home and had to do 100% of the cooking and cleaning and taking care of the kids and picking them up and dropping them off and all that?...I would definitely be limited to what I could do at work. (Participant 4)

Participant 11's reason for leaving and coming back was different from the other three non-linear participants.

My entire team was outsourced. So I was pounding the pavement looking for another job. And at that time I realized I really didn't want to pursue a career in the same industry. I have to go back to work because I need benefits. (Participant 11)

Three of the four non-linear participants came back to the same company or same parent company. There were two items mentioned by at least half of the participants that helped their transition back. One was keeping her network alive while she was out of work, and another was being able to come back to work part-time at first.

I took two leaves. In both cases, I was working, (where) I think I was working for the same manager. But he made it very easy. He was very flexible. Let me have some flexibility to kind of return back to work part-time and then eventually to full-time. (Participant 4)

One participant joked that when she was called by her company to come back for a temporary and part-time assignment, she never planned to still be working for them, now full-time. She emphasized that part of the reason she felt confident coming back was that she was coming back to a network that she knew and that knew her work. A key component of her coming back was that she kept the network with this company alive while she was not working there.

> I always kept in touch with the <company> after I left. And then when there was an opportunity where they said hey, do you want to come in and work for two weeks and help us out? …And I took it, and I tell several people it's been the longest two weeks of my life. That was back in (the early 90s)…. I was going back to a company and to colleagues that I knew. I knew how they worked. I knew what their expectations were. And they knew me. I was going into a very comfortable zone. (Participant 9)

Similarities and Differences Across Demographics

There were some trends in age groups and in STEM Profession Types where the data may prove interesting for further research. There seems to be a factor, either in society or in the workplace, that changed within the past 25 years that helped women integrate their life and work priorities better. This trend is potentially more prevalent for Engineering and Science professionals, although the data set is relatively small. The motivations later in participants' careers included a split between professional types. Again, the data set to compare is relatively small, making this an option for future research.

There were seven participants, who, when asked about hostile environments, answered that they experienced hostile environments generally in their early career, but did not view their current work environment as hostile. Every participant who answered in this fashion was at least 25 years into their career. No other participant interviewed agreed that the environments being hostile early in their career was more the norm than the exception.

Each STEM professional type represented in the response that early in their career, a hostile environment was the norm, with Engineering having the highest response with 3, Science second with 2 and both Math and Technology with 1. Table 3 includes these results, comparing responses with those who did not experience a hostile environment or who have

Table 3

Summary of Results on Experiencing a Hostile Environment

STEM Profession Type	Total Years in STEM
Experienced hostile environment early in career	
Engineering	25-30
Science	25-30
Engineering	25-30
Technology	>30
Science	>30
Math	>30
Engineering	25-30
Never experienced hostile environment in career	
Math	15-20
Math	15-20
Technology	20-25
Engineering	15-20
Engineering	10-15
Technology	10-15
Engineering	>30
Observed hostile environment in pockets of industry or company sub-cultures	
Science	>30
Technology	10-15
Math	15-20
Engineering	10-15

experience a hostile environment in industry pockets or subcultures. There was no vignette mapped during open coding for two participants that directly correlated to one of the categories in the table. All of the participants who expressed career sacrifices being needed to maintain a work-life balance were Science and Engineering professionals at least 25 years into their careers.

When asked about motivations that changed over the course of their career, the professionals that leaned more towards compensation as a motivator were Engineers. The professionals that leaned more towards culture were Math and Technology professionals. Science professionals were motivation by both compensation and culture later in their careers. References to the impact of politics were made only by participants who spent time working in large companies.

Support at Home

Several participants emphasized that a factor in enabling their success in the workplace is a strong home support structure. Some emphasized their personal relationships with sisters, brothers, fathers, or spouses who were also in STEM careers and the camaraderie that offered them in their personal lives when discussing work.

> My family was very supportive. (you know) I have to credit my parents. They had six kids, three girls and three boys and they never treated the girls any different than they treated the boys. And so (you know) when my sister and I both said we were going to math majors, that was perfectly acceptable to them. (Participant 2)

A few participants stated during the interview that they were surprised there was not a question on support at home because their husband's support was a key factor to them.

> I have a very supportive husband…we balance both of our careers.

> And I think that that's an absolutely huge contributor to whether women stay working or stay dedicated to their fields and dedicated full force, is what's their support structure like at home. (Participant 7)

One participant mentioned that maternity leave and staying home when the kids were young was not a huge consideration for her because of the flexibility of her husband's career.

> My husband stayed home when the kids were little. Every time I would take my maternity leave and then he would take off up to a year because he could do that. (Participant 12)

Societal Factors

Other data that transpired as a result of questions in changes over time in the workplace were very specific to changes roles of women and men in society. Societal factors that have influenced the environment both at home and at work for women to pursue and stay in challenging STEM careers may be an area for future research.

> I think the men in the technical engineering environment have come a long way to respecting women when they come back part-time or even full-time with kids. And now that the roles at home are changing, I think men have a better idea what it takes to work outside of the home but still maintain the level of family that all families need and kids need today. (Participant 9)

One participant reflected during the interview that perhaps as women were having children later now, they had time in the workplace to demonstrate their value early.

> I was 9 years into my career before I even got married. And 12 years in when I had a child. So at that point, it's probably harder to hang it up when you've already had success. And you see the earning potential. (Participant 18)

Summary

This chapter contains the results of the analysis, connects the analysis back to the research questions, and demonstrates that consistency of the analysis with grounded theory methodology. Twenty participants were interviewed for this grounded theory methodology study. Interview questions were structured to understand what factors contribute to motivating the modern woman to stay in STEM professions long term. All participants were women with a minimum of 10 years of experience in STEM professions. Four of the 20 participants had non-linear careers, as defined in this dissertation as a career path where the participant left the STEM workplace for more than 26 weeks and then returned to continue working in a STEM field.

There were three levels of analysis, open coding, selective coding, and theoretical coding, consistent with grounded theory methodology. Forty two codes emerged from open coding. Constant comparison analysis was exercised using mind-mapping and NVivo 10 software to discover nine selective codes, emerging into categories from the open codes. Additional constant comparison analysis was used to discover the relationships between and within the open and selective codes, leading to five themes. The five themes resulting from this study summarize the contributing factors that motivate women to stay in STEM professions long-term: a) *Interest in STEM is the Constant as Individual Needs and Priorities Change*, b) *Direct Manager Influence on Development is Critical*, c) *Performance-Based Workplace Policies and Culture are Continuously Sought*, d) *Moving Towards a No-Bias Workplace Remains Important*, e) *The Career Growth Path at Life's Crossroads Remains a Challenge.*

There were no differences in the factors that contribute to a woman's decision to persist in STEM professions via a linear career path versus a non-linear career path. Additional data on the similarities and differences discovered across demographics, how support at home contributes, and what societal factors contribute are also found in this chapter. While great strides have been made in creating good opportunities for women in STEM, it is evident in the research results that there is variability in how participants manage career growth while managing family priorities. Chapter V includes the summary for the critical analysis and discussion on the five themes.

CHAPTER V: DISCUSSION

The purpose of this qualitative grounded theory study was to identify what motivates women to stay in or return to STEM professions, leading to a motivation model. This chapter includes a discussion of major findings as related to the literature on women in STEM professions, women in the U.S. workplace, human and worker motivation, and what implications may be valuable for use by legislators, corporations, and women who work in or plan to pursue STEM professions. Also included is a discussion on connections to this study and motivation theories and workplace policies. A summary includes the limitations of the study and areas for future research at the end of this chapter.

This chapter contains discussion and future research possibilities to help answer the research questions: (R1) *What motivates women in STEM professions to stay in their profession long term?* and (R2) *What motivates women with non-linear careers in STEM professions to return to their profession after at least a 6 month break from their profession?* The theory for what motivates women to stay in or return to STEM professions is multi-dimensional and comprised of five themes: *a) Interest in STEM is the constant as individual needs and priorities change, b) Direct manager influence on development is critical, c) Performance-based workplace policies and culture are continuously sought, d) Moving towards a no-bias workplace remains important, and e) The career growth path at life's crossroads remains a challenge.* Some factors relate primarily to the individual, some to the workplace, and some are a combination of the successful relationship of both. All help contribute to an environment where women in STEM are challenged and can continuously grow.

