THE INFLUENCE OF ORGANIZATIONAL SUPPORT ON THE TURNOVER INTENTIONS OF WOMEN IN STEM OCCUPATIONS

Doctoral Dissertation Draft

Submitted to the

Graduate Faculty of Saint Leo University

In Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

By

Gayla McLaughlin Todd

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ABSTRACT

There is a need to address the underrepresentation of women in science, technology, engineering, and math (STEM) occupations for the United States to remain competitive globally, especially as it relates to staying abreast of the rapid advancements in technology. Increasing the number of women who persist in STEM occupations can help address the projected shortage of STEM labor overall, increase diversity, improve innovation for organizations, and increase the spending power of women. The purpose of the current study was to examine factors that affect women's decisions to leave STEM occupations with the goal of helping managers and leaders of organizations understand ways to reduce turnover. Social cognitive career theory, organizational support, and turnover theory were leveraged to understand the perspectives of current and former women in STEM occupations. This quantitative research involved surveying 657 women in STEM occupations in the United States through social media platforms. Results showed organizational support of work–family balance has a higher impact on turnover than overall organizational support, supervisor support, and coworker support. Additional investigations are needed to understand the lack of work–family support for women in STEM occupations and organizational approaches that can improve women's support perceptions and reduce attrition rates.

DEDICATION

I dedicate this paper to my late husband, John Todd, who always supported and believed in me and encouraged me to complete my doctorate and teach someday. John was a professor who challenged and helped shape young lives, and I plan to do the same as I start my new career as a visiting professor in the school of business at The Citadel College. I also dedicate this to my three adult sons, Connor Todd, Cameron Todd, and Christian Todd. My sons never stopped supporting me in this “much later in life” undertaking to finish my doctorate and pursue a lifelong passion for teaching the next generation. Their love of life, laughter, and learning has and will always inspire me. Last, I dedicate this to my loving parents, George and Peggy McLaughlin, who served as role models for hard work, humility, love, and kindness. They raised me to never let gender define my life and career goals.

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CHAPTER ONE: INTRODUCTION

Only 26% of those employed in science, technology, engineering, and math (STEM) occupations in the United States are women (U.S. Department of Labor, Bureau of Labor Statistics [BLS], 2019a). Gender imbalance in STEM occupations has been studied for decades and is a concern for leaders in business and government in the United States (Ambrose, 1997; Frenkel, 1990; Hewlett & Luce, 2005; McLure & Piel, 1978; Parrish & Block, 1968). Some researchers refer to the underrepresentation of women in STEM education and careers as a “leaky pipeline,” with fewer women entering STEM and then leaving at a faster rate than men (Blickenstaff, 2005; Singh et al., 2013; Vitores & Gil-Juárez, 2016; Wynn & Correll, 2018). Increasing the participation of women in STEM occupations is needed to help address concerns over global competitiveness (Noonan, 2017) and the projected shortage of STEM-ready workers in the United States (New American Economy, 2017; President’s Council of Advisors on Science and Technology [PCAST], 2012; Thébaud & Charles, 2018; U.S. National Science & Technology Council, 2018), an issue that also occurs within European countries (European Commission, 2017; European Union, 2016; United Nations Educational, Scientific, and Cultural Organization, 2017). If the current trend continues, the projected shortage of STEM workers may worsen over time as STEM occupations are growing faster than other professions. STEM opportunities in the United States are expected to grow from 9.7 million to 10.5 million between 2018 and 2028, outpacing overall U.S. job growth (BLS, 2020). The standard classifications of STEM occupations used for this study are as follows: science (life and physical), technology (computer sciences and information technology), engineering (chemical, electrical, mechanical), and mathematics (math and statistics; Hill et al., 2010).

The current study provides background and history on a variety of gender, societal, and education related issues that contribute to the shortage of women in STEM occupations. The purpose of the current study was to investigate factors that influence women's decisions to leave STEM occupations with the goal of helping leaders of organizations understand ways to reduce attrition rates. The existing research contains a primary focus on women entering the STEM pipeline during high school, college, and post-graduate academia, leaving a need for more examinations at the career level to identify the reasons women exit the STEM pipeline (Fouad & Santana, 2017). The present study involved the use of social cognitive career theory (SCCT; Lent et al., 1994; Lent et al., 2003) together with turnover theory as the foundation to help examine women's career-related interests and decisions and to measure turnover intentions among women working in STEM and those who have left STEM. Specifically, the focus was on the influence of organizational factors such as perceived organizational support, coworker and supervisor support, and work–family support on turnover intentions.

Problem and Background

Women constitute approximately 50.4% of the workforce in the United States and earn half of all STEM degrees, but only represent approximately 26% of those working in STEM jobs (BLS, 2019a). Women also leave professional STEM occupations at a higher rate than men (Cech & Blair-Loy, 2019; Corbett & Hill, 2015). Women exit the high-tech industry at a rate of 41% compared to only 17% for men (Ashcraft et al., 2016), and surveys conducted by Hill et al. (2010) showed women are half as likely as men to remain in engineering by the time they reach their 50s. The gender imbalance in STEM is a multifaceted problem concerning government, organizations, and individuals because of the overall gender pay inequity. This study encompassed all four areas of STEM with a heavy focus on engineering (E) and technology (T), the two most gender-segregated areas of the STEM workforce (Corbett & Hill, 2015; National Science Foundation, 2019).

The lack of women in STEM occupations is a concern for many organizational leaders and policymakers as the competitiveness of businesses and the U.S. economy are affected by technological advancements, which will require an adequate pool of talented scientists, technologists, mathematicians, and engineers (Cech & Blair-Loy, 2019; Corbett & Hill, 2015; Fayer et al., 2017; U.S. House Education & Workforce Committee, 2013; U.S. National Science & Technology Council, 2018). Retaining women in STEM occupations could help meet some of the growing demand for STEM workers in the United States. Compounding this issue for the United States are the anticipated shortages in skilled STEM labor needed to compete globally (U.S. House Education & Workforce Committee, 2013; U.S. National Science & Technology Council, 2018; West, 2011) and the expected growth in demand of 1.25 million engineers (E) and computer technologists (T) over the next decade in the United States (Corbett & Hill, 2015). Engineering graduation rates lag in the United States at 5% compared to 12% in Europe and 20% in Asia (U.S. House Education & Workforce Committee, 2013). Increasing women's participation in STEM will likely help increase the STEM labor pool as currently, men hold 74% of STEM positions in the United States (BLS, 2019a).

At the organizational level, the high rate of turnover among women in STEM occupations is problematic as losing highly educated and skilled employees negatively affects businesses given the recruiting and training efforts required to replace these workers (Lambert, 2003; Ng & Feldman, 2007). The imbalance of women in STEM occupations reflects a lack of workforce diversity. Diversity in the workforce is beneficial to organizations as it enhances innovation and organizational performance by representing a well-rounded set of backgrounds and experiences (Díaz-García et al., 2013; Friedman et al., 2016; Herring, 2009; Hoever et al., 2012; Steele & Derven, 2015). Continual innovation is necessary to meet consumers' ever-changing needs and demands for products and services (Dobni et al., 2018; Steele & Derven, 2015). Furthermore, organizations need to build products and services to meet the interests of market populations that are becoming more diverse, and therefore need more internal diversity to serve a broader range of customers (Salomon & Schork, 2003; U.S. National Science & Technology Council, 2018).

Another problem related to the underrepresentation of women in STEM occupations is the gender pay gap that exists in the United States, with women earning 82 cents on the dollar compared to men, on average (Graf et al., 2018; BLS, 2018). Increasing the number of women in STEM occupations will likely help as women in STEM positions earn 30% more than women in non-STEM occupations (Noonan, 2017). Wages for engineers and computer occupations are $93,620 and $100,770 on average, respectively, which is close to two times the average salary of all other job roles ($51,960) tracked by the BLS (2019b). The opportunities for lucrative pay in STEM occupations could help reduce the gender pay gap and enhance the earning power of women in the United States.

Efforts to increase the percentage of women in STEM occupations have been more successful in some areas of STEM compared to others. Table 1 from the U.S. Department of Labor website highlights how women's employment in STEM has progressed over the past several decades with substantial gains in math (M) and life sciences and social sciences (S), but a minimal increase in engineering (E) and even setbacks in computer technology (T). Women's participation in engineering occupations started at 3% in 1970, increasing to 12% in 2000 then to 14% in 2009 (Harrigan-Farrelly, 2017), where it remains, indicating a small gain of only 3% over the past 18 years (Noonan, 2017). The number of women in computer technology occupations peaked in 1990 at 34% but then dropped to 25% in 2015, showing a decline in women's participation (Harrigan-Farrelly, 2017). In terms of STEM occupations in the United States, women account for 59% of jobs in social sciences, but have nearly equal representation compared to men in mathematics (47%) and life and physical science occupations (41%).

Table 1

Women's Percentage of Employment in STEM Occupations

Occupation	1970	1980	1990	2000	2015
STEM	7%	14%	23%	25%	26%
Engineers	3%	8%	12%	12%	14%
Computer occupations	15%	26%	34%	30%	25%
Mathematics occupations	15%	36%	41%	44%	47%
Life and physical scientists	14%	21%	27%	33%	41%
Social scientists	17%	36%	51%	48%	59%

Note: Reprinted from *Trailblazing Women in STEM*, by Harrigan-Farrelly, 2017 (https://blog.dol.gov/2017/03/21/trailblazing-women-in-stem#comment-20192). In the public domain.

The gender imbalance in step occupations is covered more extensively in the review of the literature chapter, but past studies have shown there are a variety of contributing factors (Cech & Blair-Loy, 2019; Corbett & Hill, 2015; Kohlstedt, 2014). Reasons that have been cited for the lower participation of women in STEM education and occupations are early life influences from parents and teachers (Gunderson et al., 2012; MacPhee et al., 2013), gender stereotyping (Cheryan, 2012; Cheryan et al., 2013) and differences between men and women in terms of career interests and technical knowledge self-efficacy (Falk et al., 2016; Kugler et al., 2017). Studies on the explanations for why there are fewer women in STEM occupations most frequently refer to STEM self-efficacy, work–life balance concerns, organizational support, role models, mentoring, and networking opportunities (Corbett & Hill, 2015). Researchers have attempted to determine why the leaky pipeline exists for women in STEM occupations. Capturing women's perspectives on turnover intentions may help reduce the number of women leaving STEM vocations (Hill et al., 2010). The remainder of this chapter covers the purpose and significance of the study, theoretical model, research questions, assumptions, and limitations.

Purpose of the Study

Understanding the working experiences of women in STEM occupations and the reasons they persist or leave these occupations is the first step in reducing the gender gap. The primary purpose of this quantitative study was to measure the significance of work environment support-related factors among women who remain in STEM and those who leave. The study was designed to gain insight through surveys of both women who stayed in STEM occupations and those who left STEM. The awareness gained from this investigation helped achieve the goal of this study, which was to expand the knowledge on the reasons for the turnover of women in STEM occupations. This knowledge has the potential to be used to develop approaches and strategies that can have a positive impact on retaining skilled women across STEM occupations.

The SCCT model (Lent et al., 1994; Lent et al., 2003) was selected as it includes a consideration of a combination of individual personal and environmental support factors in career development and decisions (Singh et al., 2013). Past SCCT research has contained a focus on predicting academic withdrawal but rarely considered the choice to leave one's job as a noteworthy career decision (Singh et al., 2013). SCCT was combined with turnover theory to support examining women's intentions of leaving an organization, including women working in STEM and those who had departed from a career in STEM. Singh et al. (2013) developed and successfully tested SCCT combined with turnover measurement on over 2,000 women engineers. The current study involved all four areas of STEM and a focus on lesser tested work environment variables, as mentioned previously. Fouad et al. (2016) stressed the importance of further research to analyze a combination of personal and organizational factors as they relate to the turnover of women in demanding and training intensive occupations. The primary factors examined in the current study were the following organization-based support variables: perceived organizational support, perceived coworker and supervisor support, perceived work–family support, and turnover intentions. The researcher analyzed differences in turnover intentions and organizational support factors across the four areas of STEM and between current and former STEM workers.

Importance of the Study

The importance of this study relates to the benefits of addressing the gender gap that exists in STEM occupations. Increasing the representation of women can benefit both organizations and governments as they compete globally. Having a better understanding of the turnover intentions of women in STEM occupations can lead to work programs and approaches retain more women after they enter STEM occupations (Corbett & Hill, 2015). Addressing the underrepresentation of women in STEM fields in the United States has the following benefits: (a) improve global competitiveness by addressing STEM workforce shortages, (b) enhance organizational innovation and performance by improving gender diversification, (c) improve the livelihood for more women by reducing the gender pay gap, and (d) lower costs for organizations by reducing the turnover of women in STEM occupations.

This specific study is important because of the focus on organization-level issues to enhance the existing research that focused mainly on societal and educational factors related to the underrepresentation of women in STEM occupations (Armstrong et al., 2012; Corbett & Hill, 2015). Past research on women in STEM occupations contained a focus on improving the STEM education pipeline; the focus in this research was more on the decisions and actions of employees after career commencement. This study was designed to extend the existing research by examining factors influencing the turnover intentions of women in STEM occupations through interviews with women currently working in STEM occupations as well as women who have left STEM occupations. These findings will help employers plan approaches and strategies that will reduce the turnover of women in STEM occupations.

Prior qualitative and quantitative studies involved interviewing and surveying college students; only a small number of studies included women in STEM occupations and even fewer included women who left these occupations (Corbett & Hill, 2015; Fouad et al., 2016). According to researchers, many existing studies included a historical perspective of the current female STEM worker deficit in the United States (Blickenstaff, 2005; Hewlett & Luce, 2005; Sax et al., 2015). More analysis is necessary to investigate women working currently or formerly in STEM occupations (Corbett & Hill, 2015; Fouad et al., 2017).

Many studies involving women's intentions to leave STEM used publicly available longitudinal data as opposed to the focused survey approach used in the current study. Researchers have studied women's commitment to engineering occupations (Buse et al., 2013; Fouad et al., 2017) and information technology (IT) roles (Armstrong et al., 2012; Armstrong et al., 2018; Major et al., 2013). Others have called for similarly focused studies across STEM (Corbett & Hill, 2015; Singh et al., 2013), as included in this study. In summary, this project was designed to investigate the perceptions of women who are working in or who have left STEM occupations regarding organizational support factors influencing their intentions to leave their occupations. The goal was to help organizational leaders understand ways to reduce attrition rates and reap the benefits of having a diverse and representative workforce.

Theory Identification and Model

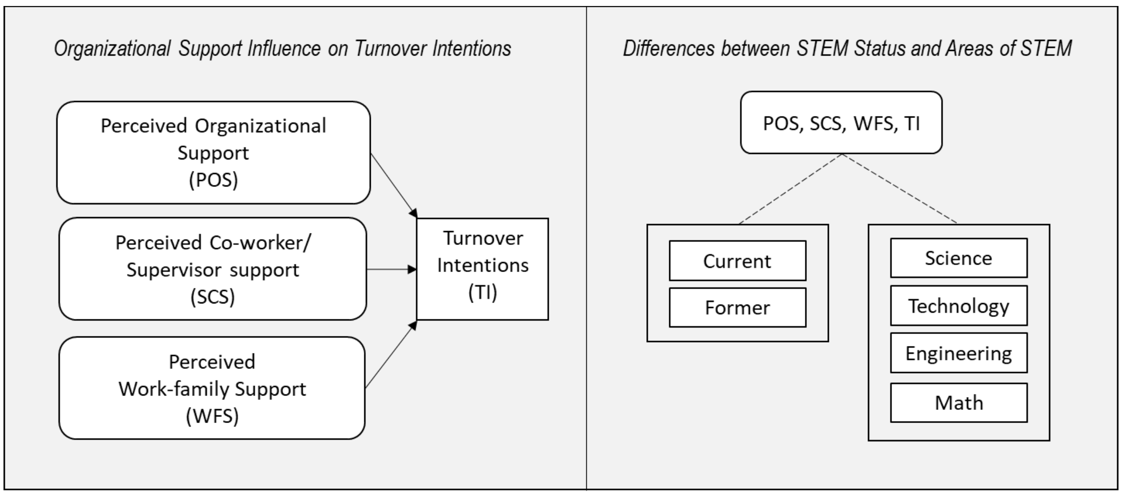
According to Grant and Osanloo (2014), writing a dissertation without a theoretical framework is analogous to building a home without a blueprint. This section covers the conceptual model by providing a diagram of how the problem was explored and includes the theoretical framework, or the formal theory and blueprint guiding the dissertation.

The conceptual framework for this study included concepts of career and turnover theory, which were used to explore the impact of environmental work factors on the turnover intentions of women in STEM occupations. The foundation used to investigate women's career decisions was SCCT together with turnover and perceived organizational support theory. SCCT contains a structure suited to examine the interplay of personal and work environment variables and was leveraged in multiple studies related to STEM career decisions (Fouad & Santana, 2017). SCCT includes choices across different career stages but seldom includes the decision to depart as a career choice (Singh et al., 2013). Understanding turnover intentions is a crucial element in helping improve employee retention (Allen et al., 2003). A survey-based quantitative approach was used to examine the impact of variables, including the perceived organization support (POS) of women in STEM occupations and those who left, to measure influences on the intentions for women to leave their STEM occupations. Allen et al. (2003) conducted a study testing the relationship between perceived organizational support and job satisfaction and commitment, and the impact on employee turnover. The results from their work showed "perceptions of supportive human resources practices (participation in decision making, fairness in assigning rewards, and access growth opportunities) contributed to the development of POS. POS mediates their relationships with organizational commitment and job satisfaction" (Allen et al., 2003, p. 99), which are essential in preventing turnover. In summary, the authors contended employees who have positive perceptions of human resources and overall organizational support are more committed and less likely to leave, which is the foundational premise of organizational support theory (Eisenberger et al., 1986).

Figure 1 is a conceptual diagram depicting a simplified view of the variables tested as part of this project. This study was designed to reveal whether POS factors (i.e., overall organizational support, coworker and supervisor support, and work–family support) predicted turnover intentions and to examine differences between STEM occupation status and the four areas of STEM. This proposition supports that if women are committed to their STEM occupations, it will help them persist through organizational challenges that occur with heavy work demands and the male-dominated STEM environment. The focus of this study was to gain knowledge of what leads to turnover and then recommend HRM interventions and approaches to reduce attrition, as well as identify differences in the organizational support perceptions and turnover intentions across the four areas of STEM, as highlighted in the framework in Figure 1. Past studies (Fouad & Santana, 2017; Glass et al., 2013; Hill et al., 2010) and employment statistics (Fayer et al., 2017; Harrigan-Farrelly, 2017) support that women perceive technology and engineering as having more organizational challenges than science and mathematics.

Figure 1

Conceptual Framework



SCCT was appropriate for this study as it is grounded in Bandura's (1986) social cognitive theory, which considers the interactions of the environment, personal, and behavior factors on the choices individuals make. Bandura's general cognitive theory posits that an individual's self-efficacy, or belief in their ability to perform specific tasks or jobs, has a significant effect on motivation and persistence (Bandura, 1989). Individuals who firmly believe they can accomplish a task are more likely to pursue it and are less likely to give up despite the challenges involved.

According to Bandura (1986), self-efficacy comes from a combination of past influences and experiences. Lent et al. (1994) expanded past studies on self-efficacy and career decisions and built the SCCT framework to explain and predict education and career interests and performance. Singh et al. (2013) extended the SCCT model to include turnover intentions and evaluated women engineers' plans to leave their organizations. The extended model findings highlight that "self-efficacy and outcome expectations directly shape employees' affective outcomes and indirectly influence subsequent turnover intentions" (Singh et al., 2013, p. 292). The primary constructs encompassed in the SCCT framework are person inputs, self-efficacy, interests, outcome expectations and goals, and contextual support. This study involved a focus on the contextual support area of SCCT through an exploration of the impact of perceived organizational based support on career persistence intentions.

Using SCCT as the theoretical foundation assisted in understanding the complexities women encounter throughout their careers, and turnover examination helped in understanding intentions to leave. The next chapter, the review of literature, covers additional details on how SCCT constructs relate to the history of women deciding to enter and leave occupations in STEM and includes examples of research used in STEM.