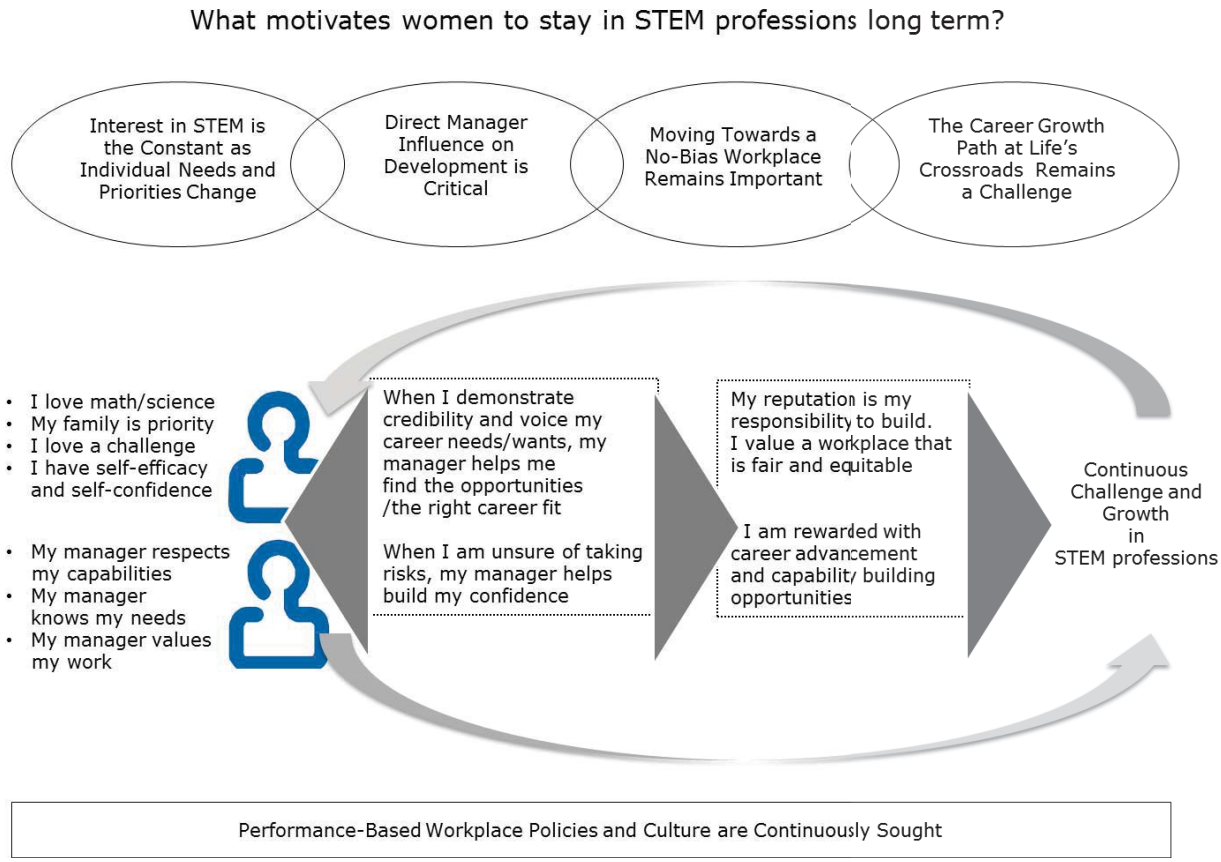


Figure 2. **Motivating Factor Themes: What Motivates Women to Stay in STEM Professions Long-Term?**

Discussion on the Model

While their career specialties, path, and experiences may include variation for each individual, each of the five common themes were prominent factors in motivating the women interviewed for this study, throughout their STEM journey. These themes have a dynamic dimension to them, as what is important to the individual changes over time. Each theme is described in detail in the follow sections.

Interest in STEM is the Constant as Individual Needs and Priorities Change

This study's conclusion that career fit is essential to motivating women to stay in STEM professions agrees with the historical literature that indicates career fit is a primary contributor and a good predictor of persistence (Giles, 2009; Jones et al., 2010; Matusovich, 2010). Career fit relates solely to an individual's interest. While one can expose someone to a profession, one cannot force them to like a specific job or career. Buse and Bilimonia (2013) concluded that among the women who had left the engineering profession, some expressed having been pushed into engineering. While some participants did admit being exposed to STEM professions by someone else, their involvement was their own idea. All participants described a genuine love for their math- and science-based careers. Participants cited enjoyment of the overall challenge of their chosen professions, often described as enjoying the problem solving, achievement, continuous learning, creativity, and the variety in their work.

This study includes the conclusion that self-efficacy in women who persisted in STEM professions was strong, in line with the literature that suggested low self-efficacy is a barrier to persistence (Buse & Bilimoria, 2013; Deemer et al., 2014; Leslie et al., 1998). All participants expressed belief in their capabilities, where many expressed having a specific

niche, which not only implied competency, but unique value in their workplace. Self-confidence is one's perception of their worth and likelihood of succeeding. Self-efficacy is the belief in one's capacity to succeed at a task or tasks. The women in this study all expressed self-efficacy throughout their career journey. Approximately half of the women expressed having self-confidence *throughout,* where approximately half of the women expressed *growing into* self-confidence.

This study is inconclusive as to what individual or workplace environmental drivers consistently contribute to why some women in STEM have low self-confidence at the start of their careers. The fact that all women had self-confidence after 10 or more years in their careers is an indicator that self-confidence, as well as self-efficacy, is important to women staying motivated in STEM professions. There were a few participants who cited self-confidence related de-motivators in the early stages of their career. While there is no one driver for lack of self-confidence, one of the consistent themes in this study was the influence of the direct manager to help instill confidence.

In this study, women emphasized family or community priorities. Even those women in the study who did not have children, expressed emphasis on their life outside of work, particularly as they matured into their careers. Throughout most interviews, the women expressed their career choices in terms of *sacrifices* or *balanced*. While some women admitted to some imbalances during times of change in their life, participants felt balanced and satisfied overall.

There was no difference in what motivated women with linear careers or nonlinear careers to stay in STEM professions. The women with nonlinear careers expressed satisfaction with their job opportunities, similar to that expressed from women in linear

careers. The women in nonlinear careers came back, because they loved their field of work, which was again, one of the primary reasons women in linear careers stayed long-term.

Direct Manager Influence on Development is Critical

While all participants expressed ownership in their career paths, across all professions and across all age demographics, participants referenced the direct manager as an important partnership throughout the career journey. Specifically, the results of this study included three sentiments: a) my manager respects my capabilities, b) he or she understands my individual needs, and c) my manager values my work. Underlying all of the sentiments expressed was an inference to trust in the employee-manager and manager-employee relationship

The emphasis on the direct manager in this study is consistent with what is in the literature regarding studies related to women in STEM. Marques (2011) made reference to the importance of the direct manager regarding how managers assist with building a reputation of confidence and how direct managers are key influences in future growth opportunities. This study's conclusion emphasizes the importance for both the worker to communicate their individual needs to the direct manager and for the direct manager to understand that needs are unique to the individual. Understanding the individual's needs, too, is in line with the literature that motivation varies according to each individual. It is important for organizations to focus on the intrinsic motivators that they can help shape, rather than just the extrinsic motivators that they can institute (Furnham et al., 2009).

One of the noticeable differences in the results of this study, as compared to existing studies, was the emphasis on direct managers versus the emphasis on mentors previously written about in the literature (Glass & Minnotte, 2010; Kerr et al., 2012; Marques, 2011; McLaren, 2009; Powell, 1992; Preston, 2004). Mentors were not overwhelmingly positioned

as drivers of motivation in this study. There were some examples in this study where participants cited peer groups, mentors, or company-sponsored mentoring programs as being helpful to them. This study is consistent with the literature that discusses the impact of mentors as *helping*, but not necessarily critical in keeping women in STEM fields (Glass & Minnotte, 2010; Kerr et al., 2012; Marques, 2011; McLaren, 2009; Powell, 1992; Preston, 2004). While the mentors and programs cited by participants in this study certainly helped assist through day-to-day challenges, the mentors were not often cited as sponsors that helped them move towards their career goals or keeping them in STEM. Their direct managers were generally cited as that key sponsor in helping them reach their goals.

Motivators change over time. It is important for managers to know their employees as individuals, to be able to understand what motivates them (Davila & Pina-Ramirez, 2014). Katarzyna and Dagmara (2012) referred to the manager-employee trust relationship as one that hinges fundamentally that the manager is in a position to make decisions that impact employees. While an employee can demonstrate competence and express a desire to move in a certain direction, within that particular company, the direct manager often has the final input into performance evaluations and career growth decisions (Katarzyna & Dagmara, 2012). Conversely, examining the employee-manager relationship through the lens of a manager, the manager has a vested interest in building the reputation and competence of his or her employees, as their work is a reflection of the manager's (Katarzyna & Dagmara, 2012).

Performance-Based Workplace Policies and Culture are Continuously Sought

Performance-based policies and culture are more satisfiers than motivators, foundational to fostering an environment for these four motivators. This study's results

emphasized that career desires and individual needs change over time, and therefore motivation to stay in or return to STEM professions may have varying points of emphasis. This multi-dimensional framework depends on the balance an individual is trying to achieve during that life stage or career stage and the options available to them in the workplace.

The literature emphasizes the importance of trust in the employee-employer relationship regarding motivation, particularly when related to fair wage (Latham, 2009). Historically, women leave STEM professions due because of the wage gaps compared with their male counterparts (Hunt, 2010). Salary inequity continues to be prevalent in the United States (Brawner et al., 2012; Giles et al., 2009; Lincoln et al., 2012; Powell, 1992; Preston, 2004; Rhea, 1996). Both full-time and part-time participants cited salary as a motivator for staying in the profession. Several cited salary as having more importance as they matured in their career, which emphasizes that salary is important in retaining women in STEM professions.

Historically, the perception also included that workplace policies are gender-biased, including workplace incentives (Pas et al., 2014; Smith et al., 2012). The participants in this study agreed that generally their workplaces had good work-life balance policies, offering them flexibility in managing their time at work and time at home. One of the most-cited structural barriers in the workplace was effective policies that promoted work-life balance (Glass & Minnotte, 2010; Kerr et al., 2012; Powell, 1992; Preston, 2004). This study is inconclusive as to whether or not policies are a barrier. Work-life balance policies were not cited as a motivator in this study because most participants attributed the flexible workplace as a part of the culture, rather than as instituted by a policy.

The results of this study would agree with the literature regarding the importance of flexible work policies. As Friedman and Lackey (1991) suggested, the results of this study indicated that a work schedule that allows more control over their lives is a motivator for women to persist in STEM professions. Flexible work arrangements were highly valued by the women who participated in this study, which is consistent with conclusions found by Catalyst (2013). Consistent with the Catalyst (2013) study, the women in this study indicated downsizing their aspirations at times in their career, even if their workplace policies afforded them a flexible work arrangement. This finding may be indicative that the workplace will employ women at comparable wages with flexible arrangements, but not target them for advancement opportunities.

One interesting difference in flexibility in the women interviewed for this study was the level of flexibility that the women had. Some defined flexibility as being able to leave the office for a child's school function. Others described flexibility in terms of a restructured work week beyond the traditional 9-5. Other participants defined flexibility as working from home. There is no standard *flexibility*. Within the United States, a minimum wage exists, as well as maternity leave. If flexibility is so critical to creating work-life balance, perhaps it is time to do something different with how it is approached for every worker, making the workplace a step closer to humanizing on a more consistent scale.

Moving Towards a No-Bias Workplace Remains Important

In previous literature, commonly cited barriers related to organizational culture and women progressing in STEM careers included workplace recognition barriers (Glass & Minnotte, 2010; Lincoln et al., 2012; Thilmany, 2010); workplace culture barriers (Beddoes & Borrego, 2011; Bystydzienski & Bird, 2006; Cheryan, 2012; Deemer et al., 2014; Glass & Minnotte, 2010; Kerr et al., 2012; Leslie, McClure, & Oaxaca, 1998; Lincoln et al., 2012;

Malcolm & Malcolm, 2011; Marques, 2011; McLaren, 2009; Powell, 1992; Thilmany, 2008; Washburn, 2007) and other male-dominated workforce barriers (Fouad, Singh, Fitzpatrick, & Liu, 2012; Thilmany, 2008). The participants in this study did not perceive the male-dominated workforce professions as a modern day barrier for STEM. Previous literature cited women feeling as if they were *tokens of diversity* on leadership teams (Glass & Minnotte, 2010; Lincoln et al., 2012).

Previous studies undertaken referred to lack of invitations to informal networks in the workplace (Glass & Minnotte, 2010; Kerr et al., 2012). Many women who participated in this study acknowledged that they were a noticeable minority. The male majority was not cited as a barrier and there was no dominant suggestion that women felt like they were diversity tokens, or felt left out of networks in the modern day STEM workplace. There were two exceptions: hostile environments were noted in pockets of the workplace or at earlier times in their careers.

Workplace recognition and workplace culture are factors in women staying motivated in STEM professions, as was described early in this chapter. These factors include mention here as the literature often positioned the barrier of workplace recognition and workplace culture barriers in connection with the male-dominated workforce that is prevalent in STEM professions (Beddoes & Borrego, 2011; Bystydzienski & Bird, 2006; Cheryan, 2012; Deemer, Thoman, Chase, & Smith, 2014; Glass & Minnotte, 2010; Kerr et al., 2012; Leslie, McClure, & Oaxaca, 1998; Lincoln et al., 2012; Malcolm & Malcolm, 2011; Marques, 2011; McLaren, 2009; Powell, 1992; Thilmany, 2008; Washburn, 2007).

Workplace recognition, despite not being positioned by the women interviewed in this study as being unequal, was certainly still seen as an uphill challenge for some women at

times in their career in terms of juggling family priorities and finding satisfying roles and growth opportunities. Having credibility is based on another's judgment of your capabilities. As the reputation is still heavily based on a small few (direct manager, direct leadership teams) and not positioned as the workplace overall, it seems like there could still be a bias for women in STEM professions regarding growth opportunities.

The participants in this study did not project the inflexible work culture positioned in the literature. Further, the participants acknowledged some long work weeks but the participants did not see these times as barriers, but part of the payback they make to the company for the flexibility they have to leave work or work from home when their personal life requires more time (Tomlinson et al., 2005). References included workplace culture as having a higher influence than workplace policies. The women in this study had mixed thoughts on workplace culture, particularly those in large organizations that noted a dislike for politics.

Since some of the hostile environment behaviors still exist in pockets, it is reasonable to suggest that the modern day STEM workplace is not completely free from remnants of the past. The positive step-changes towards performance-based policies and culture seem to be evidence of broad organization changes that help to motivate women to stay in STEM professions. What remains unclear is whether or not a stigma related to growth opportunities continues to be perpetuated because of implicit bias of the still typical male-dominated STEM culture.

The Career Growth Path at Life's Crossroads Remains a Challenge

The women in this study had various career paths, very unique to the individual. As this study verified, women in STEM seek a challenge, they enjoy learning, and enjoy doing something new. In other words, they like to continuously grow. Career growth motivation

for the women in STEM in this study was not just described as a linear trajectory up the corporate hierarchy, particularly when life event importance outweighed professional advancement as a personal priority for them in their own individual circumstance.

Freidman and Greenhaus (2000) called these career choices leaning towards having *much of it all* where women make choices that had a career sacrifice element to it at a particular life stage. Having much of it all, or *having it all*, *perhaps not always at the same time* is a similar sentiment to what the women interviewed in this study expressed. Women still want to be challenged and still have goals to achieve in their career in STEM when they marry and have children. Women in STEM expect that they will be seen first and foremost as a professional in the lens of their managers, co-workers, and clients.

Throughout their career journey stories, the women in this study largely shared their career growth opportunities through a positive lens. Many directly spoke about, or implied, that they had several occasions where the choices along their career path had a work-life balance component to consider. Some participants in this study spoke about career choices that they made to reshape their day or role when having children, where the roles helped them continue towards a steadily upward trajectory career path. For example, one participant worked 4 days, 10 hours a week. Other participants conversely spoke about the conscious choices of taking roles that were career growth sacrifices made in lieu of prioritizing family first. This outcome was especially the sentiment expressed by women who took part-time roles.

Women in this study voiced that they had growth opportunities, but not all were motivated to be on a career *fast track*. Some women were. Many participants enthusiastically heralded growth opportunities provided through lateral moves as beneficial

to their growth and development. Some women indicated that part-time work was critical to them pursuing their careers. Part-time work is not rewarded with growth opportunities, according to the women in this study.

The STEM workforce is not unique in this phenomenon, popularly known as work-life balance. Scholar articles refer to this dynamic as the work-family conflict (Kanter, 1997; Sperling, 2011). Kanter (1997) suggested that the workplace had to consider changes in the worker-employee relationship as the post-industrial society emerged in America.

All STEM professionals in this study cited conscious changes that they made to improve their own work-family conflict, particularly during periods of change in their careers. While many of the women cited changes made when they had children, some cited their individual interests outside of work. Participating in horse riding, golf, travel, volunteering, and other out-of-work activities were cited as enjoyable activities and in some cases positioned as stress management activities that their work day flexibility helped enable.

Discussion on Fit with Existing Motivation Models

Chapter II included descriptions of several motivation models. These models included Maslow's Hierarchy of Needs, Herzberg's Two-Factor theory, goal setting theory, equity theory, self-efficacy theory, and expectancy-value theory. How the motivation model discovered in this study fits with these models is discussed in the following sections.

Maslow's Hierarchy of Needs Theory

Maslow's (1964) Theory of a Hierarchy of Needs includes the suggestion that only upon fulfilling the lower needs of security, safety, and belonging, can a person realize growth, or self-actualization. In this study, a good salary and good working conditions in a performance-based culture and rewards and recognition, most closely linked to the security

and safety layers of the Maslow Hierarchy. The results of this study aligned with Maslow's Theory that certain basic needs are important. These needs are not necessarily in a hierarchy with belonging and growth. The results of this study confirmed that the motivation hierarchy is not rigid.

The motivations of individuals for belonging are important, as this study emphasizes the importance of women's reputation and credibility, but belonging is not necessarily a prerequisite for persistence in growth in STEM professions. The women in STEM professions interviewed in this study seemed to grow through various periods of self-actualization and regrowth in their careers, based on their desires and expectations of themselves as they grew as a person. The cycle of continuous growth is a strong component of what keeps women in STEM motivated, consistent with Maslow's Theory where people continue to seek experiences that stretch them, relentlessly seeking ways to explore their intrinsic interests until satisfied with reaching the peak of their capabilities.

Herzberg's Motivation Theory (Two Factor Theory)

When comparing this study's results with motivation theory, similarities and differences exist. Herzberg's motivation theory separates intrinsic and extrinsic factors, suggesting motivating factors (intrinsic) and hygiene factors (extrinsic) exists as one examines motivation in the workplace (Robbins & Judge, 2009). Looking first at extrinsic factors such as a) the quality of supervision, b) compensation, c) working conditions, d) company policies, and e) relationships with others, it is evident that these extrinsic factors are important to women in STEM professions.

While the results of this study confirmed that compensation, working condition, and company policies were important foundational components of their workplace experience,

the women in this study placed increased emphasis on their direct manager and on their ability to build credibility. The intrinsic factors of growth, recognition, and the work itself in Herzberg's theory are found as essential component for women in STEM professions in this study. Growth is a focal point of motivation in this study, where the women expressed the desire to continuously grow. All of the women expressed a genuine and sustained interest in math and science. Recognition links heavily to reputation and credibility building, essential to keeping women motivated to stay in STEM professions.

Goal-Setting Theory

Goal-setting theory is based on performance and feedback (Robbins & Judge, 2009). Several participants cited structured performance and development discussions, with two participants even indicating specific, measurable, achievable, realistic and timely (SMART) goals as used in goal-setting theory. Goal-setting theory is very task-based, and while it offers a good communication platform for task-based discussions, if used in the absence of a longer term employee development tool, the richness of the conversation is limited.