Research Questions

This study was designed to uncover insight on organizational support factors leading women to leave STEM, which is necessary to develop practical retention approaches. The business-level question guiding this study was: What organizational approaches will improve the retention of women in STEM occupations? Before this question could be answered, further insight was needed on the factors leading women to consider leaving STEM. The overarching research question for this study was: Do organizational support perceptions influence women's decision to leave STEM occupations? The specific research questions were:

RQ1: Are employees with positive perceptions of organizational support (perceived organizational support, coworker and supervisor support, work–family support) less likely to leave their STEM organizations?

RQ2: Are there unique challenges in some areas of STEM that lead women to leave their occupations?

CHAPTER TWO: REVIEW OF LITERATURE

This chapter is a review of the research-based literature regarding the factors preventing women from equal representation in STEM occupations using SCCT and turnover as the guiding foundation and research on suggested approaches for retaining more women. The history of women's underrepresentation in STEM in the United States is covered together with gaps in existing research.

Underrepresentation in STEM

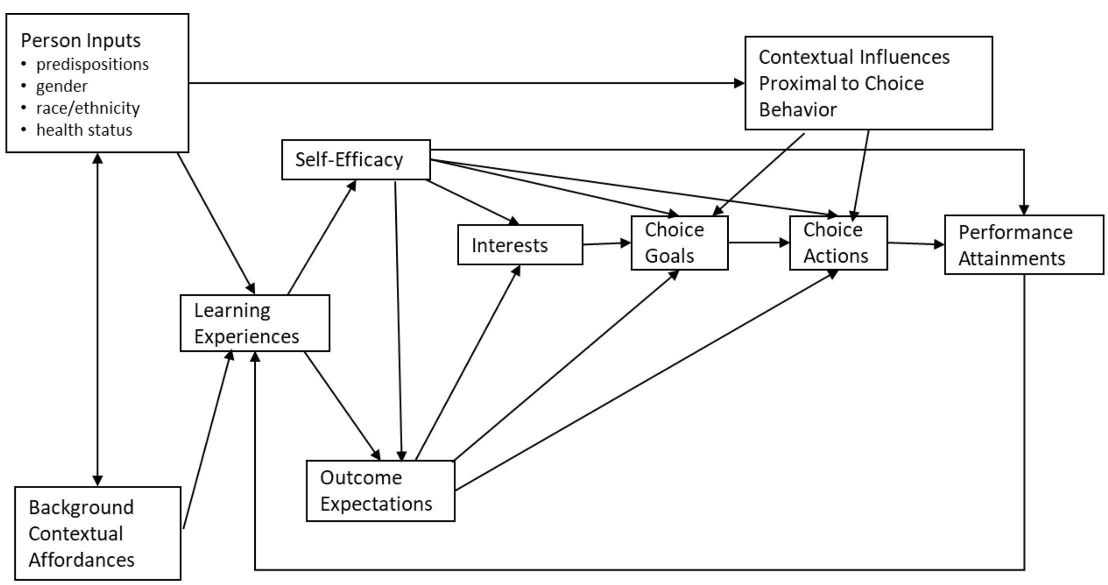
In the past 2 decades, researchers have published a variety of reports and studies relating to the increased number of women exiting STEM occupations. The two publications with the most comprehensive reviews of the literature are Kohlstedt's (2004) reflection of women in science and technology in the 20th century and Corbett and Hill's (2015) assessment of over 750 publications from the past 15 years and recommendations and approaches to improve the representation of women in engineering and technology education and occupations. Kohlstedt's (2004) review indicated the presence of women in technology and science has grown slowly, and gender gaps still exist with significant challenges relating to career advancement and pay equity compared to men. Corbett and Hill (2015) suggested that even though girls are achieving nearly equal scores in math and science in primary and secondary education, they are still less likely to take STEM exams at the end of high school and to declare majors in STEM once in college. Corbett and Hill also highlighted a stereotype study in which male science candidates were consistently offered jobs more than were female candidates, and another study showed men were offered more money than women despite having equal credentials in both study examples. As a means to better understand the history of the underrepresentation of women in STEM occupations, the American Association of University Women also conducted a large-scale study reviewing hundreds of articles on the factors behind the underrepresentation of women in STEM occupations (Hill et al., 2010). The findings indicated influences at school and home shape math and science interests; the study authors suggested focused programs are needed to increase women's participation in STEM education. The authors also pointed out that bias in the workplace is affecting the growth of women in science and engineering fields.

SCCT Lens

Lent et al.'s (1994) SCCT model in Figure 2 is used to describe the history behind women's underrepresentation in STEM through the review of literature on this topic.

Figure 2

Social Cognitive Career Theory Model of Academic and Career Choice Process



Note. From "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance," by Lent, Brown, and Hackett, 1994, *Journal of Vocational Behavior*, *45*(1), p. 93. (https://doi.org/10.1006/jvbe.1994.1027). Copyright 1994 by Elsevier.

Starting at the left of Figure 2, the model begins with *person inputs*, a reference to gender differences in background and learning experiences for girls compared to boys as they relate to STEM-related influences and activities. The *learning experiences* to which girls are exposed during their formative years affect their STEM *self-efficacy*. When girls perceive themselves to be less competent in their ability to complete education and tasks associated with STEM, it causes them to have less favorable *outcome expectations* and results in less *interest* in STEM pathways for schooling and occupations (Jordan & Carden, 2017; Milner et al., 2013). If girls lack interest in STEM, they tend to also refrain from setting the *goals* necessary to pursue STEM education and occupations and fail to take actions such as enrolling in advanced high school math and science classes (Sax et al., 2015). Without setting goals for STEM, girls are not likely to major in STEM (Moakler & Kim, 2014) or work in a STEM career (Stout et al., 2016).

This same model can be applied to the career decisions of women who are working in a STEM occupation, in that differences in background and self-efficacy lead to different levels of interest in remaining in STEM. Women are affected by environment and *contextual influences* such as managerial and coworker support (Lim, 1996; Rayton, 2006). Women's experience in the male-dominated STEM climate with limited access to networking can also lead to *performance* issues (Armstrong et al., 2012; Hill et al., 2010), and turnover intentions can be measured to track decisions to stay or leave (Hom et al., 1984). Women's departure from STEM can result from outcome expectations not being met, leading to unacceptable pay raises, promotion, mentoring, and training programs (Armstrong et al., 2012; Hill et al., 2010). In a more recent study, Fouad and Santana (2017) reviewed the research literature on studies that used the SCCT model to examine the underrepresentation of women in STEM occupations. The authors summarized aspects of the SCCT framework that work well, such as measuring the impact of self-efficacy and education support barriers on decisions to focus on high school math and science, and on college major selection. At the career level, the authors suggested SCCT helps assess barriers and support-related factors in the work environment that lead women to leave the STEM field.

Reasons for Leaving STEM

The existing research on the factors contributing to the lack of women in STEM education and occupations varies from early childhood influences, factors within primary to advanced levels of education, all the way through career level experiences. There is an abundance of studies on forces that discourage girls from taking an interest in STEM, including gender stereotype and bias and differences in childhood influences between boys and girls (Cheryan, 2012; Gunderson et al., 2012; Kim et al., 2018; Martinot & Désert, 2007). Studies indicate boys are encouraged at a young age more than girls to partake in activities and education linked to math and science, such as playing with robots and building with Lego bricks (United Nations Educational, Scientific, and Cultural Organization, 2017). This difference in encouragement leads to girls having less confidence and motivation to engage in STEM-related learning and activities. Kim et al. (2018) reviewed 47 articles, written from 2006 to 2017, on the STEM learning experience of girls in middle school and high school. Change in societal norms is still needed as the existing research emphasized "how challenging it was for female students to identify with STEM because the social environment provided a variety of signals that women do not belong to STEM and do not embody STEM prototypes" (Kim et al., 2018,

p. 601). Some examples from this study included (a) teachers, parents, and boys expressing the belief that boys are better in math and science; (b) parents indicating STEM occupations are more masculine; and (c) girls expressing less confidence and self-esteem in their math and science abilities.

The lack of self-efficacy of women in STEM occupations is a common theme across many research articles (Falk et al., 2016; Jordan & Carden, 2017; MacPhee et al., 2013; Marra et al., 2009; Milner et al., 2013; Myers & Major, 2017). Bandura (1986) was the initial researcher on the topic of self-efficacy, which is an individual's belief in their ability to do something, such as a task or job, which then influences their motivation and ability to focus. In the case of women in STEM occupations, it relates to women's confidence in their ability to be a scientist, engineer, technologist, or mathematician. Researchers have discovered this lack of confidence can affect women's longevity in STEM education (Falk et al., 2016; MacPhee et al., 2013; Marra et al., 2009). A substantial number of researchers have addressed issues related to the underrepresentation of women in STEM occupations beginning at the college level, including self-efficacy (Falk et al., 2016; Kugler et al., 2017; Marra et al., 2009). Other reviews focused specifically on student perspectives on gender stereotype issues (Cheryan & Plaut, 2010; Jones et al., 2013; Stout et al., 2016). Marra et al. (2009) conducted a 2-year study to examine the self-efficacy of female engineering students and reported a decline in aspects of self-efficacy as a result of feelings of isolation and exclusion in a male-dominated discipline. Myers and Major (2017) compared male and female college students on their perceptions of self-efficacy for balancing work and family on STEM commitment that could indicate a shift among the millennial generation.

The findings indicated female students were more committed to STEM than were male students at low levels of work–family self-efficacy, and equally committed at high levels of self-efficacy.

Singh et al. (2013) surveyed over 2,000 women engineers and found a positive relationship between self-efficacy and satisfaction, with lower self-efficacy leading to a higher likeliness to leave STEM. A broad review of the underrepresentation of women in STEM education and occupations indicates self-efficacy is a critical factor for retaining young women through college, whereas work environment and support issues are more important at the career level (Fouad & Santana, 2017). A more recent study involved surveying over 2,000 engineers and results showed male and female engineers had both similar and different reasons for leaving engineering occupations (Fouad et al., 2019). Women reported family time conflict (18.2%) and a lack of opportunities for advancement (12.5%) as the top two reasons for leaving engineering. Men responded with a lack of opportunities for advancement (22.3%) and lost interest in the field (17.3%). The results showed not liking daily tasks was among the top four reasons for both women and men for leaving engineering. Given the need to explore work-related variables, the current study was designed to fill a gap in the research by extending this investigation to focus on the impact of work support issues on turnover across all four STEM career categories (i.e., science, technology, engineering, and math).

Work climate is another area of study as women in STEM occupations face an uncomfortable environment in masculine majority occupations (Beddoes & Borrego, 2011). When working within male-dominated work environments, women report biased treatment. Women also believe they are not valued or respected equally as men, which can lead to less job satisfaction and higher turnover (Greene et al., 2010). Some studies have compared persistence in attaining STEM degrees between men and women (Harris et al., 2009; MacPhee et al., 2013; Miller & Wai, 2015). Others have focused on women in STEM occupations compared to the determination to stay in other occupations (Glass et al., 2013; Hunt, 2015). Hunt (2015) leveraged the National Survey of College Graduates data to investigate why women leave science and engineering fields faster than men and contended that most departures are the result of concerns over pay and promotion inequities, as well as a lack of mentoring opportunities compared to men. Armstrong et al. (2018) supported this claim through a study focused on the IT profession and reported career advancement and differences in social factors between men and women are a top concern in retaining women in IT.

Hunt (2015) found women in other male-dominated professions were significantly less likely to leave their jobs compared to women in science and engineering and suggested job growth and training opportunities can help retain women in STEM occupations. Another study showed women in STEM occupations were less likely to continue compared to women in non-STEM professional occupations even though there were similarities in marriage status, number of children, working hours, and work–life balance support (Glass et al., 2013). This study by Glass et al. (2103) contradicted other studies that showed women's challenges with family–life balance cause them to leave the intense job demands of STEM occupations at a faster rate than men (Armstrong et al., 2018; Kirton & Robertson, 2018). The study also revealed women in other professional jobs respond more favorably to increasing job satisfaction, tenure, and advanced education, suggesting work climate issues have a more significant impact on STEM occupations (Glass et al., 2013). Work climate issues are considered an environmental challenge in SCCT that can influence career performance and decisions. The current study was designed in response to the call for further research on the work environment and support issues.

Engineering and Information Technology

There are many studies relating to the lower percentages of women in engineering, the slowest growing subset of women in the STEM fields (Buse & Bilimoria, 2014; Fouad et al., 2017; Fouad et al., 2019; Fouad & Singh, 2011; Hill et al., 2010; Singh et al., 2013). Fouad et al. (2017) studied 1,464 women engineers and their reasons for leaving engineering occupations, and Singh et al. (2013) investigated 5,562 women who received engineering degrees and compared differences among those who never entered engineering, those who left, and those who stayed. Results of the analysis by Singh et al. showed women in engineering viewed the ability to receive job development and training, which is considered a work environment influence per SCCT, as having a favorable impact on career retention.

There are also many studies on the lack of growth in women's participation in computer sciences and information technology (Armstrong et al., 2012; Armstrong et al., 2007; Armstrong et al., 2018; Cheryan et al., 2013). Armstrong et al. (2012) studied challenges facing women in IT positions and concluded one critical problem is that women have fewer networking opportunities than men. These authors also stated adding work–life balance programs and flexible work schedules is not helpful if using them negatively affects women's advancement opportunities. This finding has been consistent in the IT fields for over a decade as Armstrong et al. (2007) uncovered adverse impacts on women's chances of promotion. Women reported being penalized for taking advantage of flexible work schedules and viewed as less committed. Female IT professionals surveyed in a UK study suggested organizations design workloads with a man in mind having no family or caregiving duties, making it more difficult for women to get promoted (Kirton & Robertson, 2018).

Social Cognitive Career Theory Research

The SCCT model is present in many studies relating to education and career decisions. Valla and Williams (2012) used the SCCT framework to evaluate primary and secondary school STEM interventions and noted the importance of skill development in building math and science self-efficacy. Moakler and Kim (2014) leveraged SCCT and contended that more emphasis should be placed on positive learning experiences to instill the self-efficacy needed for women and minorities to persist in STEM. A separate SCCT based research called out the positive influence of parents, friends, and educators in building interests and outcome expectations that lead to career choices (Ferry et al., 2000). SCCT guided a study on computer technology students, and the model fit across students with a variety of backgrounds and demographics, including White men and women, African American men and women, and beginner to advanced level students (Lent et al., 2011). Nolan et al. (2008) applied the SCCT framework to measure the views of male and female chemists and discovered men had more positive experiences in graduate-level programs and had more mentoring at each level of education. SCCT was used to interview current and former engineers and results showed those who left engineering had less of an identification with being an engineer and did not have strong work–life balance support in the workplace (Buse et al., 2013). SCCT has been shown to be a stable model across races, genders, and all levels of education (Buse et al., 2013; Ferry et al., 2000; Lent et al., 2011; Moakler & Kim, 2014; Singh et al., 2013; Valla & Williams, 2012). Most SCCT related studies deal with the impact of early life factors on career choices. A growing number of studies have covered college and occupational career decisions, and Fouad and Santana (2017) called for more research at the workplace level.

Retention and Potential Strategies

Management can implement a number of strategies and approaches to address the challenges women face in STEM occupations to improve women's retention. One method that can reduce the stereotypes and gender bias that exist in male-dominated workplace environments is diversity training. In a study on the impact of diversity training among university faculty, results showed it helped improve the implicitly biased feelings men had toward women in STEM occupations (Jackson et al., 2014). Men's views improved after the training; however, women's views changed little as women already had an unbiased perception of women in STEM occupations as expressed during pre-training tests. Ivancevich et al. (2014) suggested managing diversity will be critical for the success of organizations in the 21st century.

Human resource management (HRM) organizations can also influence the hiring and retention of more women by starting with appropriate messages of inclusion in recruiting sessions. Wynn and Correll (2018) examined 84 recruiting sessions held by technology companies and found multiple behaviors and images that were off-putting for female candidates. Some troubling examples from these sessions included overly technical images and excessive technical jargon in presentation slides, images objectifying women and portraying them in suggestive clothing, promoting a masculine fraternity culture at work, and having women only in administrative roles among the recruitment staff.

Reducing turnover is a central focus for organizations as replacing highly skilled STEM talent is costly. Recruiting replacements and the training and time involved in getting the new employees up to speed are costly (Ng & Feldman, 2007). It can also cause disruption and negatively affect productivity by decreasing morale among the employees left behind working on joint projects and result in overall reduced organizational performance (Chen et al., 2011). HRM professionals can address the lack of self-efficacy among women in STEM occupations by designing interventions that give women equal opportunities for networking, mentoring, and participating in training and development programs (Buse & Bilimoria, 2014). Investing in developing and training employees has a positive relationship with retention; a workforce learning report surveyed over 4,000 STEM and non-STEM professionals globally and found 93% of respondents reported they would remain with an organization longer if the organization is invested in training and development (Workplace Learning Report, 2018).

According to Corbett and Hill (2015), when women in engineering and technology positions have the resources and opportunities they need to take on challenges in the workplace, and are then acknowledged and rewarded for their efforts, their self-efficacy increases. HRM and organizational leaders can also improve self-efficacy by having well-defined roles and responsibilities for employees, providing appropriate resources to meet those responsibilities, and avoiding unrealistic workloads (Corbett & Hill, 2015). HRM policies that enforce consistent practices surrounding pay and advancement will also help address the perceptions of inequity that exist among women in technology and engineering.

In addition to training and opportunities, HRM can focus on providing management and mentoring support for women in STEM occupations by creating formal and informal mentorship programs. Fouad and Singh (2011) surveyed 3,700 women engineering graduates and concluded those with known mentors were more likely to be satisfied with their jobs and less likely to leave their organizations. HRM and managers can also have an impact on the challenging male-dominated climate that exists in technology and engineering environments that can make women feel isolated and less valuable. A basic approach is setting the example and being a role model by conducting personal interactions and meetings in a way that does not show favoritism and strives to make men and women both feel appreciated, worthy, respected, and visible. Creating a culture of inclusivity and supportiveness among employees and management can help reduce the turnover of women engineers (Duliani et al., 2018). This same *Harvard Business Review* article also indicated having work–life balance role models and working on challenging assignments can help retain women in engineering. Mentoring relationships can help reduce turnover at all levels of the organization, from entry-level to upper management (Duliani et al., 2018). HRM can oversee the mentoring program and ensure the main criterion for success is in place, which is "an atmosphere of mutual respect and understanding and for the mentor to have the protégé's best interest in mind" (George & Jones, 2012, p. 118).

Another major issue for HRM organizations is supporting the concern for work–life balance that seems to be lacking in science, technology, and computing work environments (Armstrong et al., 2007; Fouad et al., 2016; Myers & Major, 2017; Riffle et al., 2013). Engineering and technology roles can be demanding in nature and involve long hours that are not always conducive to work–life balance or part-time employment, which leads many women to leave for other occupations (Fouad et al., 2017). The growth of dual-career households and those of single parents has magnified the importance of HRM support for work–family programs such as flexible workday hours, job sharing, and remote work possibilities. It is vital to support the use of flexible work programs for women in STEM occupations and not just offer them symbolically (Armstrong et al., 2012; Kirton & Robertson, 2018).

Research Gap

As explained in the introduction section, existing studies involved samples of college students regarding STEM education and degree determination and career intentions. A research focus lacking is comparing the perceptions of women who have remained and those who have left STEM occupations. A study of the challenges women face in IT supported the need for more investigation at the career level as the shortage of women is now more of an organizational problem and less society related (Armstrong et al., 2012). Also missing from the existing research is the use of a survey-based quantitative approach to understanding the underlying factors contributing to the longevity of women across STEM occupations. Many of the studies relating to retaining women in STEM occupations used a review and exploratory approach (Blickenstaff, 2005; Fouad & Santana, 2017; Hill et al., 2010; J. L. White & Massiha, 2016) or a qualitative approach based on focus groups or interviewing a small number of women (Buse & Bilimoria, 2014; Buse et al., 2013) or targeting a small group of subjects at one organization or university (Jordan & Carden; 2017; Milner et al., 2013). Nadya Fouad and Romila Singh are two prominent researchers in the area of women in STEM occupations and have conducted several quantitative studies using survey data from engineering graduates from more than 30 universities (Ferry et al., 2000; Fouad et al., 2017; Fouad et al., 2019; Fouad & Santana, 2017; Fouad & Singh, 2011; Fouad et al., 2016; Singh et al., 2013). These researchers focused on retaining women in engineering and suggested the same type of research is needed directly questioning women on the reasons they consider leaving across all STEM occupations to see if there are differences (Ferry et al., 2000; Fouad et al., 2017; Fouad et al., 2019; Fouad & Santana, 2017; Fouad & Singh, 2011; Fouad et al., 2016; Singh et al., 2013). According to the National Science Foundation (2017), women have earned approximately 50% of all science and engineering degrees but account for only 14% of engineers, 25% of computer scientists and technologists, 25% of STEM managers, and 43% of jobs in life sciences (Noonan, 2017). Despite the focus and source of many reports, the results consistently show women are represented equally in biology and life sciences but reflect some level of deficiency in all other areas of STEM occupations.