Self-Efficacy Theory

The premise of self-efficacy theory suggested that with self-efficacy increased with positive feedback, where the worker will be motivated to perform better (Robbins & Judge, 2009). Self-efficacy theory has strong ties to the motivation of women in STEM professions interviewed in this study. Every woman interviewed in this study expressed strong self-efficacy. Even those who mentioned maturing into self-confidence expressed having self-efficacy, even early in their careers. The women interviewed in this study were committed to their professional goals. While they sometimes credited the support of co-workers, spouses,

and friends, the women expressed an efficacious attitude towards their capabilities to overcome challenges by heightening their efforts or acquiring new skills.

Expectancy-Value Theory

The premise of expectancy-value theory considers competency beliefs and values in motivation (Jones et al., 2010; Matusovich et al., 2010). Strong parallels exist within this study regarding expectancy-value theory. This study found that women in STEM professions have different needs and values over the course of their career. Expectancy-value theory is behavioral-based, making it potentially a good fit for managers of women in STEM. It is clear from this study that women in STEM are goal-oriented individuals, where their values at work evolve with their responsibilities for family and work over time. Keeping the seesaw of the work-family conflict balanced for women in STEM heavily depends on a trusting direct manager-employee relationship.

Equity Theory

The premise of equity theory suggested the motivation of individuals to eliminate inequities when compared to their peers (Robbins & Judge, 2009). It is difficult to assess equity theory in relation to the findings of why women include motivation to stay in STEM professions in this study, as there were no direct questions asking about equal treatment. Some women implied that they were disappointed that women did not have equal representation and would likely not for a couple generations.

Discussion on Society's Role in Helping Women Persist in STEM Professions

Bias may be undermining the chances for women to attain equity for career growth opportunities. Today, the workforce has more dual-income families, more employees working into what was previous viewed as retirement years, more workers going back to college while they are working, and more women entering the workforce than in the past

(Wittmer & Martin, 2013). Only 13% of American households have single earners (Wittmer & Martin, 2013). If 87% of the workforce works under the influence of a career growth framework created to grow a demographic of workers married men with a wife at home taking care of the children, and only 13% actually are that demographic, then arguably the career growth framework in contemporary organizations needs to be re-balanced. Society has a voice in helping to create a more balanced approach to development and growth opportunities, as history indicated that legislation can help to move the dial in creating equity in the workplace. Industry has not yet demonstrated the ability to drive substantial change in creating equity for career growth paths.

The results of this study seem to indicate that U.S. workplace policies may not be as progressive as those in other advanced countries such as Australia, England, Sweden, New Zealand, and Canada, whose policies offer incentives for recruiting women in STEM professions in particular (Giles et al., 2009; Preston, 2004). The United States lags behind European countries in workplace policies that aid worker success in setting the worker up for success, particularly in terms of childcare, or aiding the career success potential of the primary caregiver.

It has been over 40 years since the United States enacted effective legislation, through Title IX in 1972 that helped to aid women's success in the workplace, by instituting laws to minimize overt sexism. It took the United States 9 years to pass the Family Medical Leave Act in 1993, legislation that mandates 12 weeks of unpaid leave without fear of job loss, considered a tremendous step forward for working women and dual-income families at the time. It is clear that the act is not only limited, because of the limitations of the law, only 46.9% of the U.S. private sector workforce is protected by it (Kulow, 2012), severely lagging

behind other developed countries, where women and men are protected for a year of paid leave (Kulow, 2012).

If the United States wants to continue to compete in an international economy to attract the brightest men and women in STEM professions, the United States should consider more progressive laws to become a country that is an attractive option for the dual-income family. Throughout U.S. history, women are positioned as the primary caregiver (Cohen, 1996; Sperling, 2011). Family leave still impacts women more so than men. Perhaps this imbalance too needs to change, for the work-life conflict transition to work-life balance as women and men increasingly moves towards more equal shares in the responsibilities at work and at home.

Literature on the topic of the male-female equity and balance of home and family life indicated that despite legislation that provides some family-friendly accommodations, such as the U.S. Family Medical Leave Act, employers are one-sided on exercising all of the Act's intent, particularly the aspect of the act that provides accommodation for men to assume more family responsibilities (Sperling, 2011). Studies indicated that men who have exercised their rights laid out in FMLA are penalized at work, signaling that after over 20 years of the legislation being in place, the workplace has not evolved to project a view that men and women are equal caretakers in the home (Sperling, 2011). Workplace policies are gender-neutral in print, but not necessarily in practice, resulting in few fathers exercising their options for paternal benefits (Sperling, 2011).

Another area that could benefit from a better understanding of how to aid U.S. workers career advancement, is to consider more protection for the part-time worker. The stigma that the part-time worker is less dedicated to the workplace is an outdated stigma

based on a 9-5 work schedule, which today does not even exist for many full-time workers. Since women make up more than two-thirds of part-time workers in the United States, this stigma is likely to be more concentrated in the female workforce population (Hirsh, 2005). With regard to work-life balance policies that offer flexible-hours workplace cultures, this study provided some evidence to support that flexible workplace policies do not have a stigma directly related to performance. The results of this study imply that a stigma does exist in the workplace related to growth opportunities.

While workplace norms trend towards more flexible policies and societal norms are starting to move towards more caretaking responsibilities for men, neither of these environmental norms came without the help of legislative intervention (Sperling, 2011). There is a proposed Working Families Flexibility Act being considered in the United States at the federal level, which is long overdue, considering 177 nations in the world offer paid leave for new mothers and 74 for news fathers, where the United States does not yet require any (Furlow, 2014). It seems that the lack of growth opportunities, often positioned as career sacrifices, were acceptable to the women interviewed in this study. Societal bias is not segmented to women in STEM professions, but to professional women in general in the United States. Because women remain the minority overall in STEM professions, the bias filtering into the organization may be compounded.

Discussion on the Role of Industry Helping Women Persist in STEM Professions

The emphasis participants placed on their conscious choices to alter their work schedules to attain work-life balance is an indicator that the individual working mother in STEM professions may have their career path limited, because of the way certain jobs have historically been structured in the workplace. The concern for growth in a career is not unique to women in STEM professions. In the United States companies in general "do not

promote employees whose work is conditioned on a child's unexpected needs", [coined by the University of California at Hastings college as] "family responsibility discrimination" (Kulow, 2012, p. 90). Many companies have adopted policies that aid work-life balance. The argument trends towards making these benefits more universal and consistent.

The results of this study supported the notion in the literature that work-life balance is an important focus for women in the workplace (Pas et al., 2013; Smith et al., 2012). For the women in STEM professions who participated in this study, work-life conflict was not consistently viewed. Some viewed their choices as a sacrifice. Others viewed their choices as almost the norm. Others expressed gratitude to be able to do both, and similar to the literature, it was clear in this study that women in STEM internalize the roles of being a mother, worker, and wife (Pas et al., 2013).

Instead of positioning the work-life conflict as a struggle, the women in STEM professions who participated in this study seemed genuinely at peace with their choices overall, and viewed their choices as the right choice for the right time for their family. It is evident in this study that growth opportunities remain somewhat of a barrier for women in STEM. The traditional view of climbing the ladder, based on a traditional male workforce with little home responsibilities, is not creating a fair and equitable workplace for women, or any working parent who bears responsibility at home (Pas et al., 2012).

Limitations and Recommendations for Future Research

While the researcher still agrees that qualitative research was the right choice for this study, qualitative research tools, such as interviews, are not designed to capture hard facts. More credibility could be given to this study if coupled with quantitative research. For example, a survey designed for quantitative research, and subsequent statistical analysis, may offer more evidence to strengthen the data discovered using qualitative research tools.

Several areas for future research on targeted demographics could add to the findings in this study. A quantitative study could be developed to understand what role company size plays in compensating for performance versus development, since several participants in this study cited the politics of a large organization as something negative. Another demographic to study differences in would be motivation throughout the career journey, potentially even soliciting candidates of different age groups that would be willing to answer survey questions over a 5 to 10 year period to determine if there are large shifts over time in the motivation of an individual and if there are similarities across women in STEM professions.

Another quantitative study that would help to couple with this study's finding would be a study using larger and more diverse population, potentially comparing the perspectives of women and their managers in STEM across the United States. With regard to qualitative research, a more diverse demographic of using a participant and manager combination may better be able to describe the role of the direct manager in motivation. The same qualitative survey as this study potentially could be used. A broader demographic of participants and managers may give more insight into if the development of women in STEM is credited as heavily to managers as is this study.

From a race perspective, this study lacked diversity of participants. According to the U.S. Department of Commerce Report (2013), 41% of STEM professionals are Asian, 23% are non-Hispanic White, and only 6% are Black, with the remaining percentage not identifying themselves. A broader demographic of participants alone may be an area for future search, noting that all 17 of the 20 participants that did answer the demographic questionnaire were non-Hispanic White participants.

As far as additional topics to explore, any qualitative or quantitative study that sought to validate the discussion in this chapter on society's role and the workplace's role with regard to changing the framework with which we judge employees for growth opportunities would be of interest. A number of different angles could be explored. One might compare women's and men's perceived growth opportunities in the STEM workplace, or study bias in the workplace linked to how different employee age groups view the opportunities and barriers for growth in the STEM workplace.

Lee (2012) suggested a potential for studies involving employees who stayed versus left a work environment. Another angle to explore, then, may be to compare career stages of women who leave STEM professions and what is different at those career stages for women that stay. A literature review research project that studied changes in the U.S. law impacting work-life conflict, compared with changes in women in STEM worker attitude towards the workplace culture, might be useful to view any changes over time. A study that looked closer into the effects of part-time positions with respect to career growth opportunities for women in STEM over the course of their career journey may add further insight into whether or not the historically male fast-track career trajectory is still seen as *the* way to advance one's career.

Summary

The notion of a modern-day work environment that exhibits deeply rooted cultural and structural barriers for women in STEM is generally rejected in this study, although some bias is still evident today. Motivating factors for women in STEM mirror motivating factors for any worker. One exception is the emphasis on, and the inconsistency of, descriptors

placed on growth or advancement opportunities, suggesting that growth opportunities are still a barrier today.

If the STEM workforce is vital to the United States as a nation, where the STEM workforce is only 13% female for engineering and 26% female for science, technology, and math (NSF, 2012), society still has work to do to help build and retain the STEM workforce. There is no data to suggest in this study or others that the workplaces for STEM professionals have consistent policies, cultures, and values for the individual. If the U.S. workplace is not consistently creating an environment where women in STEM professions are motivated throughout their career journeys, and laws are not equipping women to balance both work and families, then there is still work to do to advance the United States in the global race in science, engineering, technology, and math.

The results of this study suggested that there are five themes related to motivating factors for women who have stayed in STEM professions long-term: a) *Interest in stem is the constant as individual needs and priorities change*, b) *Direct manager influence on development is critical* c) *Performance-based workplace policies and culture are continuously sought* d) *Moving towards a no-bias workplace remains important,* and e) *The career growth path at life's crossroads remains a challenge*. For the first, career fit is essential in relation to an individual's interest. For women in STEM, a career with challenge is key. Family priorities were emphasized as high priority individual needs, particularly when just starting to have a family.

Direct managers were consistently cited as key to staying motivated, particularly as direct managers were seen as the gateway to new challenges and growth opportunities. A fair workplace has a foundation of performance-based policies and culture. Both are

expected in the workplace of today and the future. The no-bias workplace directly relates to helping foster a good reputation. This perhaps is recognition of the opposite of a hostile workplace being a workplace where a women's credibility is not readily undermined. Continuous career challenge at life's crossroads is a reference to several dimensions related to career growth. The women in this study emphatically voiced their interest in being challenged and wanting to continuously grow.

While the attitudes that the women expressed as they shared their career experiences were positive, it was somewhat disturbing to hear the energy focused in the career growth and development opportunities. The participants in this study presented themselves as competent, experienced women, who genuinely loved their work, who spoke of their managers with high regard and who generally viewed their compensation as satisfactory. Yet, the participants had such varying descriptors about how they felt about their growth opportunities throughout their careers. Some used the word *sacrifice* to describe a growth opportunity, referring to those opportunities that were lateral or part-time. Participants saw these positions as an opportunity to stay in STEM, but at a cost to their career in STEM.

Some described growth opportunities as promotions. The words that women used when describing how they felt about promotions included an emphasis on being *valued*. If companies want to motivate women in STEM, career growth paths have to be modernized so that all growth opportunities result in the employee feeling like their careers are being invested in. If women learn new skills as part of lateral and part-time work, options they take to balance family priorities, and they are not justly considered for promotional opportunities, then the workplace has a built-in de-motivator for women. In STEM professions, where the

workers are knowledge workers, not industrial age workers, treating any growth opportunity as anything other than an investment is not only archaic, it is potentially discriminatory.

The hostile environment may not be as evident on the surface since overt discrimination that used to plague the STEM workplace is largely a practice of the past. The ownership for career advancement is primarily on the individual, which is not necessarily wrong. If the individual is also a caretaker, he or she has to choose between a career track that offers them promotions and rewards for their advancing skills and a career track that offers them lateral moves or part-time work in exchange for their advancing skills. Advancing skills are advancing skills. The results of this study suggested that women in STEM are motivated to be challenged continuously and motivated to grow. Hopefully, the workplace will soon start to recognize growth through a non-biased lens. Hopefully, in future studies, no mention of bias will be referenced by women in STEM at any point in their journey. Until then, opportunities for the workplace and government to help remove bias remain.

References

Ambrose, S., Dunkle, K., Lazarus, B., Nair, I., & Harkus, D. (1997). *Journeys of women in science and engineering: No universal constants*. Philadelphia, PA: Temple University Press.

Barber, L. (1995). U.S. women in science and engineering, 1960-1990: Progress toward equity? *The Journal of Higher Education, 66*(2), 213-234. Retrieved from http://www.jstor.org/stable/2943912

Barclay, S., Stoltz, K., & Chung, Y. (2011). Voluntary midlife career change: Integrating the transtheoretical model and the life-span, life-space approach. *The Career Development Quarterly, 59*, 386-399. doi:10.1002/j.2161-0045.2011.tb00966.x

Baumgartner, M., & Schneider, D. (2010). Perceptions of women in management: A thematic analysis of razing the glass ceiling. *Journal of Career Development, 37*, 559-576. doi: 10.1177/0894845309352242

Beasely, M., & Fisher, M. (2012). Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors. *Social Psychology of Education, 15*, 427-448. doi:10.1007/s11218-012-9185-3

Beddoes, K., & Borrego, M. (2011). Feminist theory in three engineering education journals: 1995-2008. *Journal of Engineering Education, 100*(2), 281-303. doi:10.1002/j.2168-9830.2011.tb00014.x

Catalyst Research Center Report. (2013). *The Great Debate: Flexibility vs. Face Time Busting the Myths Behind Flexible Work Arrangements.* Retrieved from http://www.catalyst.org/system/files/the_great_debate_flexibility_vs_face_time.pdf

Birks, M., & Mills, J. (2011). *Grounded theory: A practical guide.* London, UK: Sage.

Brawner, C., Camacho, M. Lord, S., Long, R., & Ohland, M. (2012). Women in industrial engineering: Stereotypes, persistence, and perspectives. *Journal of Engineering Education, 101*(2), 288-318. doi:10.1002/j.2168-9830.2012.tb00051.x

Bryant, A., & Charmaz, K. (2010). *The Sage handbook of grounded theory*. London, England: Sage.

Buse, K., & Bilimonia, D. (2013). Why they stay: Women persisting in U.S. engineering careers. *Career Development International, 18*(2), 139-154. doi:10.1108/CDI-11-2012-0108

Bystydzienski, J. (2009). Why so few women? Explaining gendered occupational outcomes in science, technology, engineering and math fields. *Sex Roles, 60*, 751-753. doi:10.1007/s11199-008-9548-6

Bystydzienski, J., & Bird, S. (2006). *Removing barriers: Women in academic science, technology, engineering, and mathematics.* Bloomington, IN: Indiana Press.

Cech, E., Rubineau, B., Silbey, S., & Seron, C. (2011). Professional role confidence and gendered persistence in engineering. *American Sociological Review, 76*, 641-666. doi:10.1177/0003122411420815

Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis.* London, UK: Sage.

Cheryan, S. (2012). Understanding the paradox in math-related fields: Why do some gender gaps remain while others do not? *Sex Roles, 66*(3-4), 184-190. doi:10.1007/s11199011-0060-z

Cohen, A. (1996). A brief history of federal financing for child care in the United States. *The Future of Children, 6*(2), 26-40. doi:10.2307/1602417

Congressional Record: Daily Digest of the 110th Congress First Session. (2007). Retrieved from http://books.google.com/books?id=nt1ARbBaSGgC&printsec=frontcover#v

=onepage&q&f=false

Cordero, E., Porter, S., Israel, T., & Brown, M. (2010). Math and science pursuits: A self-efficacy intervention comparison study. *Journal of Career Assessment, 18*, 362 375. doi:10.1177/1069072710374572

Dávila, N., & Piña-Ramírez, W. (2014). What drives employee engagement? It's all about the 'I'. *Public Manager, 43*(1), 6-9. Retrieved from https://www.td.org/Publications/Magazines/The-Public-Manager/Archives/2014/Spring/What-Drives-EmployeeEngagement-Its-All-About-the-I

Deemer, E. D., Thoman, D. B., Chase, J. P., & Smith, J. L. (2014). Feeling the threat: Stereotype threat as a contextual barrier to women's science career choice intentions. *Journal of Career Development, 41(*2), 141-158 doi:10.1177/0894845313483003

Drury, B., Siy, J., & Cheryan, S. (2011). When do female role models benefit women? The importance of differentiating recruitment from retention in STEM. *Psychological Inquiry, 22*(4), 265-269. doi:10.1080/1047840X.2011.620935

Esponisa, L. (2011). Pipelines and pathways: Women of color in undergraduate STEM majors and the college experiences that contribute to persistence. *Harvard Educational Review, 81*(2), 209-240. Retrieved from http://her.hepg.org/content/92315ww157656k3u/

Etzkowitz, H. (2008). Removing barriers: Women in academic science, technology, engineering, and mathematics. *Contemporary Sociology, 37*(1), 24-25. doi:10.1177/009430610803700108

Etzioni, A. (1964). *Modern organizations.* Englewood Cliffs, NJ: Prentice Hall.