As described in this section, research on the underrepresentation of women in STEM occupations covers a variety of areas, including childhood influences, primary and secondary education differences, lower STEM self-efficacy, and differences in career level role models, work climate, mentoring, networking, and promotional opportunities. More recent studies indicate the problem is transitioning from a societal issue to an organizational issue. The focus in the current study was on work-related support concerns that affect women's persistence in STEM and the differences in those concerns across the four areas of STEM (i.e., science, technology, engineering, mathematics).

Organizational Support and Turnover

The remainder of the literature review includes discussions of research on the factors investigated within this study relative to turnover intentions: perceived organizational support (POS), perceived supervisor and coworker support (SCS), and perceived work–family support (WFS). POS and SCS reflect more general feelings about the support overall from the organization, whereas WFS is more domain-specific in perceptions of support for balancing work and family life.

Perceived Organizational Support

Organizational support theory supposes that employees develop perceptions about the support they receive from their organizations, which then affects their job satisfaction, job outcomes, and job commitment. Perceived organizational support (POS) is defined as workers' global views of the "extent to which an organization appreciates their contributions and cares about their well-being" (Eisenberger et al., 1986, p. 501). Organizational level support is an important factor given the variety of challenges women face in STEM occupations. Examples of organizational support include allowing employees to participate in decision making, listening and responding to concerns, providing support for work–life balance, offering fair rewards, and providing growth opportunities. These support factors are in line with the lens of SCCT that a relationship exists between contextual support influences and career choices. The results of several studies indicated increased obligation and higher levels of organizational commitment are likely to occur when employees experience a more supportive work environment (Eisenberger et al., 1986; Kurtessis et al., 2017; Rhoades & Eisenberger, 2002).

Commitment develops through a multitude of work interactions over time via a two-way exchange relationship between employer and employee, and employees develop perceptions of organizational support over time. Social exchange theory supports this view as it indicates people feel obligated to help those who help them. Employees with higher levels of POS have been shown to have more trust, obligation, and affective commitment to their organizations (Kurtessis et al., 2017). Results of a study of women professionals across all types of occupations indicated POS lessens turnover intentions, and employer satisfaction has more impact on retention than job satisfaction (Jawahar & Hemmasi, 2006). Additional studies showed POS diminishes turnover intentions (Allen et al., 2003; Eisenberger et al., 2002; Kahumuza & Schlechter, 2008). One survey of women engineers did not confirm a significant relationship between POS and turnover intentions (Fouad et al., 2016). However, the measurement for POS (Caplan et al., 1975) included questions that were more social in nature and had not been used as widely as the one developed by Eisenberger et al. (1986). Despite the results, Fouad et al. (2016) investigated POS related to engineering and recommended future investigations of POS in science, technology, and mathematics.

Perceived Supervisor and Coworker Support

Measuring employees support perceptions also applies to the relationships and support employees receive from supervisors and coworkers (SCS). Many researchers have noted the importance of managerial support in job satisfaction, commitment, and retention (Allen et al., 2003; Lim, 1996; Rayton, 2006). Results of a research project across 50 countries and over 300 companies revealed most people leave their jobs because of dissatisfaction with their supervisors (Hay, 2002). Eisenberger et al. (2002) found a positive relationship between perceived supervisor support and POS that, in turn, reduced turnover decisions as employees view supervisors as agents of the organization. Other studies have shown a negative correlation between perceived supervisor support and employee turnover intentions (Kahumuza & Schlechter, 2008; Rhoades & Eisenberger, 2002; Shanock & Eisenberger, 2006). Lim (1996) postulated that social support from coworkers helps reduce job dissatisfaction and searching for alternative employment opportunities. Results of a survey of women engineers who left STEM showed general feelings of support from supervisors and coworkers were less impactful to longevity than directed support such as advancement opportunities and work–life balance provisions. However, the researchers agreed more testing is needed across STEM disciplines (Fouad et al., 2016). In the context of the STEM working environment, supervisors can have an impact on helping overcome the biased and chilly climate women face.

Rayton (2006) examined 363 employees across UK companies and found peer support and clear job expectations influenced job commitment but not satisfaction. Support from coworkers is a lesser studied topic related to turnover and occupational commitment but was addressed in the current study given the obstacles women face in the male-dominated STEM workplace. Smaller workgroup dynamics often come into play as employees are part of a team and groups, as well as an organization. Kahumuza and Schlechter (2008) suggested perceived coworker support needs to be investigated further using a more integrated approach across POS and SCS, as analyzed in the current study.

Perceived Work–Family Support

The importance of offering work–life programs and benefits has grown steadily as most households in the United States are dual-income (U.S. Census Bureau, 2017), and the millennial generation places greater emphasis on work–life balance (Kroth & Young, 2014). Work–life and family benefits include programs such as job sharing, remote work arrangements, personal leave, volunteer time, family leave, flextime, and onsite childcare. Women in STEM occupations are subject to more significant challenges given the heavy workloads and biased environment they face in their occupations (Corbett & Hill, 2015; Kirton & Robertson, 2018). Some studies have shown too few people are taking advantage of these programs for fear it will negatively affect their careers (Armstrong et al., 2012; Kirton & Robertson, 2018; Riffle et al., 2013; Thompson et al., 1999).

Thompson et al. (1999) purported management support of program use has a positive impact on employee utilization of work–family benefits. More importantly, this study showed positive perceptions of a supportive work–family culture (WFS) improved work attitudes even more than the benefits themselves and was related to lower intentions to leave the organization. A longitudinal study involving a survey across 90 organizations showed the existence of work–family benefits had less impact on affective commitment than did supervisory support of family (Thompson et al., 2004). This research supports the premise that intangibles, such as a supportive work culture, influence employee attitudes and intentions to leave more than tangible programs. A study investigating STEM faculty members on track for tenure across four Midwest universities revealed departmental work life and work–family balance affected intentions to leave and job satisfaction for both men and women (Riffle et al., 2013). The current research project involved a focus on the influence of work–family support programs on retaining women in STEM fields.

Turnover Intentions

Employee turnover is one of the most widely investigated factors in the study of management and organizations and refers to the voluntary act of leaving an organization. Turnover intention relates to employees' attitudes, behaviors, and interests relating to ending their employment. Mobley (1977) focused on the thought process and actions employees go through before leaving an organization. Mobley's intermediate linkages model indicates there are steps of potential intervention between work dissatisfaction and turnover and has been tested extensively by other researchers (Hom et al., 1984; Singh et al., 2013). Bothma and Roodt (2013) suggested turnover intentions are one step in the process of individuals deciding to leave an organization. Many turnover studies revealed low levels of job commitment and satisfaction as the first step for employees as they consider leaving an organization (Hom & Griffeth, 1994). As uncovered in the review of literature, high rates of turnover present a multifaceted problem for women in STEM occupations. The current study included an exploration of support variables in the work environment to understand their impact on the turnover intentions of women in STEM occupations. Design and methodology are covered in the next chapter.

CHAPTER THREE: DESIGN AND METHODOLOGY

A sound methodology is a critical component of research as it provides the systematic approach needed to achieve the goals of the study (Creswell & Creswell, 2018). The purpose of this chapter is to present the research methodology used in this study to investigate the influences of organizational support factors on women's intentions to leave STEM occupations. Topics covered in this chapter include the research method, analysis approach, hypotheses, research design, survey, data, instrumentation and measurements, methodological assumptions and tests, limitations, reliability, and validity.

After decades of slow progress, women are still underrepresented in STEM occupations in the United States. Increasing the number of women in STEM occupations will help address the growing demand for labor skilled in science, engineering, technology, and math. According to SCCT, contextual factors, such as perceived organizational support, influence career choices (Lent et al., 2003). Singh et al. (2013) extended the SCCT model to include turnover intentions through an examination of women engineers, which was an aspect investigated further through this analysis. The outcome of the study by Singh et al. was to provide knowledge to the leaders of organizations, including HRM, with the intent to operationalize programs and policies with the goal of retaining more women in STEM occupations.

A quantitative approach was used for this research, including descriptive analysis, multiple linear regression analysis, independent samples *t* test comparisons, and analysis of variance (ANOVA). Data were gathered through an online survey targeting women currently and formerly working in STEM occupations in the United States. Quantitative analysis was used to examine the relationships among three areas of organizational support (i.e., perceived organizational support [POS], perceived supervisor and coworker support [SCS], perceived work–family support [WFS]) on the turnover intentions (TI) of women in STEM occupations. According to organizational support theory, workers are more committed to their jobs when management and coworkers are supportive and they have opportunities for training and promotions (Eisenberger et al., 1986).

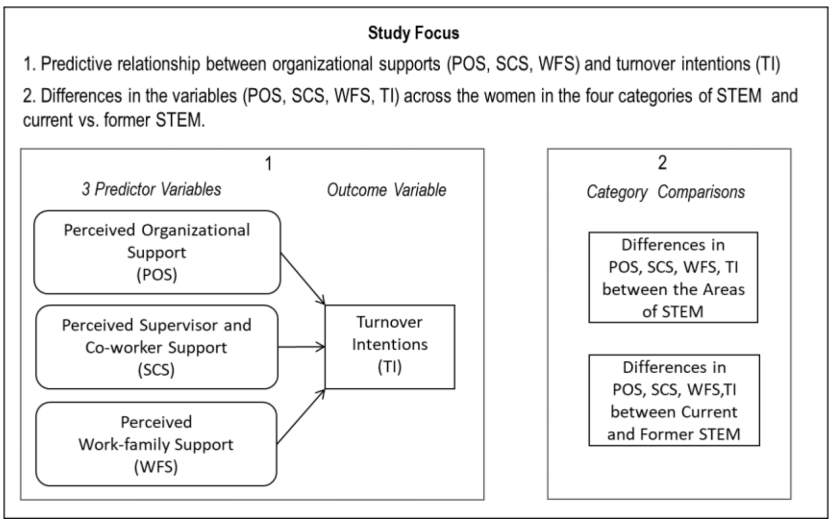
The data were analyzed for differences in the variables (i.e., POS, SCS, WFS, TI) between the four areas of STEM and between women working in STEM and those who left the field. A key focus was to investigate differences in support environments for women in engineering and technology as the review of the literature showed higher turnover rates in technology and engineering compared to math and science (Fouad & Santana, 2017; Glass et al., 2013; Hill et al., 2010). Comparisons were made between women currently and formerly working in STEM to determine whether organizational support perceptions and turnover intentions were influencing factors in leading women to leave their STEM occupations.

Research Method

The two primary methods of research are quantitative and qualitative. The quantitative method is typically numeric and statistics based, whereas the qualitative method is more descriptive based and less quantifiable. A quantitative approach, selected for this research, is preferred when there is a need to examine relationships between variables and when working with larger samples and attempting to apply findings to a more general population (McClave et al., 2015). Quantitative studies are more appropriate when the goal is objectivity, rather than subjectivity (Simon & Goes, 2011), which was the case for this study. As highlighted in Figure 3, this research involved studying the influence of three predictor variables (POS, SCS, WFS) on one outcome variable (TI). This study also involved comparing the differences in four independent variables (POS, SCS, WFS, TI) between the four categories of STEM and between women currently working in STEM and those who left the field.

Figure 3

Analysis Conducted



A qualitative approach was not chosen given the need to represent a broad study population, the desire for quantitative results, and the research bias that can happen during the interactions between the investigators and those interviewed (Creswell & Creswell, 2018). A quantitative approach was appropriate for this study given the nature of the study population (i.e., women in all areas of STEM and from across the United States), the need for survey-based data to investigate the statistical relationships between multiple variables, and the desire to make inferences and predictions based on the statistical relationships between variables.

Hypotheses

Establishing hypotheses was necessary and provided a general framework for examining the two research questions. Based on the background covered in the introduction and literature review, the following hypotheses were proposed to investigate the retention of women in STEM occupations. Figure 4 illustrates the three main hypotheses (H1, H2, H3).

Hypothesis 1: Support Influences on Turnover Intentions

The overall premise was that perceived organizational supports (i.e., perceived organizational support, perceived coworker and supervisory support, perceived work–family support) would have a significant and negative relationship with the turnover intentions of women in STEM occupations. The following null and alternative sub hypotheses were investigated for Hypothesis 1:

$H_0$1: Perceived organizational supports (POS, SCS, WFS) will not predict turnover intentions for women in STEM occupations.

H_a1: Perceived organizational supports (POS, SCS, WFS) will predict turnover intentions for women in STEM occupations.

Hypothesis 2: Differences Between Women Currently and Formerly in STEM

Hypotheses 2 related to the review of literature findings that showed women who left STEM reported higher turnover intentions and more negative support perceptions. The following null and alternative sub hypotheses were investigated for Hypothesis 2:

$H_0$2A: There will be no significant difference in perceived organizational supports (POS, PCS, and WFS) between women currently and formerly working in STEM.

H_a2A: There will be a significant difference in perceived organizational supports (POS, SCS, and WFS) between women currently and formerly working in STEM.

$H_0$2B: There will be no significant difference in turnover intentions (TI) between women currently and formerly working in STEM.

H_a2B: There will be a significant difference in turnover intentions (TI) between women currently and formerly working in STEM.

Hypothesis 3: Differences Across the Categories of STEM

Hypothesis 3 related to the finding within the review of literature that work climate and support environments in some areas of STEM (e.g., technology and engineering) are more difficult, and therefore cultivate higher turnover intentions. Furthermore, the expectation was that perceived organizational supports would have a more negative influence on technology and engineering as compared to science and math. The following null and alternative sub hypotheses were investigated for Hypothesis 3:

$H_0$3A: There will be no significant difference in perceived organizational supports (POS, SCS, WFS) across the four categories of STEM.

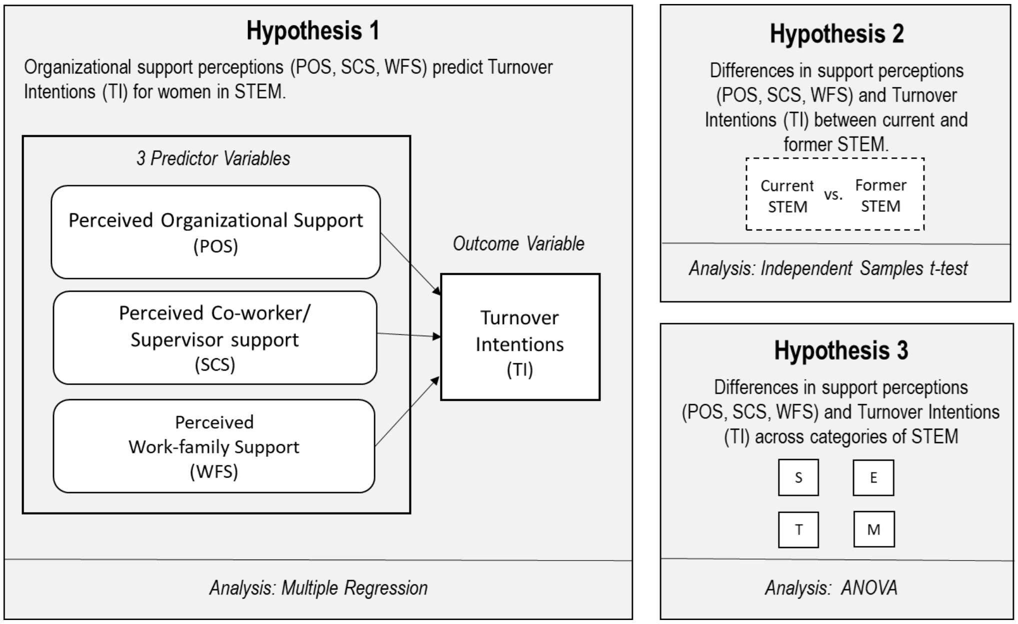
H_a3A: There will be a significant difference in perceived organizational supports (POS, SCS, WFS) across the four categories of STEM.

$H_0$3B: There will be no significant difference in turnover intentions (TI) across the four categories of STEM.

H_a3B: There will be a significant difference in turnover intentions (TI) across the four categories of STEM.

Figure 4

Hypotheses 1, 2, and 3



Research Design

A quantitative correlational design was used in this study to assess and measure the relationships between two or more variables. A quantitative design is appropriate when testing the relationship between two or more variables, at one point in time, and across one or more groups of subjects and supported this study involving three predictor variables, one outcome variable, and women in STEM occupations across the United States. This category of research is non-experimental as it consists of testing the same set of variables across a defined group and does not include manipulation of the variables (Silverman, 2013).

As highlighted in Figure 4, this study involved multiple regression to analyze Hypothesis 1, independent samples *t* tests to analyze Hypothesis 2, and ANOVA to analyze Hypothesis 3. Descriptive and exploratory analyses were run to test assumptions. Multiple regression analysis was appropriate for Hypothesis 1 based on the nature and number (i.e., two or more) of study variables and the proposed question involving the need to understand the relationships between three predictor variables (POS, SCS, WFS) and one outcome variable (TI). Applying multiple regression analysis allows for exploring the relationships between sets of variables, including one dependent variable and two or more independent variables, and is suited to analyze complex real-life situations (Creswell & Creswell, 2018).

Multiple regression requires the use of continuous or ratio variables. Likert scale data were used for the predictor and outcome variables and were coded numerically in SPSS for use as interval data (also known as continuous data). Interval data is a requirement to run a regression analysis (Muijs, 2011; Wilson-Doenges, 2015). Ongoing debates exist among the research community over the use of Likert data as ordinal or continuous. There is a consensus among many researchers that continuous is appropriate for Likert scale data (consisting of multiple items) and ordinal for individual single Likert items (Boone & Boone, 2012; Sullivan & Artino, 2013). Using Likert scales as interval data allows for the application of predictive analytics and parametric tests in general. A predictor type design was chosen for Hypothesis 1 to reflect the interest in anticipating an outcome rather than just relating one variable to another, and the desire to measure the likeliness of the outcome variable. Independent samples *t* test and ANOVA were used for Hypotheses 2 and 3 consecutively as they are appropriate for comparing mean differences across two or more groups (current and former STEM, and the four areas of STEM) and in one or more characteristics (POS, SCS, WFS, TI).

This research involved an investigation of whether certain organizational support factors predicted the turnover intentions of women in STEM occupations and the differences between women currently and formerly working in STEM and across the four areas of STEM. It is important to note that as a result of controlling the variables using statistical procedures, the results measured a degree of association rather than a probable cause and effect.

Analysis Approach

As highlighted in Figure 4, this study involved calculating scores for the three predictor variables (POS, SCS, WFS) and the outcome variable (TI) and assessing the degree of association between the predictor variables and the outcome variable. The survey of women in STEM occupations was conducted at one point in time to measure the organizational support perceptions and turnover intentions for women currently and formerly working in STEM. The study involved measuring whether the three organizational support variables (POS, SCS, WFS) predicted turnover intentions (TI) and assessing the mean differences in the variables (POS, SCS, WFS, TI) between those who left STEM and those who remained in STEM, as well as between the four categories of STEM. A rejection of the first null hypothesis (H1) would indicate women who perceive strong support from their organizations are less likely to consider leaving STEM occupations. A rejection of the second null hypothesis (H2) would suggest turnover intentions are higher and support perceptions are lower for women who have left STEM compared to those who remain. A rejection of the third null hypothesis (H3) would suggest women in technology and engineering have higher turnover intentions and lower organizational support perceptions compared to women in the rest of the STEM fields. The independent and dependent variables (POS, SCS, WFS, TI) used in this study came from previously tested Likert scales as covered in the measurement section in this chapter.