Fouad, N., Fitzpatick, M., & Liu, J. (2011). Persistence of women in engineering careers: A qualitative study of current and former female engineers. *Journal of Women and Minorities in Science and Engineering, 17*(1), 69-96. doi:10.1615/JWomenMinorScienEng.v17.i1.60

Fouad, N., Singh, R., Fitzpatrick, M., & Liu, J. (2012). *Stemming the tide: Why women leave engineering (National Science Foundation Report 2012*). Retrieved from the University of Milwaukee-Wisconsin website http://studyofwork.com/files/2012/10/NSF_Report_2012-101d98c.pdf

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth Publishers.

Freidman, M., & Lackey, G. (1991). *The psychology of human control: A general theory of purposeful behavior*. New York, NY: Praeger Publishers.

Friedman, S. D., & Greenhaus, J. H. (2000). *Work and family - allies or enemies?: What happens when business professionals confront life choices.* New York, NY: Oxford University Press.

Furnham, A., Eracleous, A., & Chamorro-Premuzic, T. (2009). Personality, motivation, and job satisfaction: Herzberg meets the Big Five. *Journal of Managerial Psychology, 24*, 765-779. doi:10.1108/02683940910996789

Gilbert, A. (2009). Disciplinary cultures in mechanical engineering and material science. *Equal Opportunities International, 28*(1), 24-35. doi:10.1108/0261015910933613

Giles, M., Ski, C., & Vrdoljak, D. (2009). Career pathways of science, engineering and technology research postgraduates. *Australian Journal of Education, 53*(1), 69-86. doi:10.1177/000494410905300106

Gill, S. (2012). Book review: Workplace flexibility: Realigning 20th- century jobs for the 21st-century workforce. *Gender & Society, 26*, 521-522. doi:10.1177/0891243211408719

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research.* New Brunswick, NJ: Aldine Transaction.

Glass, C., & Minnotte, K. (2010). Recruiting and hiring women in STEM fields. *Journal of Diversity in Higher Education, 3*(4), 218-229. doi:10.1037/0020581

Grosvold, J. (2011). Where are all the women? Institutional context and the prevalence of women on the corporate board of directors. *Business & Society, 50*, 531-555. doi:10.1177/0007650311408791

Heilbronner, N. (2013). The STEM pathway for women: What has changed? *Gifted Child Quarterly, 57*(1), 39-55. doi:10.1177/0016986212460085

Hewlett, S. (2007). *Off-ramps and on-ramps: Keeping talented women on the road to success.* Boston, MA: Harvard Business School Publishing.

Hira, R. (2010). U.S. Policy and the STEM workforce system. *American Behavioral Scientist, 53*, 949-961. doi:10.1177/0002764209356230

Hunt, J. (2010). *Why do women leave science and engineering?* Cambridge, MA: National Bureau of Economic Research. doi: 10.3386/w15853

Ibison, M., & Baily, B. (2009). Women's advancement: One engineering firm's pathway to leadership. *American Water Works Association Journal, 101*(8), 44-51. Retrieved from http://www.environmental-expert.com/articles/women-s-advancement-one engineering-firm-s-pathway-to-leadership-70139

Johns, M. (2008). Understanding the gender gap in science, technology, engineering, and mathematics fields: Empirical approaches to a puzzling phenomenon. *Sex Roles, 58* , 590-591. doi:10.1007/s11199-007-9328-8

Jolly, J. (2009). Historical perspectives: The National Defense Educations Act, current STEM initiative, and the gifted. *Gifted Child Today, 32*(2), 50-53. doi:10.4219/gct-2009-873

Jones, B., Paretti, M., Hein, S., & Knott, T. (2010). An analysis of motivation constructs with first-year engineering student: Relationships among expectancies, values, achievement, and career plans. *Journal of Engineering Education, 99*, 319-336. doi:10.1002/j.2168-9830.2010.tb01066.x

Jonsen, K., Tatli, A., Ozbilgin, M., & Bell, M. (2013). The tragedy of the uncommons: Reframing workforce diversity. *Human Relations, 66*(2), 271-294. doi:10.1177/0018726712466575.

Kanter, R. M. (1977). *Work and family in the United States: A critical review and agenda for research and policy.* New York, NY: Russell Sage Foundation.

Katarzyna, K., & Dagmara, L. (2012). The importance of trust in manager-employee relationships. *International Journal of Electronic Business Management, 10*(3), 224-233. Retrieved from: http://ijebm.ie.nthu.edu.tw/ijebm_web/IJEBM_static/Paper-V10_N3/A06.pdf

Katz, F. (1968). *Autonomy and organization: The limits of social control*. New York, NY: Random House.

Katz, D., & Kahn, R. (1966). *The social psychology of organizations.* New York, NY: John Wiley & Sons.

Kerr, B., Multon, K., Syme, M., Fry, N., Owens, R., Hammond, M., & Robinson-Kurplus, S. (2012). Development of the distance from Privilege measures: A tool for understanding the persistence of talented women in STEM. *Journal of Psychoeducational Assessment, 30*(1), 88-102. doi:10.1177/0734282911428198

Khanin, D., Turel, O., & Mahto, R. (2012). How to increase job satisfaction and reduce turnover intentions in the family firm: The family-business embeddedness perspective. *Family Business Review, 25*, 391-408. doi:10.1177/894486512441944

Kulow, M. D. (2012). Legislating a family friendly workplace: should it be done in the United States? *Northwestern Journal of Law and Social Policy, 7* (Winter), 88-115. Retrieved from http://scholarlycommons.law.northwestern.edu/cgi/iewcontent.cgi?article=1081&context=njlsp

Lambert, E., & Hogan, N. (2009). The importance of job satisfaction and organizational commitment in shaping turnover intent: A test of a causal model. *Criminal Justice Review, 34*(1), 96-118. doi:10.1177/0734016808324230

Latham, G. (2009). *Becoming the evidence based manager: Making the science of management work for you*. Boston, MA: Nicholas Brealey Publishing.

Lee, J. (2012). *Stereotypes, interest, and persistence: An examination of why women leave the science, technology, engineering, and math fields.* Long Beach, CA: California State University.

Leedy, P., & Ormrod, J. (2012). *Practical research: Planning and design* (10th ed.). Upper Saddle River, NJ: Pearson.

Leslie, L., McClure, G., & Oaxaca, R. (1998). Women and minorities in science and engineering. *The Journal of Higher Education, 69*(3), 239-276. Retrieved from http://www.jstor.org/stable/2649188

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry.* Newbury Park, CA: Sage Publications.

Lincoln, A., Pincus, S., Koster, J., & Leboy, P. (2012). The Matilda Effect in science: Awards and prizes in the US, 1990s and 2000s. *Social Studies of Science, 42* 307-320. doi:10.1177/0306312711435830

Locke, E. (1976). The nature and causes of job satisfaction. In M. D. Dunnette (Ed.), *Handbook of industrial and organizational psychology* (pp. 1297-1349). Chicago, IL: Rand McNally.

London, M. (1983). Toward a theory of career motivation. *Academy of Management Review, 8*, 620-630. doi:10.5465/AMR.1983.4284664

Lowell, B. (2010). A long view of America's immigration policy and the supply of foreign-born STEM workers in the United States. *American Behavioral Scientist, 53*, 1029-1044. doi:10.1177/0002764209356237

Malcolm, L., & Malcolm, S. (2011). The double bind: The next generation. *Harvard Educational Review, 81*(2), 162-171. Retrieved from http://her.hepg.org/content/a84201x508406327/

Marques, V. C. (2011). *Emerging leadership styles: Women's success strategy in engineering organizations and the new management paradigm*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3454093)

Maslow, A. (1964). *Toward a psychology of being.* New York, NY: Van Nostrand Reinhold.

Matusovich, H., Streveler, R., & Miller, R. (2010). Why do students choose engineering? A qualitative, longitudinal investigation of student's motivational values. *Journal of Engineering Education, 99*(4), 289-303. doi:10.1002/j.2168-9830.2010.tb01064.x

Mavriplis, C., Heller, R., Bell, C., Dam, K., Yassinskaya, N., Shaw, M., & Sorensen, C. (2010). Mind the gap: Women in STEM career breaks. *Journal of Technology Management & Innovation, 5*(1), 140-151. Retrieved from http://www.redalyc.org/articulo.oa?id=84716409011.

McClaren, P. (2009). Women and minorities in science, technology, engineering and mathematics: Upping the numbers. *Canadian Journal of Administrative Sciences, 26*(2), 170-171. doi:10.1002/cjas.99

McClelland, D. (1984). *Motives, personality, and society: Selected papers*. New York, NY: Praeger Publishers.

McIlwee, J., & Robinson, J. (1992). *Women in engineering: Gender, power, and workplace culture*. Albany, NY: State University of New York Press.

Morganson, V., Jones, M., & Major, D. (2010). Understanding women's under representation in science, technology, engineering, and mathematics: The role of social coping. *The Career Development Quarterly, 59*(2) 169-179. doi:10.1002/j.21610045.2010.tb00060

National Science and Technology Council. (2013). *Summary from the Office of Science and Technology Policy.* Retrieved from http://www.whitehouse.gov/administration/eop/ostp/nstc

National Science and Technology Council Report. (2011). *Federal science, technology, engineering, and mathematics Education Portfolio: A report from the federal inventory of STEM education fast-track action committee on STEM education.* Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/costem_federal_stem_education_portfolio_report.pdf

National Science Foundation Report. (2012). Science and engineering labor force. Retrieved from www.nsf.gov/statististics/seind12/pdf/c03.pdf

Nebel, E. (1978). Motivation, leadership, and employee performance: A review. *Cornell Hotel and Restaurant Administration Quarterly, 19*(1) 62-69. doi:10.1177/001088047801900112

Noe, R., Hollenbeck, J., Gerhart, B., & Wright, P. (2010). *Human resource management*. New York, NY: McGraw Hill / Irwin.