Participants, Data, and Survey

The survey targeted women currently and formerly working in STEM in the United States. Working in STEM was defined as any woman working as a scientist, technologist, engineer, or mathematician. It also included women working as a business professional or manager for a STEM-focused company, and higher education researchers and teachers in STEM. Examples of STEM-focused companies are broad and include research laboratories, research institutions, pharmaceutical, technology providers, computer hardware and software development, and all types of engineering firms. The decision to include a broader set of participants came from studies indicating the STEM work climate is more difficult for women than other male-dominated occupations (Glass et al., 2013) and would affect business professionals and managers as well as STEM specific roles. The survey was used to gather input from women spanning all four areas of STEM (science, engineering, technology, math) and across multiple locations throughout the United States.

To remain competitive globally and keep up with rapid advancements in technology, the United States needs a workforce trained in the four areas of STEM. Investigating the factors that cause women to leave STEM occupations can lead to proactive HRM and management approaches to improve turnover. Retaining more women in STEM occupations can help increase the STEM labor pool in the United States.

Participants and Data

The two primary survey groups studied were women currently working in STEM and women who had left STEM. All participants included in the sample had at least 1 year of experience in STEM per the survey eligibility requirements. One year of employment was necessary for employees to experience the organizational support environment long enough to provide proper support related perceptions (Eisenberger et al., 1986). Those who formerly worked in STEM had to have left within the past 7 years to ensure appropriate memory recall (Marsden & Wright, 2010). The survey screening questions excluded those who were unable to meet the requirements for participation. The survey captured the perceptions of women who worked in the challenging support environments in STEM, whether they were in a traditional STEM role or a manager or professional working in a STEM environment. All study responses were analyzed across those currently and formerly working in STEM for the three hypotheses. Hypothesis 2 involved comparing the differences between current and former STEM workers.

A difference from past studies is that inclusion in the survey was not dependent solely on traditional undergraduate and graduate degree achievement but also on STEM occupation role and experience. STEM degree requirements could erroneously lower the number of relevant respondents based on the growing trend in technology and engineering occupations that no longer tightly match occupation with a specific college degree and can result from on the job or specialized training without a traditional degree. The screening questions related to age, years of experience in STEM, STEM occupation status, role in STEM, STEM category, years since last in STEM, and education level (see Appendix D). Specifically, the data used to test the hypotheses included demographic data (STEM category: current STEM, former STEM; STEM occupation: science, technology, engineering, math) and the four Likert scale-based variables (POS, SCS, WFS, TI).

Data were gathered using an online survey to target over 2,000 women in STEM occupations and reach a minimum of 350 participants, and at least 50 women from each of the four areas of STEM. A quantity of 50 was selected to exceed the comfortable minimum needed for regression and comparisons analysis of 20 instances or greater (Statistical Solutions, 2018). Sampling techniques were used to test the accuracy of regression analysis and mean comparisons results. The target of 2,000 came from estimations made by Baruch and Holtom (2008) that average response rates from individuals are 52.7%, with a standard deviation of close to 20%, coupled with other reported response rate averages of 20% or less by Muijs (2011). According to Muijs, response rates are higher when the audience has a passion or interest in the subject of the survey. It was essential to have some representation from women persisting in STEM and those who had left, but the samples did not need to be equal. A lower response was expected for former STEM workers as they do not belong to specific organizations or jobs that could be directly targeted through email or social media.

The survey consisted of 11 screening and demographic questions and 42 survey items (see Appendix D) measuring the Likert scale variables (POS, SCS, WFS, TI). The survey approach is outlined next and includes the methods used to engage participants. The instrumentation and measurement section includes the Likert scales and survey items details.

Survey Approach

Multiple media platforms were used to reach the study population, including Twitter, LinkedIn, Facebook, and direct emails. A snowball approach was used to capture adequate numbers of women across all four areas of STEM (science, technology, engineering, and math). Communications were sent via email, Twitter, and LinkedIn asking for participants to forward the survey to women they knew in specific areas of STEM. This same approach was used to ensure the study included adequate numbers of women who departed from STEM.

As a member of the TriWiSTEM (Triangle Women in STEM) organization in Raleigh, North Carolina, the researcher leveraged TriWiSTEM and other women in STEM groups to solicit participants. An official email message from the TriWiSTEM board was sent to all members asking for their participation in this survey on retaining women in STEM occupations. Invitations were sent to various STEM professional organizations via email, LinkedIn, and Twitter, as mentioned previously (see Appendix A), with a link connecting them to the survey. Numerous regional women in STEM-related organizations (i.e., Women Who Code Denver, Women Who Code San Francisco, Women in Tech Summit, Women in Machine Learning/Data Science, Public Science NCSU, Women in Ocean Science) shared the survey information on LinkedIn and Twitter. The largest national organization that promoted the survey was the Society of Women Engineers (SWE), posting it on their LinkedIn and Twitter pages.

Before starting the questions, participants were presented with an implied consent statement as part of the online survey process, explaining the nature of the study (see Appendix B). The survey interface included prompts that led participants down the appropriate path of questions based upon being in a current or former STEM occupation. Survey participants had to be at least 20 years of age, work in an accepted STEM-related role in the United States, and have a minimum of 1 year of STEM work experience as covered in the previous section. As part of the online survey process, ineligible respondents were given a message thanking them for their time and explaining they were not able to participate in the study. The survey was created using Qualtrics survey software. The rationale used for measuring the variables is described next.

Instrumentation and Measurement

The online survey included 11 screening and demographic questions and 42 survey questions related to the study variables (see Appendix D). According to Stanton et al. (2002), a longer survey time yields lower response rates and can dilute the quality of the responses with the onset of survey fatigue. Muijs (2011) suggested 30 minutes maximum to avoid fatigue and ensure higher completion rates. The survey went through two rounds of testing with eight different individuals. The final survey format and questions took an average of 10 minutes to complete based on testing feedback from individuals who took the survey. Participants responded to questions consisting of basic demographics and items for the Likert-scale based variables. The scales used reflected perceived organizational support (POS), perceived supervisor and coworker support (SCS), perceived work–family support (WFS), and turnover intentions (TI).

The scales used for this research are publicly available and have been tested in previous studies with acceptable Cronbach’s alpha scores. Cronbach’s alpha tests for internal consistency and reflects higher reliability when items measure the same thing within a scale (Cronbach, 1951; Muijs, 2011). The variables used in this study were all

Likert scales with multiple items. The Likert scales were transformed into numerical interval data for processing and analysis in SPSS. Interval data are a requirement for parametric analysis (Leedy & Ormrod, 2013). The examination of POS, SCS, WFS, and TI (interval type data) across the four STEM categories (nominal type data) and current and former STEM (nominal type data) involved multiple regression analysis, ANOVA, and independent samples *t* tests. Multiple regression is a parametric test requiring all data to be numeric and of the interval type and was used to test whether POS, SCS, and WFS (interval type data) predicted TI (interval type data). The independent samples *t* test was used to analyze the differences in POS, SCS, WFS, and TI between women currently and formerly working in STEM as it only involved two groups. ANOVA was appropriate for comparisons across the four different areas of STEM as it can be used to analyze variances across independent groups based on nominal data items involving three or more groups (Wilson-Doenges, 2015).

Not all researchers agree, but there is broad support for the use of Likert scale data in parametric analysis with support for using them as interval and, in some cases, ratio data (Carifio & Perla, 2007). Table 2 is a summary table of items and a description of each of the Likert scales used for the measurement of the study variables and examples of usage in past studies.

Table 2

Survey Constructs

Construct	Measures	Source
Perceived organizational support (POS)	8 items using a 7-Point Likert scale	(Eisenberger et al., 1986)
Perceived coworker and supervisor support (SCS)	16 items using a 7-Point Likert scale	(Eisenberger et al., 1986) re-worded POS items to reflect supervisory and coworker and combined supervisor and coworker into one scale
Perceived work–family support (WFS)	15 items using a 7-Point Likert scale	(Thompson et al., 1999).
Turnover intentions (TI)	3 items using a 7-Point Likert scale	(Hom et al., 1984)
Demographic data	Age Education level Occupation status Occupation tenure Role in STEM Area of STEM Reason left STEM	11 screening and demographic questions

Perceived Organizational Support (POS)

This 8-item measure (see Appendix C) created by Eisenberger et al. (1986) is used to assess employees' feelings of being appreciated for their contributions and of the organization's overall interest in their well-being. It includes a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). A Cronbach's alpha of .95 was achieved using this scale in a later study by Shore and Tetrick (1991) that focused on construct validity. A Cronbach's alpha of .70 or more is the desired score for internal consistency (Cronbach, 1951) and involves testing different sequencing of questions to make sure they consistently measure the same concept or trait. Reliability is higher the closer the score is to one.

Eisenberger et al. (1986) posited that career choice behaviors influence contextual factors such as a supportive work climate, which is also a fundamental premise of SCCT. Sample items for this scale are as follows: “My organization takes pride in my accomplishments at work;” “Even if I do the best job possible, the organization would fail to notice;” and “The organization really cares about my well-being.” Refer to Appendix C for the complete list of items.

POS mean values were computed in SPSS using the POS Likert item responses for each survey participant. The POS mean values were then used in independent samples *t* tests, ANOVA, and regression analysis. POS was part of the investigation to predict turnover intentions as well as the comparison of means between current and former STEM workers and the four categories of STEM.

Perceived Supervisor and Coworker Support (SCS)

This 16-item scale (see Appendix C) is an adapted version created by Eisenberger et al. (1986) from the original perceived organizational support scale. The questions are the same, but the words “my organization” were replaced with “my supervisor” and “my coworker.” It includes a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*) work. In a later study, Eisenberger et al. (2002) tested the adapted version to examine perceived coworker support with employee retention and reported a Cronbach’s alpha score between .72 and .80, which exceeds the recommended value of .70.

Several studies have successfully tested these same modified scales for perceived supervisor support with perceived coworker support (Eisenberger et al., 2002; Kahumuza & Schlechter, 2002; Kurtessis et al., 2017; Rhoades & Eisenberger, 2002; Shanock & Eisenberger, 2006; Stinglhamber & Vandenberghe, 2003). Kahumuza and Schlechter

(2008) used the modified items to investigate the impact of perceived supervisor support and perceived coworker support (SCS) on intentions to quit. The researchers found high validity and reliability and reported a Kaiser-Meyer-Oklin (KMO) value of .85, which is well above the recommended value of .60. Sample prompts from this scale are: “My supervisor shows very little concern for me,” “My supervisor takes pride in my accomplishments at work,” “My coworkers fail to appreciate any extra effort from me,” and “My coworkers value my contribution to their well-being.” Refer to Appendix C for the complete list of the Likert scale items.

Mean values for SCS were computed in SPSS using the SCS Likert item responses for each survey participant. The SCS mean values were then used in independent samples *t* tests, ANOVA, and regression analysis. SCS was analyzed as part of measuring the significance of the relationship of support variables with turnover intentions, as well as the comparison of means between current and former STEM workers and the four categories of STEM.

Perceived Work–Family Support (WFS)

The Work–Family Support 15-item scale (see Appendix C) leverages the two dimensions developed by Thompson et al. (1999), time demands of work and managerial support, and evaluates the perceived impact of work–family support on employees within an organization. It uses a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

Thompson et al. (1999) suggested positive perceptions of managerial support for work–family culture result in higher usage of work–family benefits, more organizational attachment, better job attitudes, and reduced turnover. Employees who feel supported at work are more likely to take advantage of work–life balance benefits and have a more positive attitude about their job. A comparative study of women engineers revealed managerial support for work–life balance is a content-specific workplace support factor that contributes to women persisting in STEM (Fouad et al., 2016). Fouad et al. (2016) suggested content-specific elements such as managerial support for work–life balance and development opportunities have more impact on retention than generally perceived organizational support.

Example items for the WFS measurement include: “Employees are often expected to take work home at night and/or on weekends;” “In general, managers in this organization are quite accommodating of family-related needs;” and “Middle managers and executives in this organization are sympathetic toward employees’ child-care responsibilities.” Thompson et al. (1999) reported a strong Cronbach’s alpha score of .92 for this scale. Refer to Appendix C for a full list of the Likert scales item.

WFS mean values were computed in SPSS using the WFS Likert item responses for each survey participant. The WFS mean values were then used in independent samples *t* tests, ANOVA, and regression analysis. The current study involved testing the differences in WFS across the areas of STEM, and between women currently and formerly working in STEM. WFS was also part of the variables examined in predicting turnover intentions.

Turnover Intentions (TI)

The construct for this outcome variable consisted of a scale with three items (see Appendix C) adapted from Hom et al. (1984) and measures an individual’s intentions to leave their occupation in STEM using a 7-point Likert scale (1 = *strongly agree* to 5 = *strongly disagree*). Higher values indicate higher likeliness to leave an occupation. The original wording by Hom et al. referenced organizational turnover and was changed to reflect occupational turnover as the purpose of this study was to examine women leaving STEM for another occupation or some form of non-employment. Singh et al. (2018) calculated a Cronbach's alpha score of .86 for this turnover intention scale as part of their research on the impact of work–family conflict on the turnover intentions of women in engineering. These researchers also changed the wording to reflect intention to leave an engineering occupation. The turnover intention scale items in this study were: "I often think about quitting my occupation in STEM," "I plan to stay in my STEM occupation for some time," and "I intend to look for a different career outside my STEM occupation within one year."

TI mean values were computed for each survey participant using the turnover intention Likert item responses and then leveraged in the analysis. Multiple regression was used to measure the degree of influence of the three predictor variables (POS, SCS, WFS) on this outcome variable (TI). The turnover intention variable was part of the comparison of the means between current and former STEM workers and between the four areas of STEM.

Analysis Preparation and Plan

The survey setup in Qualtrics involved efficient coding of variables numerically and categorically. Questions and responses were designed to support the need for nominal and interval data as required for analysis. The Likert scale variables (POS, SCS, WFS, TI) were continuous (interval type) data as required for regression analysis. STEM Category (the four areas of STEM) and STEM Occupation Status (Current and Former) were nominal data as appropriate for independent samples *t* test and ANOVA comparisons. Data were exported from Qualtrics into SPSS, after which cleaning, computation, and analysis preparation were carried out to remove unnecessary data, followed by Likert scale computations (mean and median) to allow for testing the hypotheses. Specifically, four new variables were created using the mean computation feature in SPSS and were used for the linear regression testing using the Likert scale variables (POS, SCS, WFS, TI). Reverse item coding happened in the Qualtrics software setup with no changes required after exporting the data to SPSS.

The appropriate statistical approach is determined by the nature of the study, the type of data involved, and the desired relationship analysis between the variables (Statistical Solutions, 2018), as discussed in the next section.

Methodological Assumptions and Tests

Multiple regression, independent samples *t* tests, and ANOVA were the parametric tests used in this study. Parametric testing assumes there is a normal distribution of the data, and results provide a stronger statistical power in testing hypotheses over non-parametric tests (Muijs, 2011).

Multiple regression is appropriate when there are multiple predictor variables and one outcome variable, and all are continuous type variables, as was the case with the three predictor variables (POS, SCS, WFS) and the outcome variable (TI) used to test Hypothesis 1. Independent samples *t* test was used for Hypothesis 2 (comparing current STEM to former STEM) as appropriate with one continuous independent variable and the need to compare differences across two groups using a nominal type variable. ANOVA is appropriate when there are one or more continuous dependent variables and the need to compare differences across three or more groups using a nominal type variable, which was the case with Hypothesis 3 (across the four categories of STEM). The rest of this section contains details of the tests of assumptions and planned analysis for multiple regression, independent samples *t* test, and ANOVA.

Hypothesis 1

Multiple regression analysis was used to examine whether the independent variables (POS, SCS, WFS) predicted the dependent variable (TI) or were likely the result of chance for Hypothesis 1. The test of assumptions for multiple regression include (a) no multicollinearity, (b) homoscedasticity, (c) residuals normally distributed, and (d) a linear relationship between the predictor variables and the outcome variable (Statistical Solutions, 2018).

Multicollinearity was evaluated using coefficient results with a desired variance inflation factor (VIF) value of less than 10 and tolerance less than 1. Scatterplots were use for homoscedasticity to confirm the residuals were equal across the regression line. Residual statistics results (how far residuals fall from the regression line) were used to test whether the residuals were normally distributed. The acceptable range for standardized residuals is between -3 and 3 (Field, 2013). Cook's Distance test was used for outliers. Linearity was tested using the normal probability plot to confirm the predictor variables had a straight-line relationship with the outcome variable. The average acceptable sample size for multiple regression is 20 (Statistical Solutions, 2018).

Each predictor variable was evaluated by what it added to the prediction of the dependent variable. The collective influence of the predictor variables was evaluated by the *F* test. The amount of variance in the dependent variable was determined by the predictor variables and based on the *R* square value, the multiple correlation coefficient of determination. The significance of each predictor variable was measured by the *t* test and the beta coefficients for the degree of prediction for each predictor variable. To reject the null hypothesis (H1), the collective influence of the three predictor variables (POS, SCS, WFS) had to predict TI ($p < 0.05$) significantly.

Hypothesis 2

Independent samples *t* tests were conducted in SPSS to test the means for each of Likert scale variables (POS, SCS, WFS, TI) between women currently and formerly working in STEM for Hypothesis 2. Tests of assumptions were evaluated in SPSS using the explore feature together with the independent samples *t*-test results. Normality and homogeneity of variances were tested for the independent samples *t* test. Normal distribution was tested using the Kolmogorov-Smirnov goodness of fit test. This test has a desired non-significant result of $p > 0.05$. Levene's test was used to assess homogeneity and determine whether variances across the groups were of the same nature. Rejecting the null hypothesis was based on achieving a significant difference ($p < 0.05$) in the means for the variables being tested between women currently and formerly working in STEM. Hypothesis $H_0$2A tested POS, SCS, and WFS. Hypothesis $H_0$2B tested TI.

Hypothesis 3

One-way ANOVA analyzes the average scores and the variations within those scores between three or more groups and reports whether the differences between them are significant or likely the result of chance. A one-way ANOVA was conducted to test the means for each of the variables (POS, SCS, WFS, TI) between the four STEM categories (science, technology, engineering, math). The tests of assumptions require normal distributions of the group samples, dependent variables that are unique or selected randomly, and homogeneity with the groups being compared (Muijs, 2011). A q-q plot was used to determine data normality and Levene's test for homogeneity of variances. ANOVA results in SPSS were used to test the hypothesis. Rejecting the null hypothesis was based on achieving a significant difference ($p < 0.05$) among the group (four areas of STEM) means for the variables being tested. Hypothesis $H_0$3A tested POS, SCS, and WFS. Hypothesis $H_0$3B tested TI. Tukey post-hoc test was used to determine the specific groups (i.e., areas of STEM) that had significantly different means.

In summary, H1 predicted women in STEM occupations (both current and former) with stronger perceptions of organizational support would be less likely to consider leaving their organizations. H2 predicted women who left STEM would exhibit higher turnover intentions and lower perceptions of organizational support compared to women who remained in STEM occupations. Last, H3 predicted turnover intentions would be higher and organizational support perceptions would be lower in some areas of STEM compared to others. Technology and engineering were expected to have lower support perceptions and higher turnover intentions as identified in the post hoc Tukey test in SPSS.

Validity and Reliability

Assessing validity and reliability is a crucial part of any research and together determine the degree to which a study can be used to gain knowledge about the issue examined. Validity is essential and refers to the "quality of a scale as a measure of its intended construct" to ensure research instruments assess what they are intended to measure (McCrae et al., 2011, p. 28).

Reliability refers to consistency in processes, measurements, and findings, and research is reliable if the same techniques and procedures are applied across another set of participants, on another occasion, or by another researcher and still return consistent findings (Leedy & Ormrod, 2013). Having one online protocol and interface for all surveys can contribute to reliability, which happened in the current study.

This research was non-experimental and involved a quantitative analysis of data gathered from survey responses. Approaches to positively affect validity and reliability for this type of study are as follows: appropriate survey length and structure, proper word choice for question clarity, easy to follow survey layout, consistency in data collection method and analysis, and coefficient alpha testing to measure internal consistency (Marczyk et al., 2005). Three key validity concerns are internal, external, and construct validity. Internal validity relates to whether the relationship is causal, and external validity is concerned with the ability to generalize the results across other settings and populations. Construct validity refers to whether the dimension examined measures what it claims to measure (Leedy & Ormrod, 2013). The data analysis process was structured to affect the degree to which the constructs measured what was intended, such as using coefficient alpha to measure internal consistency. As mentioned in the instrument and measurement section, all the Likert scales were previously tested across multiple studies with accepted Cronbach's alpha scores and with consistent results across different populations.