Pas, B., Peters, P., Doorewaard, H., Eisinga, R., & Lagro-Janssen, T. (2014). Supporting 'superwomen'?: Conflicting role prescriptions, gender-equality arrangements and career motivation among Dutch women physicians. *Human Relations, 67*, 175-204. doi:1177/0018726713489998

Powell, D. (1992). Women in engineering: Canadian panel calls for more. *Science, 256*, 607. doi 10.1126/science.1585171

Preston, A. (2004). Plugging the leaks in the scientific workforce. *Issues in Science and Technology, 20*(4), 69-74. Retrieved from: http://www.issues.org/20.4/preston.html

Pringle, J., & Dixon, K. (2003). Re-incarnating life in the careers of women. *Career Development International, 8*(6), 291-300. doi:10.1108/13620430310496107

Rhea, J. (1996). As their 'shelf lives' shrink, an NSF study finds half of U.S. engineers working outside engineering. *Research Technology Management, 39*(4), 2-4. Retrieved from http://www.iriweb.org/Main/Library/RTM_Journal/RTM_Index/Public_Site/RTM/RTM_Journal_Online.aspx?hkey=5ec79d60-99c3-4321-9cac-ed96e24bfb87

Robbins, S., & Judge, T. (2009). *Organizational behavior*. Upper Saddle River, NJ: Pearson.

Rosenthal, L., London, B., Sheri, R., & Lobel, M. (2011). The roles of perceived identity compatibility and social support for women in a single-sex STEM program at a co-educational university. *Sex Roles, 65*, 725-736. doi:10.1007/s11199-011-99450

Sealy, R., & Singh,V. (2010). The importance of role models and demographic context for senior women's work identity development. *International Journal of Management Reviews, 12*(3), 284-300. doi:10.1111/j.1468-2370.2009.00262.x

Servon, L., & Visser, M. (2011). Progress hindered: The retention and advancement of women in science, engineering and technology careers. *Human Resources Management Journal, 21*(3), 272-284. doi:10.1111/j.1748-8583.2010.00152.x

Smith, C., Santucci, D., Xu, S., Cox, A., & Henderson, K. (2012). " I love my job but . .": A narrative analysis of women's perceptions of their careers in parks and recreation. *Journal of Leisure Research, 44*(1), 52-69. Retrieved from http://js.sagamorepub.com/jlr/article/view/2509

Sperling, J. H. (2013). Reframing the work-family conflict debate by rejecting the ideal parent norm. *The American University Journal of Gender, Social Policy, & the Law, 22*(1), 47-90. Retrieved from http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1625&context=jgspl

Sullivan, S. E., & Baruch, Y. (2009). Advances in career theory and research: A critical review and agenda for future exploration. *Journal of Management*, *35*, 1542-1571. doi:10.1177/0149206309350082

Stake, R. (2010). *Qualitative research: Studying how things work.* New York, NY: The Guilford Press.

Steers, R., Mowday, R., & Shapiro, D. (2004). The future of work motivation theory. *Academy of Management Review, 29*, 379-387. Retrieved from http://www.jstor.org/stable/20159049

Szelenyi, K., & Inkelas, K. (2011). The role of living-learning programs in women's plans to attend graduate school in STEM fields. *Research in Higher Education, 52*, 349-369. doi:10.1007/s11162-010-9197-9

Thilmany, J. (2008). Not a welcoming place. *EMBO Reports, 9*, 951-953. doi:10.1038/embor.2008.178

Tomlinson, J., Olsen, W., Neff, D., Purdam, K., & Mehta, S. (2005). *Examining the potential for women returners to work in areas of high occupational gender segregation, report for the department of trade and industry.* Retrieved from http://webarchive.nationalarchives.gov.uk/+/http://www.dti.gov.uk/training_development/Women_Returners_DTI_November2005.pdf

Urquhart, C. (2013). *Grounded theory for qualitative research*. London, England: Sage.

U.S. Bureau of Labor and Statistics. (2008). *Table 817: Civilian Employment of Scientist, Engineers, and Related Occupations by Occupation and Industry.* Retrieved from http://www.census.gov/compendia/statab/2012/tables/12s0817.pdf

U.S. Census Bureau. (2011). *Statistical abstract of the United States: Section 16: Science and Technology.* Retrieved from http://www.census.gov/prod/2011pubs/11statab/science.pdf

U.S. Department of Justice Civil Rights Division. (2001). *Title IX legal manual*. Retrieved from http://www.justice.gov/crt/about/cor/coord/ixlegal.pdf

U.S. Department of Commerce Report. (2013). *Disparities in STEM employment, by sex, race, and Hispanic origin*. Retrieved from http: //www.census.gov/prod/2013pubs/acs-24.pdf

U.S. Department of Labor Report. (2011). *Women's employment during the recovery.* Retrieved from http://www.dol.gov/_sec/media/reports/FemaleLaborForce/FemaleLaborForce.pdf

Varma, R. (2010). India-born in the U.S. science and engineering workforce perceptions of women in management: A thematic analysis of razing the glass ceiling. *American Behavioral Scientist, 53*, 1064-1078. doi:10.1177/0002764209

Varma, R., & Freehill, L. (2010). Special issue on science and technology workforce. *American Behavioral Scientist, 53*, 943-948. doi:10.1177/0002764209356229

Washburn, M. (2007). Cultivating greater acceptance of women in technology: A pilot study. *International Journal of Information and Communication Technology Education, 3*(1), 22-35. Retrieved from http://www.inderscience.com/jhome.php?jcode=ijict

Wittmer, J. E., & Martin, J. L. (2013). Lessons learned from a part-time worker typology applied to full-timers. *American Journal of Business, 28*(2), 210-232. doi:10.1108/AJB-05-2013-0032

Yin, R. (2011). *Qualitative research from start to finish.* New York, NY: The Guilford Press.

Appendix A: Email to Potential Participants

FROM: Coatesworth, Megan
TO: Potential Study Participant
SUBJECT: Student research of employee motivation of women in STEM professions

I am in the process of conducting my doctoral dissertation by completing a research study on what motivates women to continue their careers in science, technology, engineering, and math (STEM) professions, and I am asking for your help. This email is sent to you to request your voluntary participation in my study.

The time commitment is minimal-just 1-2 hours of your time. I am seeking to interview women in STEM professions who fit into one of two categories:

1. Women in STEM professions who have been in the profession continuously for more than 10 years (where the definition of continuously is that they have not taken leave from work or had a gap between jobs that lasted more than 26 weeks).

2. Women in STEM professions who have been in the profession for a total of 10 years, where they left their profession at some time, for a period of at least 26 weeks, and subsequently decided to return to the profession. (The reason for the 26 week+ leave period can be any reason, personal or professional, and the participant will not be requested to share the reason for leave).

By taking part, your contribution may help other women by providing them with insights on how to have successful careers in STEM professions.

To participate, please reply back to this email. I encourage you to forward this email to friends or colleagues who you think may be interested.

Thank you in advance for helping me with this important study.

Sincerely,
Megan Gebhardt Coatesworth
University of the Rockies Doctoral Student

Appendix B: Demographic Questionnaire

1. **What is your STEM discipline (select the closest that applies)**
- o Science
- o Engineering
- o Technology
- o Math

2. **How many years have you been working in STEM fields? (If you have taken a break from the profession and have come back, add the years of service together. Do not include the time for the break in the total amount of years)**
- o <10
- o 10-15
- o 15-20
- o 20-25
- o 25-30
- o >30

3. **Have you ever taken a break from the STEM professions for any reason that lasted over 26 weeks?**
- o No. I have not taken a break that has lasted over 26 weeks
- o Yes, my break from the profession lasted between 6 months to 1 year
- o Yes, my break from the profession lasted between 1 year to 2 years
- o Yes, my break from the profession lasted between 2 years and 5 years
- o Yes, my break from the profession was over 5 years

4. **What is your age?**
- o 21-30
- o 31-40
- o 41-50
- o 51-60
- o 60 or over
- o Decline to answer

5. **What is your race?**
- o African-American, Black
- o Chinese
- o Filipino
- o Indian
- o Japanese
- o Korean
- o White Caucasian – Non Hispanic
- o Hispanic or Latino
- o Mexican
- o American Indian, Alaskan Native
- o Middle Eastern
- o More than one race

- o Southeast Asian
- o African-American, Black
- o Unknown or not reported
- o Decline to answer

6. What is the highest level of education you have completed?

- o Some college
- o 4-year college degree (e.g. B.S., B.A.)
- o Master's degree
- o Doctoral degree
- o Professional degree (JD, MD)
- o Other
- o Decline to answer

7. The organization you work for is in which of the following:

- o Public Sector
- o Private Sector
- o Not-for-Profit
- o Unknown
- o Other
- o Decline to answer

Appendix C: Consent Form

Informed Consent Form for a study on *Women Staying in STEM Professions Long Term: A Motivation Model.* You are being invited to participate in a research project conducted by Megan Gebhardt Coatesworth, who is a doctoral candidate at the University of the Rockies.

You are invited to participate in a research study about your personal experiences throughout your career, including any barriers that you may have overcome and/or factors that motivated you to stay. The interview will take approximately 60 minutes. The potential risks associated with this study are minimal. You will be given the opportunity to add additional information at your discretion at the end of the interview.