Ethical Considerations

Ethical standards in research are important to protect subjects involved in research and to ensure the integrity and credibility of the study (Israel, 2015). The Saint Leo

University Institutional Review Board (IRB) reviewed and approved the study on February 20, 2020. The online survey included an implied consent statement before entering the question section of the study (see Appendix B). Before entering the response sections of the survey, participants were presented with a clear explanation of the study's purpose and a list of the procedures. All participants had to confirm they were over 20 years of age. The survey was completely anonymous, and no personally identifiable information was captured as part of the survey process. There were no data privacy concerns because participants entered no personal information. Qualtrics complies with all federal regulations regarding privacy and is ISO 270001 compliant.

Assumptions and Limitations

Statements of assumptions and limitations are necessary to minimize misunderstanding the results of a study (Leedy & Ormrod, 2013). The first assumption was that data gathered from surveying women could accurately establish factors that motivate women to persist or leave STEM occupations. Work support factors and turnover intentions were assumed to be relevant variables worthy of testing in predicting turnover based on past studies covered in the literature review section. It was assumed that survey respondents would answer the questions honestly, completely, and in a way that accurately reflected reality. The aim of this research was to capture a broad sample of women across age, tenure in STEM, education level, and all four areas of STEM.

Assessing whether the study results correctly depict a broad representation of women in STEM occupations in the United States is difficult given the approach of gathering respondents through professional women's organizations, social media platforms, email, and using the snowballing method by asking women to forward the survey. Some qualitative researchers believe the snowballing approach results in less generalizability (Given, 2008). The accuracy of survey research findings can be affected by participants misreading or misunderstanding survey questions (Muijs, 2011). The data collected only captured the perceptions held by women in STEM occupations through self-reporting from an online survey. One concern with self-reporting is anonymous participants tend to report less honestly (Lelkes et al., 2012). This study was focused on specific aspects of career decisions and did not test the full SCCT model on career behaviors and choices. This analysis captured results for one point in time and did not reflect career stages over time.

Summary

In this chapter, the methodologies were discussed, including participant selection, data collection, assumptions, analysis, testing, ethical considerations, reliability, validity, and limitations. This review provided the research methodology and the rationale for using a quantitative correlational design to address the research hypotheses appropriately. It presented an outline of the approach used to determine support for the proposed hypotheses. The next chapter presents the analyses performed and the study results.

CHAPTER FOUR: DATA AND ANALYSIS

The purpose of this study was to investigate organizational support factors influencing women's decisions to leave STEM occupations with the goal of helping management and HRM organizations better understand sources of turnover to then formulate ways to improve retention rates. Specifically, the research questions were: Are employees with positive perceptions of organizational support (perceived organizational support, coworker and supervisor support, work–family support) less likely to leave their STEM organizations? Are there unique challenges in some areas of STEM that lead women to leave their occupations? The previous chapters of this study provided background on the underrepresentation of women in STEM occupations, the theoretical foundation, and the research design and methodology for this study. This chapter covers the data collection, descriptive and statistical analyses for each of the three hypotheses, and a summary of the findings.

Data Collection

The Qualtrics survey platform was used for tracking survey responses. Soliciting survey participants took under 8 weeks. The Saint Leo University Institutional Review Board (IRB) approved the study on February 20, 2020. The survey was launched on March 11, 2020, and concluded on May 3, 2020. Participants were solicited as planned through direct emails, LinkedIn messages and posts, Facebook posts, Twitter posts, and numerous post reshares. The survey structure worked efficiently to screen out respondents not meeting the eligibility criteria, allowing for a smooth data export of the completed responses. Reverse and numeric data coding transferred directly from Qualtrics to SPSS using the export feature. Minimal data clean-up was needed in SPSS to remove unnecessary data fields and the 85 partially completed responses. Missing data were not a concern for the study as only completed responses were included.

The survey resulted in 657 completed responses from women in STEM occupations in the United States (former STEM, n =51; current STEM, n = 606). It was difficult to estimate a response rate given the nature of promoting through social media and because the survey was completely anonymous. However, the 657 completed responses resulted from an estimated reach of over 3,000 people (over 1,000 emails and over 50 posts and reshares representing over 2,000 views or engagements), representing an estimated response rate of 20%. The remainder of this chapter covers the analysis for each of the hypotheses and a summary of the findings.

Descriptive Analysis

As highlighted in Table 3, the 657 completed responses reflected a nearly equal distribution across the four areas of STEM with technology (n = 196) having the highest count, followed by science (n = 161), engineering (n = 151), and math (n = 149). Technology is the largest area of STEM and constitutes over 50% of STEM occupations in the United States (BLS, 2020) and is important for this study given the reported challenges for women per the review of literature. Having many responses from each area of STEM helped to support STEM area comparisons made for Hypothesis 2 and to represent women in STEM occupations broadly for Hypotheses 1 and 3. Women who had formerly worked in STEM were a difficult group to capture, but 51 was an adequate number for the quantitative analysis (Wilson-Doenges, 2015).

Table 3

Area of STEM by Current and Former STEM

	Current STEM	Former STEM	Total
Science	145	16	161
Technology	180	16	196
Engineering	137	14	151
Math	144	5	149
Total	606	51	657

Table 4 presents an overview of the demographics of the completed responses for each of the four areas of STEM by education level, age group, and years of experience. Response data that are representative across the population demographics studied improve the case to generalize the findings to a broader audience (Creswell & Creswell, 2018). There was near even representation across the three education levels (bachelor's or less, $n = 223$; master's, $n = 209$; PhD/doctorate, $n = 225$) with math and science accounting for 87% of the PhD/doctorate level degrees, and technology and engineering accounting for 79% of the bachelor's degrees. There were 16 responses with less than a bachelor's degree (see Appendix K), and all were in technology ($n = 9$) and engineering ($n = 5$). In terms of years of STEM experience, more than half of the women fell into the lowest range of 1 to 10 years and nearly a quarter had over 30 years of experience. There was even distribution across the five age groups as well (20 to 30, 21%; 31 to 40, 27%; 41 to 50, 26%; Over 50, 26%). Per Appendix K, most of the participants identified as a scientist, technologist, engineer, or mathematician ($n = 259$), followed by teacher/researcher in higher education ($n = 188$), business professional ($n = 107$), and manger ($n = 103$).

Except for the small number of women who left STEM, the response demographics demonstrated a sample representative of women in STEM occupations in the United States in terms of age, experience, education, role, and area of STEM. This study was focused on women in STEM occupations in the United States with no information captured relating to race or ethnicity.

Table 4

Demographic Overview

Area of STEM by education level					
	Bachelor's or less	Master's	PhD/doctorate	Total	
Science	34	40	87	161	
Technology	100	78	10	196	
Engineering	77	55	19	151	
Math	4	36	109	149	
Total	223 (34%)	209 (32%)	225 (34%)	657	
Area of STEM by years in STEM					
	1 – 10	11 – 20	21 – 30	Over 30	Total
Science	91	24	19	27	161
Technology	89	26	32	49	196
Engineering	77	15	18	41	151
Math	89	16	18	26	149
Total	346 (53%)	81(12%)	87 (13%)	143 (22%)	657
Area of STEM by age group					
	20 – 30	31 – 40	41 - 50	Over 50	Total
Science	30	50	51	30	161
Technology	30	38	55	73	196
Engineering	47	33	31	40	151
Math	29	54	35	31	149
Total	136 (21%)	175 (27%)	172 (26%)	174 (26%)	657

Reliability

Cronbach's alpha was run for each of the Likert scale variables (POS, SCS, WFS, TI) to quantify internal consistency, ensuring all items in the scale were correlated with each other and measured the same thing. The reliability statistics (see Table 5) indicated all four Likert scales were above the acceptable threshold of .70 (Cronbach, 1951; Muijs, 2011). For additional detail, the total-item statistics results are in Appendix E for the four scales.

Table 5

Cronbach's Alpha Scores

Reliability statistics			
	Cronbach's alpha	Cronbach's alpha based on standardized items	*N*
POS	.924	.925	8
SCS	.944	.944	16
WFS	.938	.940	15
TI	.778	.805	3

Hypotheses Testing

This section covers the test of assumptions and the statistical analysis and results for each of the hypotheses. Multiple linear regression analysis was applied to Hypothesis 1, independent samples *t* test for Hypothesis 2, and ANOVA for Hypothesis 3. The alternate hypotheses and sub hypotheses are restated here for clarity.

H_a1: Perceived organizational supports (POS, SCS, WFS) will predict turnover intentions for women in STEM occupations.

H_a2A: There will be a significant difference in perceived organizational supports (POS, SCS, and WFS) between women currently and formerly working in STEM.

H_a2B: There will be a significant difference in turnover intentions (TI) between women currently and formerly working in STEM.

H_a3A: There will be a significant difference in perceived organizational supports (POS, SCS, WFS) across the four categories of STEM.

H_a3B: There will be a significant difference in turnover intentions (TI) across the four categories of STEM.

Hypothesis 1: Multiple Regression

Hypothesis 1 was used to examine whether perceived organizational supports (POS, SCS, WFS) significantly predicted turnover intentions (TI) for women in STEM occupations.

Assumptions

Multicollinearity, linearity, normality, homoscedasticity, and error independence assumptions were tested for regression analysis. Per Table 6, tests run for the assumption of collinearity indicated multicollinearity was not a concern as all VIF values were less than 10.0 and tolerance less than 1.0 (POS, *Tolerance* = .30, *VIF* = 3.28; SCS, *Tolerance* = .39, *VIF* = 2.6; WFS, *Tolerance* = .54, *VIF* = 1.84). The VIF value signifies the degree of correlation between the predictor variables. A high VIF value makes it more difficult to estimate the relationship between each predictor variable and the outcome variable (Freedman, 2009).

Table 6

SPSS Collinearity Statistics

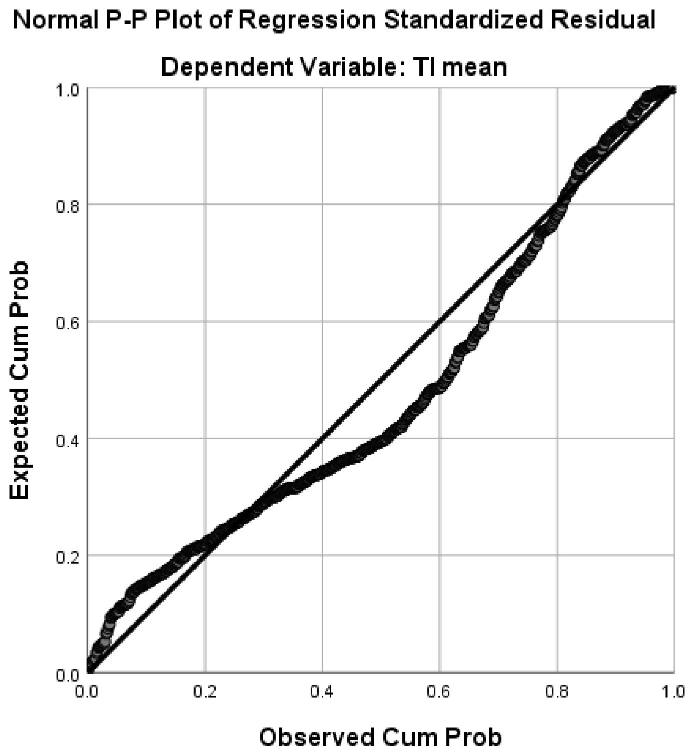
Coefficients[a]								
	Unstandardized coefficients		Standardized coefficients				Collinearity statistics	
Model	B	Std. error	Beta	*t*	Sig.		Tolerance	VIF
1 (Constant)	5.594	.235		23.816	.000			
POS mean	-.292	.063	-.277	-4.636	.000		.305	3.276
SCS mean	-.090	.065	-.074	-1.391	.165		.389	2.571
WFS mean	-.275	.051	-.245	-5.440	.000		.541	1.849

a. Dependent variable: TI mean

Linearity, homoscedasticity, and normality tests are highlighted in Figures 5, 6, and 7. The predictor variables had a linear relationship as required, with the data points following close to the line in the normal P-P plot in with a slight deviation in the middle (see Figure 5).

Figure 5

Probability Plot



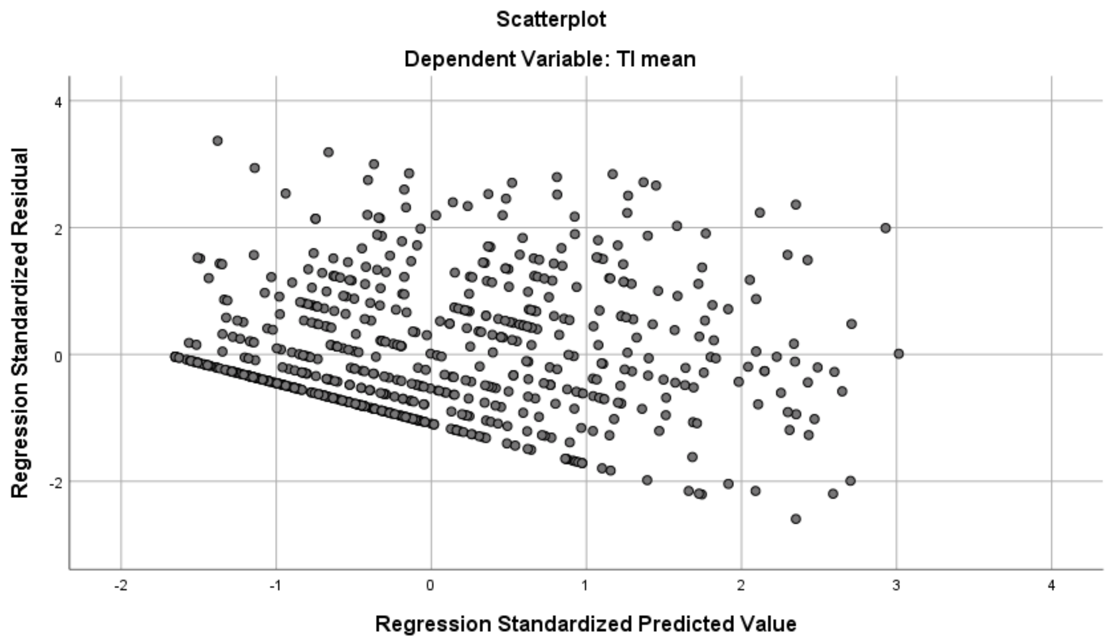
The scatterplot in Figure 6 highlights the assumption for homoscedasticity. Although there was a slight pattern below the zero line, the data points generally fell above and below, indicating they were spread similarly among lower and higher TI predictor values. The test for homoscedasticity is achieved when the variance of the residuals is close for each level of the predictor variables indicating there are no extreme outliers (Statistical Solutions, 2018).

For normality, the standardized residuals (minimum = -2.50, maximum = 3.38) fell within the acceptable minimum range but were slightly above the maximum range as illustrated visually in Figure 6 and numerically in the residual statistics table in Appendix F. The acceptable range for standardized residuals is between -3 and 3 (Field, 2013).

Extreme outliers were not a concern, as shown in the residuals statistics table (Cook's Distance, maximum = .52). An acceptable range for Cook's Distance is less than 1 (Field, 2013).

Figure 6

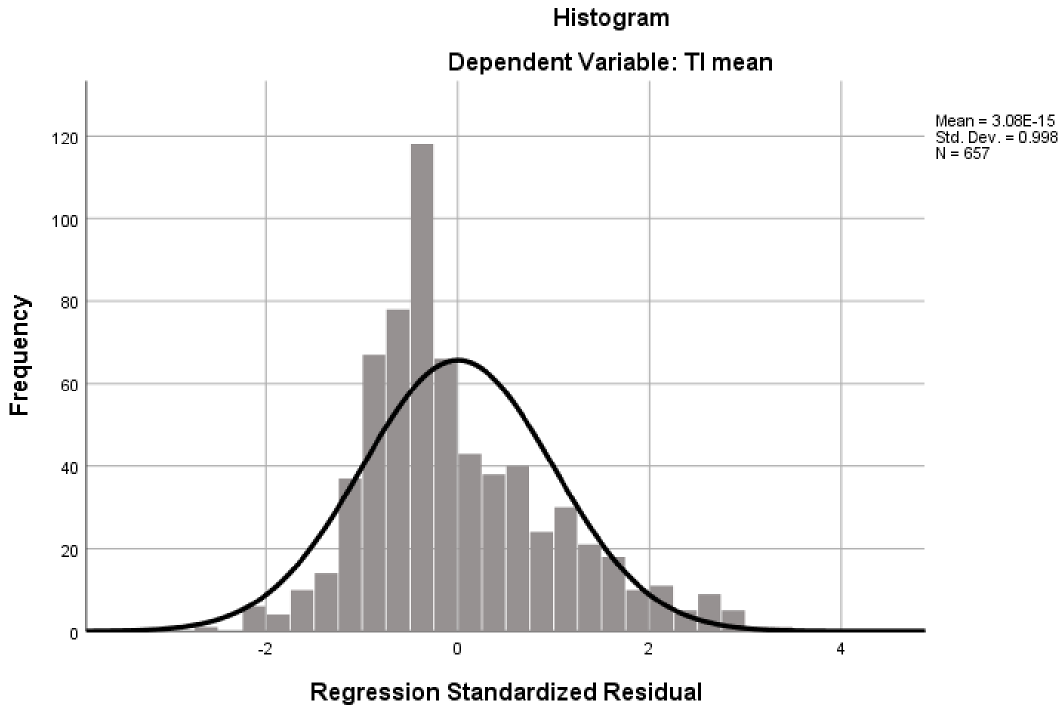
Scatterplot



The data met the assumption of independence of errors (*Durbin-Watson Value* = 1.92), as shown in Figure 7, meaning the residual terms were uncorrelated. An acceptable range for Durbin-Watson is between 0 and 4, with optimal values close to 2 (McClave et al., 2015). The full set of IBM SPSS tables and charts for regression can be found in Appendix F.

Figure 7

Standardized Residuals



Analysis

Multiple linear regression was carried out in SPSS to investigate whether perceived organizational supports (POS, SCS, WFS) significantly predicted turnover intentions (TI) for women in STEM occupations. The model summary results in Table 7 indicate the model explained 28% (R^2 = .28) of the variance. The R square value indicates the magnitude of the relationship between the set of predictors and the outcome variable (Freedman, 2009). Per the model, POS, SCS, and WFS predicted 28% of the turnover intentions of women in STEM occupations.

Table 7

Regression Model Summary

Model summary[b]					
Model	R	R square	Adjusted R square	Std. error of the estimate	Durbin-Watson
1	.535[a]	.286	.283	1.21541	1.917

a. Predictors: (Constant), WFS mean, SCS mean, POS mean

b. Dependent variable: TI mean

Results from the ANOVA, shown in Table 8, indicate the regression model was a significant predictor of turnover intentions, $F(3, 653) = 87.21$, $p = .000$. This result confirms the statistical significance of the model (the three predictor variables collectively) but does not indicate which specific predictor variables are significant.

Table 8

Regression Analysis of Variance

ANOVA[a]						
Model		Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	386.500	3	128.833	87.213	.000[b]
	Residual	964.633	653	1.477		
	Total	1351.133	656			

a. Dependent Variable: TI mean

b. Predictors: (Constant), WFS mean, SCS mean, POS mean

Results

The standardized beta coefficients indicate the relative contribution of each predictor to the regression equation (McClave et al., 2015). Perceived organization support had a higher absolute value and therefore had a stronger effect on the outcome variable compared to work–family support. Though perceived organizational support (b =. 277, p = < 0.05) and work–family support ($b = .245$, $p < 0.05$) contributed significantly, supervisor and coworker support did not (*b* = .074, *p* = .165; see Table 9). Thus, the null hypothesis of organization supports (POS, SCS, WFS) not predicting turnover (TI) was rejected.

The model shows that with every unit increase in one standard deviation of POS, TI decreased by .27, and with every unit increase in one standard deviation of WFS, TI decreased by .24. The results support that women in STEM occupations who had higher perceptions of organizational support and work–family thought less about leaving their organizations compared to supervisor/coworker support.

Table 9

Coefficients

Coefficients[a]								
		Unstandardized coefficients		Standardized coefficients			Collinearity statistics	
Model		B	Std. error	Beta	*t*	Sig.	Tolerance	VIF
1	(Constant)	5.594	.235		23.816	.000		
	POS mean	-.292	.063	-.277	-4.636	.000	.305	3.276
	SCS mean	-.090	.065	-.074	-1.391	.165	.389	2.571
	WFS mean	-.275	.051	-.245	-5.440	.000	.541	1.849

a. Dependent variable: TI mean

Alternate Analysis

Because SCS was not significant, other model variations of multiple regression were tested. The model that stood out was examining whether POS, supervisor support (removing coworker support from SCS), and WFS significantly predicted TI for women in STEM occupations. Supervisor and coworker were separate scales (8 items each) that were merged into one for this study and were successfully merged in previous studies as well (Fouad et al., 2016).

The new model variation resulted in all three predictor variables significantly contributing to turnover intentions as indicated in Appendix G (POS: $b = .227$, $p < 0.05$; Supervisor: $b = .144$, $p < 0.05$; WFS: $b = .238$, $p < 0.05$). POS still had the strongest effect on the outcome variable, followed by work–family support and supervisor support. According to the results, 29% of the variance in turnover was explained by POS, supervisor support, and WFS, and the model was a significant predictor of turnover intentions, $F(3, 653) = 89.63$, $p = < 001$. The supporting model summary, ANOVA, and coefficient tables for the alternate analysis are in Appendix G. This result supports that perceptions of coworker support were less important in preventing turnover compared to POS, supervisor support, and WFS.

Hypothesis 2: Independent Samples t Test

This section covers the test of assumptions and the analysis and results for Hypothesis 2 (H_a2A and H_a2B). Hypothesis 2 tested whether there was a significant difference in POS, SCS, WFS, and TI between women currently and formerly working in STEM.

Assumptions

The current ($n = 606$) and former STEM ($n = 51$) workers had adequate sample sizes. The test of assumptions for Hypothesis 2 indicated issues with data normality for the independent samples *t* test. The parametric approach was still used to test the hypothesis as the comparable non-parametric test (Mann-Whitney U) was run and yielded the same results in terms of variable significance and will be discussed in this section.

As illustrated in Table 10, the Kolmogorov-Smirnov normality issues were found across all the variables in the current STEM group. POS was the only variable with normality issues found across the former STEM group. Similar results were found for the Shapiro-Wilks test, as shown in the same table. However, the *t* test is known to be a robust test that can often withstand issues with normality (Lumley et al., 2002; Schmider et al., 2010).

Table 10

Normality Tests Current vs. Former STEM

Tests of normality for current vs. former STEM							
		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Current or former STEM	Statistic	*df*	Sig.	Statistic	*df*	Sig.
POS mean	Current STEM	.088	606	.000	.950	606	.000
	Former STEM	.127	51	.040	.946	51	.021
SCS mean	Current STEM	.100	606	.000	.932	606	.000
	Former STEM	.077	51	.200*	.970	51	.220
WFS mean	Current STEM	.047	606	.003	.981	606	.000
	Former STEM	.105	51	.200*	.963	51	.116
TI mean	Current STEM	.187	606	.000	.841	606	.000
	Former STEM	.103	51	.200*	.944	51	.018

*. This is a lower bound of the true significance.

a. Lilliefors significance correction

Homogeneity of variance (Levene's test for equality of variances) was also tested and highlighted in column three in Table 12. The only dependent variable that violated the homogeneity assumption was POS [$F(655) = 10.617$, $p < 0.05$]; therefore, the equality of variance not assumed results were used for POS.

Analysis

Table 11 shows the independent samples *t* test group statistics. Table 12 shows results from the independent samples *t* test comparing the means to determine whether there was a significant difference between women currently and formerly working in STEM for the three organizational support variables (H_a2A) and turnover intentions (H_a2B). Per Table 11, the overall means for the women currently working in STEM group were higher for the three organizational support variables (POS, *M* = 5.19; SCS, *M* = 5.53; WFS, *M* = 4.80) compared to the women who left STEM (POS, *M* = 4.01; SCS, *M* = 4.65; WFS, *M* = 3.51). Means for the women currently working in STEM group were lower for turnover intentions (TI, *M* = 2.23) compared to women who left STEM (TI, *M* = 3.37). POS and WFS represented a larger difference in mean scores between women currently and formerly working in STEM compared to SCS. The group statistics indicate women who left STEM on average scored lower in their support perceptions and higher for turnover intentions.

Table 11

Independent Samples t Test Group Statistics

Group Statistics					
	Current or former STEM	*N*	Mean	Std. deviation	Std. error mean
POS mean	Current STEM	606	5.1933	1.30037	.05282
	Former STEM	51	4.0074	1.62604	.22769
SCS mean	Current STEM	606	5.5292	1.14885	.04667
	Former STEM	51	4.6471	1.22824	.17199
WFS mean	Current STEM	606	4.7968	1.21305	.04928
	Former STEM	51	3.5124	1.40738	.19707
TI mean	Current STEM	606	2.2332	1.38875	.05641
	Former STEM	51	3.3725	1.57006	.21985

The non-parametric Mann-Whitney U test (see Appendix H) was run and results showed the difference between women currently and formerly working in STEM was significant for the three organization support variables (POS, $p < .001$; SCS, $p < .001$; WFS, $p < .001$) and turnover intentions (TI, $p < .001$).

Results

As shown in Table 12, the independent samples *t* test was associated with a statistically significant effect for all four independent variables [POS: $t(655) = 5.07$, $p < 0.05$; SCS: $t(655) = 5.24$, $p < 0.05$; WFS: $t(655) = 7.17$, $p < 0.05$; TI: $t(655) = 5.57$, $p = .000$]. The parametric and non-parametric tests both indicated a significant difference in the means for all four variables (POS, SCS, WFS, and TI) between women currently and formerly working in STEM. Thus, the null hypothesis ($H_0$2A) of no differences in POS, SCS, and WFS between women currently and formerly working in STEM was rejected.

Also, the null hypothesis (H_02B) of no differences in TI between women currently and formerly working in STEM was rejected.

Women currently working in STEM had a significantly higher perception of organizational supports (POS, SCS, WFS) compared to women who left STEM (H_a2A). Also, women working in STEM had significantly lower turnover intentions than women who left STEM. This finding indicates women who remained in STEM had higher perceptions of organizational support and thought less about leaving.

Table 12

Independent Samples t Test Results

		Levene's test for equality of variances		*t* test for equality of means						
		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean diff.	Std. error diff.	95% confidence interval of the diff. Lower	Upper
POS mean	Equal var assumed	10.617	.001	6.125	655	.000	1.18592	.19363	.80571	1.56614
	Equal var not assumed			5.074	55.514	.000	1.18592	.23374	.71760	1.65425
SCS mean	Equal var assumed	1.478	.225	5.238	655	.000	.88213	.16842	.55143	1.21283
	Equal var not assumed			4.950	57.608	.000	.88213	.17821	.52536	1.23890
WFS mean	Equal var assumed	3.750	.053	7.168	655	.000	1.28439	.17918	.93255	1.63624
	Equal var not assumed			6.323	56.429	.000	1.28439	.20314	.87752	1.69126
TI mean	Equal var assumed	2.603	.107	-5.568	655	.000	-1.13933	.20462	-1.54112	-.73754
	Equal var not assumed			-5.020	56.781	.000	-1.13933	.22698	-1.59387	-.68478

Hypothesis 3: ANOVA

This section covers the test of assumptions and the analysis and results for Hypothesis 3 (H_a3A and H_a3B). Hypothesis 3 tested whether there was a significant difference in POS, SCS, WFS, and TI between the four areas of STEM (science, technology, engineering, math).

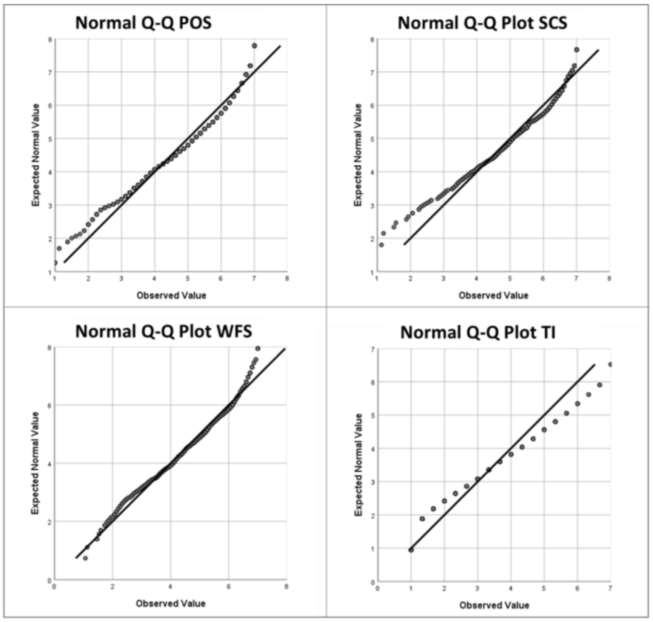
Assumptions

The groups tested were women from the four areas of STEM, which represented adequate and nearly equal sample sizes: science (n = 161), technology (n = 196), engineering (n =151), and math (149). The normality and variance tests run for Hypothesis 3 indicated some issues with homogeneity of variances, as explained in this section. The ANOVA approach was used to test the hypothesis as variable significance was the same in the non-parametric test (Kruskal-Wallis H) and the parametric test (ANOVA).

The normal Q-Q plot showed most of the data points fell on or near the line, although some points departed from the line (see Figure 8). Data points following the straight diagonal line indicate normal data distribution and are appropriate for parametric testing (McClave et al., 2015). Despite the deviation, ANOVA is known for its robustness in handling data that are not perfectly normal (Lumley et al., 2002; Schmider et al., 2010).

Figure 8

Normal Q-Q Plots for the Dependent Variables



Results of the Levene's test (Table 13) showed WFS and TI violated the homogeneity of variance assumption, but POS and SCS met the assumption.

Table 13

Test of Homogeneity of Variances

		Levene statistic	df1	df2	Sig.
POS mean	Based on mean	1.328	3	653	.264
SCS mean	Based on mean	.383	3	653	.766
WFS mean	Based on mean	6.583	3	653	.000
TI mean	Based on mean	6.634	3	653	.000

Analysis

The determination was made to proceed with the parametric test as ANOVA is considered a robust test of means even when violating the variance assumption (Schmider et al., 2010), and because of the equal findings in variable significance in the non-parametric test. The Kruskal-Wallis H test (see Appendix J) showed the difference between the four areas of STEM was significant for work–family support ($p < 0.05$) and turnover intentions ($p < 0.05$), but not for POS ($p = .223$) and SCS ($p = .589$). Per the one-way ANOVA results in Table 14, WFS [$F(3, 657) = 3.72$, $p = .011$] and TI [$F(3, 657) = 3.55$, $p = .014$] had a significant effect, but POS [$F(3, 657) = 1.07$, $p = .359$] and SCS [$F(3, 657) = .60$, $p = .617$] did not. This finding was consistent with the non-parametric Kruskal-Wallis H test in finding significant differences in WFS and TI, but not in POS and SCS.

Table 14

ANOVA Results

		Sum of squares	*df*	Mean square	*F*	Sig.
POS mean	Between groups	6.004	3	2.001	1.075	.359
	Within groups	1215.390	653	1.861		
	Total	1221.394	656			
SCS mean	Between groups	2.493	3	.831	.598	.617
	Within groups	908.059	653	1.391		
	Total	910.552	656			
WFS mean	Between groups	17.969	3	5.990	3.729	.011
	Within groups	1048.915	653	1.606		
	Total	1066.885	656			
TI mean	Between groups	21.691	3	7.230	3.551	.014
	Within groups	1329.441	653	2.036		
	Total	1351.133	656			

Results

The Tukey HSD post-hoc test is used to evaluate the nature of the differences between the means (see Appendix I). For WFS, there were significant differences between technology and engineering, and between technology and math. For TI, there were significant differences between technology and science. However, because only WFS had significant differences, and not POS and SCS, the null hypothesis ($H_0$3A) of no significant differences in organizational supports (POS, SCS, WFS) between the four areas of STEM failed to be rejected. The null hypothesis ($H_0$3B) of no significant differences in turnover intentions (TI) was rejected.

This finding indicates there were significant differences between some areas of STEM in terms of the perception of work–family support but not in perceived organizational support and supervisor and coworker support. Specifically, there were significant differences in WFS between technology and engineering, and between technology and math. It also implies significant differences in turnover intentions between technology and science.

In reviewing mean values, technology had the highest mean for all three support variables (POS, M = 5.22; SCS, M = 5.51; WFS, M = 4.94), but also the highest mean for turnover intentions (TI, M = 4.94). This finding indicates there are other reasons besides organizational support that are leading to high turnover intentions for women in technology. Women in math occupations had the lowest mean for all three organizational support variables (POS, M = 5.02; SCS, M = 5.35; WFS, M = 4.56) and the second-highest turnover intention mean (TI, M = 2.14) behind science. This indicates women in math occupations in this study had the lowest perceptions of support compared to the rest of STEM, and higher turnover intentions than women in technology and engineering. Women in engineering occupations had the second highest mean value for turnover intentions (TI, M = 2.45) behind technology but did not have the lowest mean for any of the support variables.

Summary of Findings

Chapter 4 provided the data collection and data analysis for this research study on the impacts of organizational support on the retention of women in STEM occupations. The 657 survey responses included a nearly equal distribution across the four areas of STEM, and there was a strong representation across age, years of experience, education level, role in STEM, and area of STEM. Multiple regression was used to analyze perceptions of support that predicted turnover intentions. Differences in organizational support perceptions and turnover intentions were examined between women currently and formerly working in STEM, and across the four areas of STEM using independent samples *t* test and ANOVA, respectively. Minor issues were uncovered in the test of assumptions, and comparable non-parametric tests were run and resulted in the same variable significance.

Results showed feelings of being supported by the organization (perceived organizational support, supervisor/coworker support, work–family) predicted intentions to leave an organization for women in STEM occupations (H1). Though the model studied was deemed significant, the supervisor/coworker variable was not significant. An alternate model with higher significance showed supervisor (removing coworker) support, together with perceived organization support and work–family support, to be a significant contributor to turnover and explained 29% of the variance in turnover.

All three perceptions of support (overall organization, supervisor and coworker support, work–family) were significantly higher and turnover intentions were significantly lower for women currently in STEM occupations compared to women who left STEM occupations (H2). The differences were more substantial in work–family support and perceived organizational support based on mean statistics. Supervisor/coworker support was less impactful than the other support perceptions.

Work–family support was identified (H3A) as the only organizational support factor that was significantly different across the four areas of STEM, with substantial differences found between technology and science, and between technology and math. This hypothesis was not supported as perceived organization support and supervisor/coworker support were not significant. Hypothesis H3B was supported as turnover intentions were significant across the four areas of STEM, with significant differences between women in technology and science.

In summary, Hypothesis 1, Hypothesis 2, and Hypothesis 3B were supported, but Hypothesis 3A was not. The results have potential policy and practical implications for the retention of women in STEM occupations in the United States. These implications are discussed in Chapter 5 along with a summary of the research project, conclusion, and recommendations for future research.

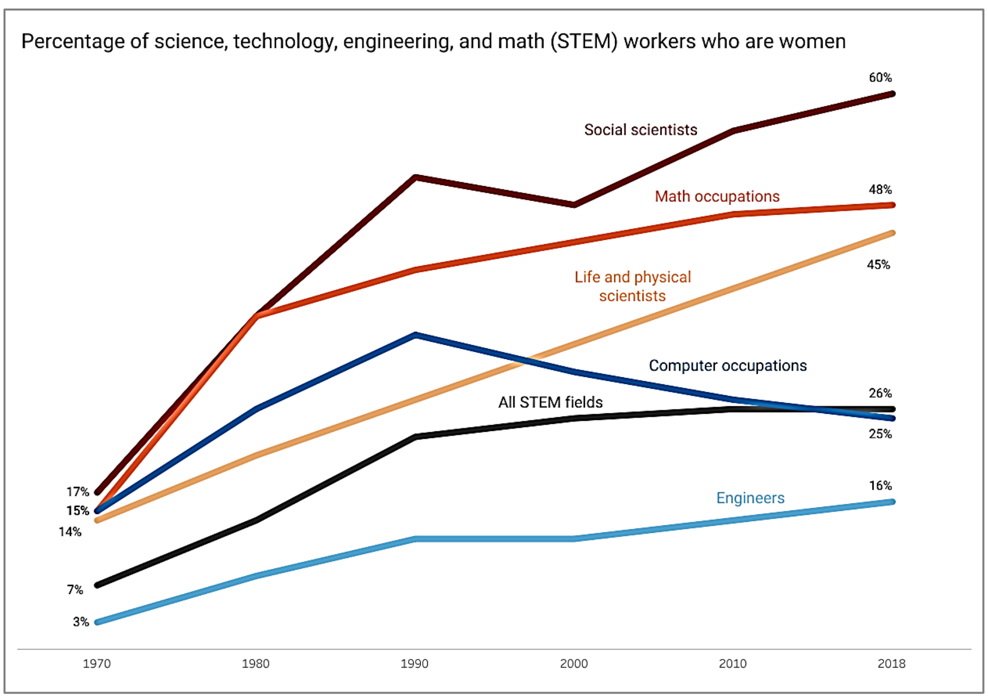
CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

In the United States, there are 9.7 million STEM jobs and 151 million non-STEM jobs (BLS, 2020). STEM jobs are growing faster (8.8%) than non-STEM jobs (5%; BLS, 2020). Women account for 50.4% of the U.S. workforce but only hold 26% of STEM occupations (BLS, 2019a). The progress has been slow for women in STEM occupations over the past 48 years. Figure 9 highlights the sluggish growth in engineering, a decline in technology, and a strong position in life sciences and mathematics with 45% and 48%, respectively.

Figure 9

Women in STEM Occupations Over Time 1970 to 2018



Note. From *Percentage of Science, Technology, Engineering, and Math (STEM) Workers who are Women*, by U.S. Department of Labor, Women's Bureau, 2018 (https://www.dol.gov/agencies/wb/data/facts-over-time). In the public domain.

The benefits of having more women in STEM occupations include workforce diversity and the resulting increase in innovation and performance, avoiding costs associated with turnover, and helping to reduce the gender pay gap.

This research contained a focus on career level issues associated with the underrepresentation of women in STEM occupations. Chapter 1 covered the background on the shortage of women in STEM occupations, and the purpose and importance of the study. Reasons for the shortage included stereotype and gender bias at all levels of education (Cheryan, 2012; Gunderson et al., 2012), and a lack of mentoring, networking opportunities (Buse & Bilimoria, 2014; Duliani et al., 2018), overall organizational support (Allen et al. 2003; Jawahar & Hemmasi, 2006; Shanock & Eisenberger, 2006), and work–family support at the career level (Armstrong et al., 2007; Myers & Major, 2017; O'Neill et al., 2009; Singh et al., 2018). Chapter 2 encompassed a review of the literature. SCCT (Lent et al., 2003), turnover intention theory (Hom et al., 1984), and organization support theory (Eisenberger et al., 1986) were the underpinnings of this research. SCCT was selected as it considers both individual and environment support influences on career decisions, including turnover intentions. Organizational support theory supports claims that employees may be less likely to think about leaving if they have a positive perception of being supported by their organizations (Eisenberger et al., 1986; Kurtessis et al., 2017).

Chapter 3 presented the design and methodology, including the survey instruments, the variables tested, and the analysis approach. Previously tested Likert scales were used to help with reliability. Chapter 4 included the data analysis and findings on the impact of organizational support on the turnover intentions of women in

STEM occupations. H3B was the only hypothesis that was not supported as work–family support was the only support variable that was significant between the four areas of STEM. The remainder of this chapter addresses the conclusion, practice implications, and future recommendations.