Your interview will be used to contribute to empirical evidence in a growing body of research on STEM professions, primarily aimed at retaining women in these professions. Women in STEM professions in the future may benefit from your experience.

Your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time. You also have the right to refuse to answer any question(s) for any reason during the interview. Although the interview questions are not intended to be intrusive or cause distress, if you feel distressed at any time, you have the right to withdraw. In the unlikely event that I, the interviewer, sense distress, I will stop the interview and recommend that you seek local resources to assist you.

A description of your experiences will be part of the published study. Your name will be replaced with a pseudonym to protect your anonymity and ensure that your individual privacy will be maintained in all publications or presentations.

If you use any company names or names of colleagues/managers during your interview, those names will not be used in any publications or presentations associated with this study. Instead, 'the company' or 'the participant's manager' or similar language will be used.

Our conversation will be digitally recorded and later transcribed. Upon completion of this study, and subsequent approval of this research by my committee, all recorded materials will be erased after seven years. The same approach will be used with regards to any written notes or memos documented by the researcher.

If you have questions regarding your rights as a research participant or any concerns regarding this project, you may report them – confidentially, if you wish – to the University of the Rockies Institution Review Board at xxxxxxxx@rockies.edu.

Consent given by _____ on _____ and received by Megan Gebhardt Coatesworth

Appendix D: Interview Protocol

Initial Questions for Interviews

1. You signed an informed consent before our interview. I would like to record you acknowledging that you have read this, that you understand it, and that you give consent to participate. Can you please confirm your consent to participate?
2. Briefly, what do you do now professionally?
3. When you were growing up, what types of careers did you think about pursuing?
4. When did you first think of becoming a _____?
5. Tell me why you went into your field of study. Was it your first choice?
6. How would you describe your career?
7. What do you enjoy most about your profession?
8. As you look back on your career, was there ever a situation where you found yourself at a crossroads of continuing in your field versus choosing another path? <If so> Can you describe this situation? What influenced your decision?
9. For linear participants: Have you ever thought of leaving? For the non-linear participants: Have you ever thought of leaving again? What influenced your decision to stay?
10. For non-linear career participants: When you returned to the workplace, was there anyone or anything in particular that eased your transition back?
11. What makes you stay (or what made you come back after your leave)?
    a. Which are the most important reasons?
    b. Why are those reasons important to you?
    c. Continue to ask more about contributing factors

12. Is there anything specific that influenced any big shifts or changes along the way?
13. Were there any changes for you, during your career or your life that changed the motivating factors for you? When you first started your career, what were the drivers that motivated you? Is what makes you stay-the same as what motivated you to enter in the first place?
14. I'm interested in understanding the effects of the changes in the workplace itself, too, that may have been instrumental in you continuing in STEM professions.
    a. There has been quite a bit documented on women in STEM that leads to believe that the environment in the workplace can be somewhat unwelcoming for women to find career success. Has there been anything in particular, either in the policies or the culture that has been key to your career longevity in the profession?
    b. Thinking back on your career are there any changes that were instituted in the workplace that you thought were positive for women in STEM professions?
    c. Would you consider these changes key to motivating you to stay?
15. Is there anything else you would like to emphasize about your work experience?

Question added following participant 4:

16. What does your workplace do specifically that keeps things challenging and interesting for you?
17. Participants thus far are suggesting that there has been a shift in the workplace–a positive shift–moving away from the hostile environment that is written in the literature about the STEM workplace culture. There also seems to be a tie-in to self-

confidence for the women I have interviewed so far. Have you seen a shift in workplace culture and / or your own confidence? What is the timing for both?

Questions added following participant 8:

18. Flexibility and predictability have emerged as a theme of importance to most participants. Can you comment on this? Does your workplace have any policies that help create this environment? Is your workplace culture amenable to helping create more flexible or predictable workdays for you when / if you needed it?
19. Some participants are commenting on what one participant termed as a modern-day barrier for growth opportunities: part-time work. Can you comment on how part-time work is viewed in the workplace, if you see it as a barrier for advancement?
20. Some participants think women create barriers for themselves with regard to being complacent with their careers as compared to men. What is your perspective on this? Do you view any of your choices as a barrier that you created versus the culture of the company?
21. What do you think technology has created for the environment at work, now that people are sometimes working virtually versus in the office?
22. Some participants have emphasized building their reputation as a key part of being considered for growth opportunities. What do you think? What has helped or hindered your reputation building in your career?

Questions added following participant 12:

23. Some participants interviewed so far have emphasized being credible and feeling valued as something that has motivated them, but they seem to reach this at different points in their careers. Can you speak to whether you agree with the emphasis on

credibility/feeling valued and if so, what contributed to that for you and if you remember, at what point did you feel you reached this sense of yourself?

24. Many participants have emphasized that opportunities for growth are a key part of motivating them. There does not seem to be a consistent or direct path emerging. There is no one recipe for growth success. When you have sought growth opportunities, what has been successful for you? What has your company done that has helped? What barriers to growth, if any, have you experienced?

Appendix E: Non-Disclosure Form

Student First Name: Megan Last Name: Coatesworth

Title of Dissertation: Women Staying in STEM Professions Long Term: A Motivational Model

Name of Service Provider: _____

Address:

_____

Type of Assistance: Transcribing audio tapes / Recording conference call logs

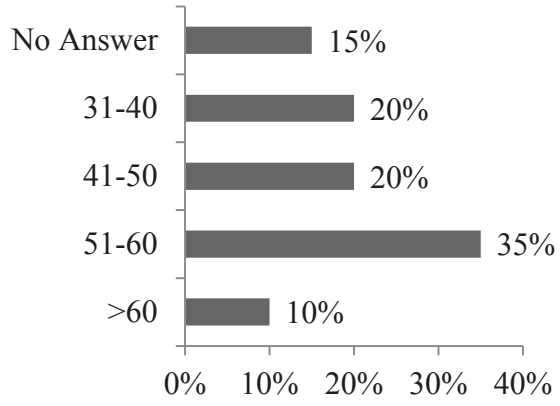
I hereby agree not to disclose or share any confidential information pertaining to the above-referenced research study obtained in the process of providing the services identified above. Confidential information includes but is not restricted to research participants' names, demographic characteristics, or any other personally identifying information; assessment instrument responses or scores; participants' ratings, narrative responses, or comments, whether in response to questions or spontaneous; and / or any other information that might compromise the confidentiality or anonymity of the participants. I hereby agree to refrain from discussing with or disclosing any confidential information regarding research participants to any persons other than the researcher, the members of the UoR dissertation committee, or the UoR IRB. All research materials in my possession will be stored securely and no other parties will have access to them. I agree to report immediately to the UoR IRB any breach, whether suspected or known, of this confidentiality statement regarding the above research project.

Signature: _____ Date: _____

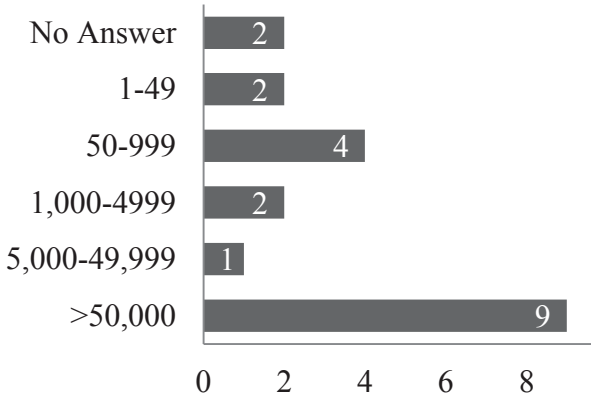
Appendix F: Participant Demographics

Total Years in STEM	Number of Participants
10-15	4
15-20	4
20-25	2
25-30	4
>30	6

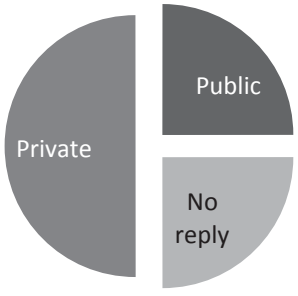
STEM Profession Type	Number of Participants
Science	4
Technology	4
Engineering	7
Math	5



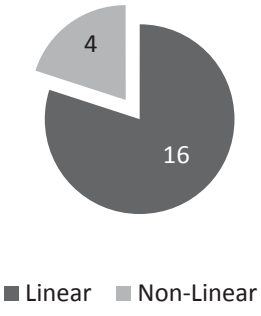
Participant Age



Company size



Business Sector



Participant Type

Appendix G: Open Coding Results

Codes 1-14	Codes 14-28	Codes 29-42
Likes math	Expressed believing in capabilities	Changes in workplace culture – not hostile now
Likes science	Expressed maturing into confidence	Lateral moves are good capability building
Continuously learning	Expressed confidence throughout career	Evidence of advancement opportunities
Being part of teams	Peer relationships	Networking
Challenging	Workplace policies	Investment via training is available
Identifying with profession	Recognition and rewards	Career is limited due to family priorities
Creating	Client relationships	Fulfillment of growing others
Problem solving	Sponsor	Credibility
Variety of work	Direct Managers	Reputation
Flexibility/ predictability	Hostile environment	Visibility
Expressed having a niche	Good environment – good	Technology advancements effect on workplace
Societal trends towards gender based work and home	Career advancement is limited for the part-time worker	What motivates me has changed over time
Personal relationships outside of work	Priority of Family	What motivates me has not changed over time
Lack of evidence of advancement opportunities	Opportunistic outlook	Compensation