Discussion and Conclusion

Based on the results, lower perceptions of organization support lead to higher turnover intentions for women in STEM occupations. This study differs from past studies by making comparisons across all four areas of STEM and between women currently and formerly working in STEM and capturing responses primarily through social media as opposed to a specific organization or university. Learning about the experiences of women and the challenges that cause them to leave STEM can help government and business leaders in their effort to reduce attrition.

Research Question 1

Are employees with positive perceptions of organizational support (perceived organizational support, coworker and supervisor support, work–family support) less likely to leave their STEM organizations? Analyzing results from the 657 women in STEM occupations indicated perceptions of support do have an impact on turnover intentions for women in STEM occupations in the United States. The most significant influences on turnover intentions were broad organizational support and work–life support, followed by supervisor support. This outcome aligns with past studies that showed employees who experience a supportive environment are more likely to commit to their organizations (Eisenberger et al., 1986; Kurtessis et al., 2017).

The finding that work–life support was significant in preventing turnover supports two past studies by Thompson and colleagues (Thompson et al., 1999; Thompson et al., 2004). In their assessment, they noted work–life programs need strong endorsements from top management and supervisors with no punishments for using programs such as flextime, job sharing, family leave, and onsite daycare. Coworker support was not identified as a significant factor (except in current versus former STEM) in this study, indicating women in STEM occupations are not as influenced by their associates as much as they are by their supervisors and overall organizational support. This discovery supports previous research that showed supervisor support has a greater influence on employees' positive perceptions of their organizations than does coworker support (Kurtessis et al., 2017). This finding is contradictory to past research regarding the difficulties women in technology face in male-dominated workplace environments (Ashcraft et al., 2016; Funk & Parker, 2018; S. White, 2020). However, the survey items did not distinguish between harassment or mistreatment from immediate coworkers and the broader set of associates within a company or whether the harassment or mistreatment was perpetrated by male or female coworkers.

Women who formerly worked in STEM had lower support perceptions (organizational support, supervisor/coworker support, work–family support) and higher turnover intentions compared to women still working in STEM. This result adds to past research that indicated organizational support perceptions can reduce turnover (Kahumuza & Schlechter, 2008).

Research Question 2

Are there unique challenges in some areas of STEM that lead women to leave their occupations? Differences between the four areas of STEM were not significant for all the variables tested. Work–family support was the only support variable that showed significance between the areas of STEM and specifically between technology and science, and between technology and math. Turnover intentions also had significant differences between technology and science. The results revealed women in technology had unique STEM occupation challenges, which aligns with a prior study indicating higher turnover rates (S. White, 2020).

Though not statistically significant, a mean value comparison showed women in technology had the highest value for all three organization support variables and the highest for turnover intentions. This could imply women in technology feel more supported but still think about leaving more than women in science, engineering, and math. Additional factors need to be studied regarding the turnover of women in technology. In contrast, women in math had the lowest mean values in all three areas of support perceptions and the second to the lowest score in turnover intentions. This discovery may indicate women in math feel less supported by their organizations than women in science, technology, and engineering, but persist in their occupation for other reasons.

Additionally, women in engineering scored second in turnover intentions behind women in technology. Technology and engineering had the two highest means for turnover intentions, which supports past research demonstrating higher turnover rates compared to other areas of STEM (Corbett & Hill, 2015; S. White, 2020). Overall, technology and engineering were not as distinctly different from the other areas of STEM as anticipated.

Though outside of the focus of the study, there was a significant difference in perceptions of work–life support between roles in STEM, specifically between higher education (researchers and teachers) and those working in the industry as a scientist, technologist, engineer, or mathematician (see Appendix L). Women in higher education had lower perceptions of work–family support. This finding supports the findings of past studies proposing that work–family support is an area for improvement to retain more women in STEM occupations (Cech & Blair-Loy, 2019).

In summary, organizational leaders can improve the attrition rates of women in STEM occupations by improving their support at the organizational level, supervisor level, and work–family support. By focusing on support perception and turnover issues across the four areas of STEM, and between women currently and formerly working in STEM, this study advances the empirical and theoretical literature on the reasons women are underrepresented and leave STEM occupations at a higher rate than men.

Practice Implications

High-level leadership, management, and HRM can leverage the knowledge gained from this research and incorporate the results into approaches and policies to improve the support provided to women in STEM occupations and reduce turnover. Perceived organizational support and work–life support had the most significant impact on turnover and should be a focus for leadership and HRM. Supervisor support had lesser significance and coworker the least.

Positive perceptions of organizational support happen when employees feel appreciated for their work efforts and believe their organizations care about their welfare. Factors that can improve organizational support perceptions include “supportive aspects of leadership, fairness, HR practices, and working conditions” (Kurtessis et al., 2017, p. 25). Supervisor support is linked with and adds to perceptions of organizational support, making it difficult for employees to differentiate support from supervisors and executive leadership (Eisenberger et al., 2002; Kahumuza & Schlechter, 2008). Leadership and supervisors need to work together on policies and procedures that make employees feel valued and supported.

Support perceptions can be boosted by removing gender inequities, giving women networking and mentoring opportunities, and senior management giving women fair chances for promotion (Jawahar & Hemmasi, 2006). Studies have also shown women are more likely to remain in work cultures that promote inclusivity and provide projects that are challenging (Duliani et al., 2018).

Management support of work–family programs is essential for women to feel comfortable using these programs. Unfortunately, as past literature shows, too many companies have work–family programs in writing, but women may be less likely to use them as they may fear it will hurt their career growth opportunities (Thompson et al., 1999). Having female role models in leadership who use and support work–life programs can improve support perceptions (Duliani et al., 2018). Organizations in which everyone promotes a culture of fairness in terms of opportunities and treatment at all levels of management is likely to have less turnover from women in STEM occupations.

Research Recommendations

The support variables studied accounted for 29% of the variance in predicting turnover. Therefore, additional research is needed to explore the other 71%. Work–family support and perceived organizational support were the two consistently significant factors associated with turnover and should be investigated further. Additional investigations are needed with women in technology as they reported feeling supported but also had the highest turnover intentions. A qualitative research approach using interviews could add more depth in understanding the reasons some women in technology feel less supported than others. Other factors to examine include team size, coworker gender-mix, corporate culture, mentoring and advancement opportunities, and utilization of work–life programs.

Subsequent research could involve conducting the same survey with male participants to determine whether there are significant differences in support perceptions and turnover intentions between men and women. More research is needed to understand why men leave STEM careers (Fouad et al., 2017). The results could help validate the findings of this study or reveal new paths to examine.

Initially, the constructs of coworker and supervisor support were combined into one factor but results showed coworker support was only significant when comparing women currently and formerly working in STEM. The results indicate supervisor support should be studied as a separate scale or combined with perceived organizational support. An analysis of organization support theory uncovered that supervisor support closely aligned with perceived organizational support more than coworker support (Kurtessis et al., 2017). A broader investigation of coworker perceptions could include the immediate team and the wider set of coworkers across the organization and compare support from male versus female coworkers. Results of this study do not reflect whether coworker support differed by gender or by whether the support was provided by a direct team member or associate outside the immediate workgroup.

A report by the U.S. National Science & Technology Council (2018) highlighted diversity as a key component in growing the STEM workforce, stating:

> A diverse talent pool of STEM-literate Americans prepared for the jobs of the future will be essential for maintaining the national innovation base that supports key sectors of the economy and for making the scientific discoveries and creating the technologies of the future. (p. 7)

Closing the gender gap in STEM is vital as the need for technology and innovation will continue to grow. Men and women have unique experiences and differences, and “the United States simply can’t afford to ignore the perspectives of half the population in future engineering and technical designs” (Corbett & Hill, 2015, p. 10).

REFERENCES

Allen, D., Shore, L., & Griffeth, R. (2003). The role of perceived organizational support and supportive human resource practices in the turnover process. *Journal of Management*, *29*(1), 99–118. https://doi.org/10.1177/014920630302900107

Ambrose, S. A. (1997). *Journeys of women in science and engineering: No universal constants*. Temple University Press. https://doi.org/10.1002/j.2168-9830.1998.tb00366.x

Armstrong, D. J., Nelms, J., Riemenschneider, C., & Reid, M. (2012). Revisiting the barriers facing women in information systems. *The Journal of Computer Information Systems*, *53*(2), 65–74. https://doi.org/10.1080/08874417.2012.11645615

Armstrong, D. J., Riemenschneider, C. K., Allen, M. W., & Reid, M. F. (2007). Advancement, voluntary turnover and women in IT: A cognitive study of work-family conflict. *Information & Management*, *44*(2), 142–153. https://doi.org/10.1016/j.im.2006.11.005

Armstrong, D. J., Riemenschneider, C. K., & Giddens, L. G. (2018). The advancement and persistence of women in the information technology profession: An extension of Ahuja's gendered theory of IT career stages. *Information Systems Journal*, *28*(6), 1082–1124. https://doi.org/10.1111/isj.12185

Ashcraft, C., McLain, B., & Eger, E. (2016). *Women in tech: The facts*. National Center for Women & Information Technology. https://www.ncwit.org/sites/default/files /resources/womenintech_facts_fullreport_05132016.pdf

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall. www.jstor.org/stable/258004

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, *44*(9), 1175–1184. https://doi.org/10.1037/0003-066X.44.9.1175

Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations*, *61*(8), 1139–1160. https://doi.org/10.1177/0018726708094863

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

Blickenstaff, J. (2005). Women and science careers: Leaky pipeline or gender filter? *Gender & Education*, *17*(4), 369–386. https://doi.org/10.1080/09540250500145072

Boone, H., & Boone, D. (2012). Analyzing Likert data. *Journal of Extension*, *50*(2), 1–4.

Bothma, C. F. C., & Roodt, G. (2013). The validation of the Turnover Intention Scale. *South African Journal of Human Resource Management*, *11*(1), 72–83. https://doi.org/10.4102/sajhrm.v11i1.507

Buse, K. R., & Bilimoria, D. (2014). Personal vision: Enhancing work engagement and the retention of women in the engineering profession. *Frontiers in Psychology*, *5*, 1400. https://doi.org/10.3389/fpsyg.2014.01400

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

Caplan, R. D., Cobb, S., French, J. R. P., Jr., Harrison, R. V., & Pinneau, S. R., Jr. (1975). *Job demands and worker health* (Publication No. 75–160). U.S. Department of Health, Education, and Welfare. https://pdfs.semanticscholar.org/a1e3/4f4a1cd35b21e4ebf140ee52cb5757d99683.pdf

Carifio, J., & Perla, R. (2007). Ten common misunderstandings, misconceptions, persistent myths and urban legends about Likert scales and Likert response formats and their antidotes. *Journal of Social Sciences*, *3*(3), 106–116. https://doi.org/10.3844/jssp.2007.106.116

Cech, E. A., & Blair-Loy, M. (2019). The changing career trajectories of new parents in STEM. *Proceedings of the National Academy of Sciences of the United States of America*, *116*(10), 4182–4187. https://doi.org/10.1073/pnas.1810862116

Chen, M. F., Lin, C.-P., & Lien, G. Y. (2011). Modelling job stress as a mediating role in predicting turnover intention. *Service Industries Journal*, *31*(8), 1327–1345. https://doi.org/10.1080/02642060903437543

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. https://doi.org/10.1007/s11199-011-0060-z

Cheryan, S., & Plaut, V. (2010). Explaining underrepresentation: A theory of precluded interest. *Sex Roles*, *63*(7-8), 475–488. https://doi.org/10.1007%2Fs11199-010-9835-x

Cheryan, S., Plaut, V. C., Handron, C., & Hudson, L. (2013). The stereotypical computer scientist: Gendered media representations as a barrier to inclusion for women. *Sex Roles*, *69*(1-2), 58–71. https://doi.org/10.1007/s11199-013-0296-x

Corbett, C., & Hill, C. (2015). *Solving the equation: The variables for women's success in engineering and computing*. American Association of University Women. https://ww3.aauw.org/research/solving-the-equation/

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334. https://doi.org/10.1007/BF02310555

Díaz-García, C., González-Moreno, A., & Sáez-Martínez, F. (2013). Gender diversity within R&D teams: Its impact on radicalness of innovation. *Innovation: Management, Policy & Practice*, *15*(2), 149–160. https://doi.org/10.5172/impp.2013.15.2.149

Dobni, C. B., Klassen, M., & Nelson, W. T. (2018). Innovation strategy in the US: Top executives offer their views. *The Journal of Business Strategy*, *36*(1), 3–13. https://doi.org/10.1108/JBS-12-2013-0115

Duliani, F., Cohen, L., & Duberley, J. (2018). What managers can do to keep women in engineering. *Harvard Business Review*. https://hbr.org/2018/06/what-managers-can-do-to-keep-women-in-engineering

Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology*, *71*(3), 500–507. https://doi.org/10.1037/0021-9010.71.3.500

Eisenberger, R., Stinglhamber, F., Vandenberghe, C., Sucharski, I. L., & Rhoades, L. (2002). Perceived supervisor support: Contributions to perceived organizational support and employee retention. *The Journal of Applied Psychology*, *87*(3), 565–573. https://doi.org/10.1037/0021-9010.87.3.565

European Commission. (2017). *Labour market and wage developments in Europe - Annual review 2017*. http://ec.europa.eu/social /main.jsp?catId=738&langId=en&pubId=8040&furtherPubs=yes

European Union. (2016). *Does the EU need more STEM graduates?* https://publications.europa.eu/en/publication-detail/-/publication/60500ed6-cbd5-11e5-a4b5-01aa75ed71a1

Falk, N., Rottinghaus, P., Casanova, T., Borgen, F., & Betz, N. (2016). Expanding women's participation in STEM: Insights from parallel measures of self-efficacy and interests. *Journal of Career Assessment*, *25*(4), 571–584. https://doi.org/10.1177/1069072716665822

Fayer, S., Lacey, A., & Watson, A. (2017). *STEM occupations: Past, present, and future*. U.S. Department of Labor, Bureau of Labor Statistics. https://www.bls.gov /spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/home.htm

Ferry, T. R., Fouad, N. A., & Smith, P. L. (2000). The role of family context in a social cognitive model for career-related choice behavior: A math and science perspective. *Journal of Vocational Behavior*, *57*(3), 348–364. https://doi.org/10.1006/jvbe.1999.1743

Field, A. P. (2013). *Discovering statistics using IBM SPSS Statistics: And sex and drugs and rock n roll* (4th ed.). Sage.

Fouad, N., Chang, W., Wan, M., & Singh, R. (2017). Women's reasons for leaving the engineering field. *Frontiers in Psychology, 8*(875), 1–10. https://doi.org/10.3389/fpsyg.2017.00875

Fouad, N. A., Kozlowski, M. B., Singh, R., Linneman, N. G., Schams, S. S., & Weber, K. N. (2019). Exploring the odds: Gender differences in departing the engineering profession. *Journal of Career Assessment*. https://doi.org/10.1177/1069072719876892

Fouad, N., & Santana, M. (2017). SCCT and underrepresented populations in STEM fields: Moving the needle. *Journal of Career Assessment*, *25*(1), 24–39. https://doi.org/10.1177/1069072716658324

Fouad, N., & Singh, R. (2011). *Stemming the tide: Why women leave engineering*. National Science Foundation. https://www.energy.gov/sites/prod/files /NSF_Stemming%20the%20Tide%20Why%20Women%20Leave%20Engineerin g.pdf

Fouad, N., Singh, R., Cappaert, K., Chang, W., & Wan, M. (2016). Comparison of women engineers who persist in or depart from engineering. *Journal of Vocational Behavior*, *92,* 79–93. https://doi.org/10.1016/j.jvb.2015.11.002

Freedman, D. (2009). *Statistical models: Theory and practice* (rev. ed.). Cambridge University Press.

Frenkel, K. A. (1990). Women & computing. *Communications of the ACM*, *33*(11), 34–46. https://doi.org/10.1145/92755.92756

Friedman, H., Friedman, L., & Leverton, C. (2016). Increase diversity to boost creativity and enhance problem solving. *Psychosociological Issues in Human Resource Management*, *4*(2), 7–33. https://doi.org/10.22381/pihrm4220161

Funk, C., & Parker, K. (2018, January 9). *Women and men in STEM often at odds over workplace equity*. Pew Research Center. http://www.pewsocialtrends.org /2018/01/09/women-and-men-in-stem-often-at-odds-over-workplace-equity/

George, J., & Jones, G. (2012). *Understanding and managing organizational behavior*. Pearson Prentice Hall.

Given, L. M. (2008). *The Sage encyclopedia of qualitative research methods*. Sage.

Glass, J., Sassler, S., Levitte, Y., & Michelmore, K. (2013). What's so special about STEM? A comparison of women's retention in STEM and professional occupations. *Social Forces*, *92*(2), 723–756. https://doi.org/10.1093/sf/sot092

Graf, N., Brown, A., & Patten, E. (2018, April 9). *The narrowing, but persistent, gender gap in pay*. Pew Research Center. http://www.pewresearch.org/fact-tank/2018/04/09/gender-pay-gap-facts/

Grant, C., & Osanloo, A. (2014). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house." *Administrative Issues Journal Education Practice and Research*, *4*(2), 12–25. https://doi.org/10.5929/2014.4.2.9

Greene, J., Stockard, J., Lewis, P., & Richmond, G. (2010). Is the academic climate chilly? The views of women academic chemists. *Journal of Chemical Education*, *87*(4), 381–385. https://doi.org/10.1021/ed800042z

Gunderson, E., Gerardo, R., Levine, S., & Beilock, S. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles*, *66*(3-4), 153–166. https://doi.org/10.1007/s11199-011-9996-2

Harrigan-Farrelly, J. (2017). *Trailblazing women in STEM*. U.S. Department of Labor. https://blog.dol.gov/2017/03/21/trailblazing-women-in-stem

Harris, N., Cushman, P., Kruck, S., & Anderson, R. (2009). Technology majors: Why are women absent? *The Journal of Computer Information Systems*, *50*(2), 23–30. https://doi.org/10.1080/08874417.2009.11645381

Hay, M. (2002). Strategies for survival in the war of talent. *Career Development International*, *7*(1), 52–55. https://doi.org/10.1108/13620430210414883

Herring, C. (2009). Does diversity pay? Race, gender, and the business case for diversity. *American Sociological Review*, *74*(2), 208–224. https://doi.org/10.1177/000312240907400203

Hewlett, S. A., & Luce, C. B. (2005). Off-ramps and on-ramps. *Harvard Business Review*, *83*(3), 43–54. https://hbr.org/2005/03/off-ramps-and-on-ramps-keeping-talented-women-on-the-road-to-success

Hill, C., Corbett, C., & St. Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. American Association of University Women. https://www.aauw.org/files/2013/02/Why-So-Few-Women-in-Science-Technology-Engineering-and-Mathematics.pdf

Hoever, I. J., Van Knippenberg, D., Van Ginkel, W. P., & Barkema, H. G. (2012). Fostering team creativity: Perspective taking as key to unlocking diversity's potential. *Journal of Applied Psychology*, *97*(5), 982–996. https://doi.org/10.1037/a0029159.

Hom, P. W., & Griffeth, R. W. (1994). *Employee turnover*. South-Western College.

Hom, P. W., Griffeth, R. W., & Sellaro, C. L. (1984). The validity of Mobley's (1977) model of employee turnover. *Organizational Behavior and Human Performance, 34*, 141–174. https://doi.org/10.1016/0030-5073(84)90001-1

Hunt, J. (2015). Why do women leave science and engineering? *ILR Review*, *69*(1), 199–226. https://doi.org/10.1177/0019793915594597

Israel, M., (2015). *Research ethics and integrity for social scientists: Beyond regulatory compliance*. Sage. https://doi.org/10.4135/9781473910096

Ivancevich, J. M., Konopaske, R., & Matteson, M. T. (2014). *Organizational behavior and management*. McGraw-Hill Irwin.

Jackson, S. M., Hillard, A. L., & Schneider, T. R. (2014). Using implicit bias training to improve attitudes toward women in STEM. *Social Psychology of Education: An International Journal*, *17*(3), 419–438. https://doi.org/10.1007/s11218-014-9259-5

Jawahar, I. M., & Hemmasi, P. (2006). Perceived organizational support for women's advancement and turnover intentions. *Women in Management Review*, *21*(8), 643–661. https://doi.org/10.1108/09649420610712036

Jones, B., Ruff, C., & Paretti, M. (2013). The impact of engineering identification and stereotypes on undergraduate women's achievement and persistence in engineering. *Social Psychology of Education: An International Journal*, *16*(3), 471–493. https://doi.org/10.1007/s11218-013-9222-x

Jordan, K., & Carden, R. (2017). Self-efficacy and gender in STEM majors. *Modern Psychological Studies*, *22*(2), 8. https://scholar.utc.edu/mps/vol22/iss2/8

Kahumuza, J., & Schlechter, A. F. (2008). Examining the direct and some mediated relationships between perceived support and intention to quit. *Management Dynamics*, *17*(3), 2–19.

Kim, A. Y., Sinatra, G. M., & Seyranian, V. (2018). Developing a STEM identity among young women: A social identity perspective. *Review of Educational Research*, *88*(4), 589–625. https://doi.org/10.3102/0034654318779957

Kirton, G., & Robertson, M. (2018). Sustaining and advancing IT careers: Women's experiences in a UK-based IT company. *The Journal of Strategic Information Systems*, *27*(2), 157–169. https://doi.org/10.1016/j.jsis.2018.01.001

Kohlstedt, S. G. (2004). Sustaining gains: Reflections on women in science and technology in 20th-century United States. *NWSA Journal*, *16*(1), 1–26.

Kroth, A., & Young, S. J. (2014). New professionals, new desires: What millennials want in their work. *Recreational Sports Journal*, *38*(1), 23–32. https://doi.org/10.1123/rsj.2013-0013

Kugler, A., Tinsley, C., & Ukhaneva, O. (2017). *Choice of majors: Are women really different from men?* (Discussion Paper Series, DPD 10947). IZA Institute of Labor Economics. https://doi.org/10.3386/w23735

Kurtessis, J. N., Eisenberger, R., Ford, M. T., Buffardi, L. C., Stewart, K. A., & Adis, C. S. (2017). Perceived organizational support: A meta-analytic evaluation of organizational support theory. *Journal of Management*, *43*(6), 1854–1884. https://doi.org/10.1177/0149206315575554

Lambert, M. (2003). Recruiting and retaining employees: Critical issues for organizational leaders. *Physician Executive*, *29*(4), 18–19.

Leedy, P. D., & Ormrod, J. E. (2013). *Practical research: Planning and design*. Pearson.

Lelkes, Y., Krosnick, J. A., Marx, D. M., Judd, C. M., & Park, B. (2012). Complete anonymity compromises the accuracy of self-reports. *Journal of Experimental Social Psychology*, *48*(6), 1291–1299. https://doi.org/10.1016/j.jesp.2012.07.002

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior*, *45*(1), 79–122. https://doi.org/10.1006/jvbe.1994.1027

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. *Journal of Counseling Psychology*, *50*(4), 458–465. https://doi.org/10.1037/0022-0167.50.4.458

Lent, R. W., Lopez, F. G., Sheu, H., & Lopez, A. M. (2011). Social cognitive predictors of the interests and choices of computing majors: Applicability to underrepresented students. *Journal of Vocational Behavior*, *78*(2), 184–192. https://doi.org/10.1016/j.jvb.2010.10.006

Lim, V. K. G. (1996). Job insecurity and its outcomes: Moderating effects of work-based and nonwork-based social support. *Human Relations*, *49*(2), 171–194. https://doi.org/10.1177/001872679604900203

Lumley, T., Diehr, P., Emerson, S., & Chen, L. (2002). The importance of the normality assumption in large public health data sets. *Annual Review of Public Health*, *23*(1), 151–169. https://doi.org/10.1146/annurev.publhealth.23.100901.140546

MacPhee, D., Farro, S., & Canetto, S. S. (2013). Academic self-efficacy and performance of underrepresented STEM majors: Gender, ethnic, and social class patterns. *Analyses of Social Issues & Public Policy*, *13*(1), 347–369. https://doi.org/10.1111/asap.12033

Major, D. A., Morganson, V. J., & Bolen, H. M. (2013). Predictors of occupational and organizational commitment in information technology: Exploring gender differences and similarities. *Journal of Business and Psychology*, *28*(3), 301–314. https://doi.org/10.1007/s10869-012-9282-5

Marczyk, G., DeMatteo, D., & Festinger, D. (2005). *Essentials of research design and methodology*. Wiley.

Marra, R., Rose, M., Rodgers, K., Shen, D., & Bogue, B. (2009). Women engineering students and self-efficacy: A multi-year, multi-institution study of women engineering student self-efficacy. *Journal of Engineering Education*, *98*(1), 27–38. https://doi.org/10.1002/j.2168-9830.2009.tb01003.x

Marsden, P. V., & Wright, J. D. (2010). *Handbook of survey research*. Emerald.

Martinot, D., & Désert, M. (2007). Awareness of a gender stereotype, personal beliefs, and self-perceptions regarding math ability: When boys do not surpass girls. *Social Psychology of Education: An International Journal*, *10*(4), 455–471. https://doi.org/10.1007/s11218-007-9028-9

McClave, J., Benson, G. T., & Sincich, T. (2015). *Statistics for business and economics*. Pearson/Prentice Hall.

McCrae, R., Kurtz, J., Yamagata, S., & Terracciano, A. (2011). Internal consistency, retest reliability, and their implications for personality scale validity. *Personality* *and Social Psychology Review*, *15*(1), 28–50. https://doi.org/10.1177/1088868310366253

McLure, G. T., & Piel, E. (1978). College-bound girls and science careers: Perceptions of barriers and facilitating factors. *Journal of Vocational Behavior, 12*(2), 172–183. https://doi.org/10.1016/0001-8791(78)90032-5

Miller, D., & Wai, J. (2015). The bachelor's to PhD. STEM pipeline no longer leaks more women than men: A 30-year analysis. *Frontiers in Psychology*, *6*(37), 1–10. https://doi.org/10.3389/fpsyg.2015.00037

Milner, D. I., Horan, J. J., & Tracey, T. J. G. (2013). Development and evaluation of STEM interest and self-efficacy tests. *Journal of Career Assessment*, *22*(4), 642–653. https://doi.org/10.1177/1069072713515427

Moakler, M. W. J., & Kim, M. M. (2014). College major choice in STEM: Revisiting confidence and demographic factors. *The Career Development Quarterly*, *62*, 128–142. https://doi.org/10.1002/j.2161-0045.2014.00075.x

Mobley, W. H. (1977). Intermediate linkages in the relationship between job satisfaction and employee turnover. *Journal of Applied Psychology*, *62*(2), 237–240. https://doi.org/10.1037/0021-9010.62.2.237

Muijs, D. (2011). *Doing quantitative research in education with SPSS*. Sage. https://doi.org/10.4135/9781849203241

Myers, D. P., & Major, D. A. (2017). Work-family balance self-efficacy's relationship with STEM commitment: Unexpected gender moderation. *The Career Development Quarterly*, *65*(3), 264–277. https://doi.org/10.1002/cdq.12097

National Science Foundation. (2017). *Women, minorities, and persons with disabilities in science and engineering*. https://www.nsf.gov/statistics/2017/nsf17310/static/downloads/nsf17310-digest.pdf

National Science Foundation. (2019). *Women, minorities, and persons with disabilities in science and engineering*. https://ncses.nsf.gov/pubs/nsf19304/digest

New American Economy. (2017). *Sizing up the gap in our supply of STEM workers: Data & analysis*. https://research.newamericaneconomy.org/report/sizing-up-the-gap-in-our-supply-of-stem-workers/

Ng, T., & Feldman, D. (2007). Organizational embeddedness and occupational embeddedness across career stages. *Journal of Vocational Behavior*, *70*, 336–351. https://doi.org/10.1016/j.jvb.2006.10.002

Nolan, S. A., Buckner, J. P., Marzabadi, C. H., & Kuck, V. J. (2008). Training and mentoring of chemists: A study of gender disparity. *Sex Roles*, *58*, 235–250. https://doi.org/10.1007/s11199-007-9310-5

Noonan, R. (2017). *Women in STEM: 2017 update*. U.S. Department of Commerce Economic and Statistics Administration Office of the Chief Economist. https://www.commerce.gov/news/fact-sheets/2017/11/women-stem-2017-update

O'Neill, J. W., Harrison, M. M., Cleveland, J., Almeida, D., Stawski, R., & Crouter, A. C. (2009). Work-family climate, organizational commitment, and turnover: Multilevel contagion effects of leaders. *Journal of Vocational Behavior*, *74*(1), 18–29. https://doi.org/10.1016/j.jvb.2008.10.004

Parrish, J. B., & Block, J. S. (1968). The future for women in science and engineering. *Bulletin of the Atomic Scientists*, *24*(5), 46–49. https://doi.org/10.1080/00963402.1968.11457674

President’s Council of Advisors on Science and Technology. (2012). *Engage to excel: Producing one million additional college graduates with degrees in science*. Executive Office of the President. https://obamawhitehouse.archives.gov /sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf

Rayton, B. A. (2006). Examining the interconnection of job satisfaction and organizational commitment: An application of the bivariate probit model. *The International Journal of Human Resource Management*, *17*(1), 139–154. https://doi.org/10.1080/09585190500366649

Rhoades, L., & Eisenberger, R. (2002). Perceived organizational support: A review of the literature. *Journal of Applied Psychology*, *87*(4), 698–714. https://doi.org/10.1037/0021-9010.87.4.698

Riffle, R., Schneider, T., Hillard, A., Polander, E., Jackson, S., DesAutels, P., & Wheatly, M. (2013). A mixed methods study of gender, STEM department climate, and workplace outcomes. *Journal of Women and Minorities in Science and Engineering*, *19*(3), 227–243. https://doi.org/10.1615/JWomenMinorScienEng.2013005743

Salomon, M. F., & Schork, J. M. (2003). Turn diversity to your advantage. *Research Technology Management*, *46*(4), 37. https://doi.org/10.1080/08956308.2003.11671575

Sax, L. J., Kanny, M. A., Riggers-Piehl, T. A., Whang, H., & Paulson, L. N. (2015). "But I'm not good at math": The changing salience of mathematical self-concept in shaping women's and men's STEM aspirations. *Research in Higher Education*, *56*(8), 813–842. https://doi.org/10.1007/s11162-015-9375-x

Schmider, E., Ziegler, M., Danay, E., Beyer, L., & Bühner, M. (2010). Is it really robust? Reinvestigating the robustness of ANOVA against violations of the normal distribution assumption. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, *6*(4), 147–151. https://doi.org/10.1027/1614-2241/a000016

Shanock, L. R., & Eisenberger, R. (2006). When supervisors feel supported: Relationships with subordinates' perceived supervisor support, perceived organizational support, and performance. *The Journal of Applied Psychology*, *91*(3), 689–695. https://doi.org/10.1037/0021-9010.91.3.689

Shore, L. M., & Tetrick, L. E. (1991). A construct validity study of the Survey of Perceived Organizational Support. *Journal of Applied Psychology*, *76*(5), 637–643. https://doi.org/10.1037//0021-9010.76.5.637

Silverman, D. (2013). *Doing qualitative research*. Sage.

Simon, M. K., & Goes, J. (2011). *Dissertation and scholarly research: Recipes for success*. Dissertation Success.

Singh, R., Fouad, N., Fitzpatrick, M., Liu, J., Cappaert, K., & Figuereido, C. (2013). Stemming the tide: Predicting women engineers' intentions to leave. *Journal of Vocational Behavior*, *83*, 281–294. https://doi.org/10.1016/j.jvb.2013.05.007

Singh, R., Zhang, Y., Wan, M., & Fouad, N. A. (2018). Why do women engineers leave the engineering profession? The roles of work-family conflict, occupational commitment, and perceived organizational support. *Human Resource Management*, *57*(4), 901–914. https://doi.org/10.1002/hrm.21900

Stanton, J. M., Sinar, E. F., Balzer, W. K., & Smith, P. C. (2002). Issues and strategies for reducing the length of self-report scales. *Personnel Psychology*, *55*, 167–193. https://doi.org/10.1111/j.1744-6570.2002.tb00108.x

Statistical Solutions. (2018). *Statistical analysis: A manual on dissertation and thesis statistics in SPSS*. https://www.statisticssolutions.com/spss-manual/

Steele, R., & Derven, M. (2015). Diversity & inclusion and innovation: A virtuous cycle. *Industrial and Commercial Training*, *47*(1), 1–7. https://doi.org/10.1108/ICT-09-2014-0063

Stinglhamber, F., & Vandenberghe, C. (2003). Organizations and supervisors as sources of support and targets of commitment: A longitudinal study. *Journal of Organizational Behavior*, *24*(3), 251–270. https://doi.org/10.1002/job.192

Stout, J., Grunberg, V., & Ito, T. (2016). Gender roles and stereotypes about science careers help explain women and men's science pursuits. *Sex Roles*, *75*(9-10), 490–499. https://doi.org/10.1007/s11199-016-0647-5

Sullivan, G. M., & Artino, A. R., Jr. (2013). Analyzing and interpreting data from Likert-type scales. *Journal of Graduate Medical Education*, *5*(4), 541–542. https://doi.org/10.4300/JGME-5-4-18

Thébaud, S., & Charles, M. (2018). Segregation, stereotypes, and STEM. *Social Sciences*, *7*(7), 111. https://doi.org/10.3390/socsci7070111

Thompson, C. A., Beauvais, L. L., & Lyness, K. S. (1999). When work-family benefits are not enough: The influence of work-family culture on benefit utilization, organizational attachment, and work-family conflict. *Journal of Vocational Behavior*, *54*(3), 392–415. https://doi.org/10.1006/jvbe.1998.1681

Thompson, C. A., Jahn, E. W., Kopelman, R. E., & Prottas, D. J. (2004). Perceived organizational family support: A longitudinal and multilevel analysis. *Journal of Managerial Issues*, *16*(4), 545–565.

United Nations Educational, Scientific, and Cultural Organization. (2017). *Cracking the code: Girls' and women's education in science, technology, engineering and mathematics (STEM)*. https://unesdoc.unesco.org/ark:/48223/pf0000253479

U.S. Census Bureau. (2017). *America's families and living arrangements: 2017*. https://www.census.gov/data/tables/2017/demo/families/cps-2017.html

U.S. Department of Labor, Bureau of Labor Statistics. (2018). *BLS reports: Highlights of women's earnings in 2017* (Report 1075). https://www.bls.gov /opub/reports/womens-earnings/2017/pdf/home.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2019a). *Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity* [Table]. https://www.bls.gov/cps/cpsaat11.htm

U.S. Department of Labor, Bureau of Labor Statistics. (2019b). *Occupational employment and wages: 2018*. https://www.bls.gov/news.release/pdf/ocwage.pdf

U.S. Department of Labor, Bureau of Labor Statistics. (2020). *Employment in STEM occupations, 2018 and projected 2028* [Table]. https://www.bls.gov/emp/tables/stem-employment.htm

U.S. Department of Labor, Women's Bureau. (2018). *Facts over time. Women in the labor force. Percentage of science, technology, engineering and math (STEM) workers who are women* [Figure]. https://www.dol.gov/agencies/wb/data/facts-over-time

U.S. House Education & Workforce Committee. (2013). *Hearing highlights need for more effective STEM education programs* [Press release]. https://republicans-edlabor.house.gov/news/documentsingle.aspx?DocumentID=328081

U.S. National Science & Technology Council. (2018). *Charting a course for success: America's strategy for STEM education*. https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf

Valla, J. M., & Williams, W. M. (2012). Increasing achievement and higher-education representation of underrepresented groups in science, technology, engineering, and mathematics fields: A review of current K-12 intervention programs. *Journal of Women and Minorities in Science and Engineering*, *18*, 21–53. https://doi.org/10.1615/jwomenminorscieneng.2012002908

Vitores, A., & Gil-Juárez, A. (2016). The trouble with 'women in computing': A critical examination of the deployment of research on the gender gap in computer science. *Journal of Gender Studies*, *25*(6), 666–680. https://doi.org/10.1080/09589236.2015.1087309

West, D. (2011). *The next wave: Using digital technology to further social and political innovation*. Brookings Institution Press. https://doi.org/10.1111/1478-9302.12041_79

White, J. L., & Massiha, G. H. (2016). The retention of women in science, technology, engineering, and mathematics: A framework for persistence. *International Journal of Evaluation and Research in Education*, *5*(1), 1–8. http://doi.org/10.11591/ijere.v5i1.4515

White, S. (2020). Women in tech statistics: The hard truths of an uphill battle. *CIO online*. https://www.cio.com/article/3516012/women-in-tech-statistics-the-hard-truths-of-an-uphill-battle.html

Wilson-Doenges, G. (2015). *SPSS research methods: A basic guide*. W.W. Norton & Company.

Workplace Learning Report. (2018). *The rise and responsibility of talent development in the new labor market*. https://www.cornerstoneondemand.com/sites/default/files/partner/asset/files/linkedin-learning-workplace-learning-report-2018.pdf

Wynn, A., & Correll, S. (2018). Puncturing the pipeline: Do technology companies alienate women in recruiting sessions? *Social Studies of Science*, *48*(1), 149–164. https://doi.org/10.1177/0306312718756766

APPENDICES

APPENDIX A

Sample Email to Participants

APPENDIX A

Sample Email to Participants

To the women in higher ed Math and Science at XXXX University,

I live in Raleigh, NC and am conducting my Doctoral research survey (with Saint Leo University) on the retention of women in STEM occupations in the United States and asking for you to fill out my survey. I especially need more women in math and science to participate in the survey. Please forward and share as much as you can. The survey is anonymous and takes less than 10 minutes to complete.

I am surveying women currently and formerly working in STEM in the U.S. My study relates to support factors at the occupation level and the impact it can have on retaining women in STEM and will analyze results across the four areas of STEM. Please forward to women you know that have left STEM as well. I am excited about this topic and see the need to increase the number of women to better represent society in all facets of STEM. I look forward to teaching college next after 28 years working as a woman in Tech.

Survey Link: https://saintleo.co1.qualtrics.com/jfe/form/SV_5ooHs9jcrmlNNKR

FYI - Eligibility for the survey:

- Women currently working in a STEM occupation in the United States (including business professionals and managers working for STEM-focused companies, and those teaching or working in higher ed STEM departments.
- Women that formerly worked in a STEM occupation and left within the past 7 years for any reason
- At least one-year experience working in STEM

Thank you for your help with this important study. I would be glad to share my results after my dissertation is complete. Email me if you are interested.

Sincerely,

Gayla Todd

gayla.todd@saintleo.edu

https://www.linkedin.com/in/gayla-mclaughlin-todd-08b1861

APPENDIX B

Implied Consent Form

APPENDIX B

Implied Consent Form

IMPLIED CONSENT TO PARTICIPATE IN RESEARCH

Investigator: Gayla Todd, gayla.todd@saintleo.edu

Title of Study: The Persistence of Women in STEM

Purpose of Study: You are being asked to participate in a research study designed to better understand the persistence of women in STEM careers.

Procedures: You will be asked to fill out a survey relating to the study including 11 qualifying multiple-choice questions and 42 Likert scale questions with response options ranging from strongly agree to strongly disagree. Eligible participants are women that are currently in or have left STEM-related occupations in the United States (including business professional positions and college professors teaching in STEM disciplines) in the last three years. Responding to the survey should not take more than 10 minutes.

Benefits: Participation is voluntary and there are no benefits to participants.

Risks: The risks are none greater than those of daily life.

Costs/incentives: There are no incentives and there are no costs beyond those of daily life.

Confidentiality: No information that can identify you personally will be collected as part of the research. The research is completely anonymous. All data will be kept on a password protected computer and network.

Use of information: The results of the survey will be included in my doctoral dissertation for the Doctor of Business Administration degree at Saint Leo University. Identifiable information will not be collected and not part of this document.

Voluntary: The participants may withdraw from the study at any time, or decline to participate, without any penalty.

By filling out this survey, you are indicating the following:

- **You have read the above consent statement and have had an opportunity to ask questions to your satisfaction.**
- **You understand that additional questions should be directed to Dr. Diane Monahan, Saint Leo Faculty Advisor, diane.monahan@saintleo.edu.**
- **You agree to participate in the study, under the terms outlined in this consent statement.**

APPENDIX C

Survey Instrument

APPENDIX C

Survey Instrument

Screening and Demographic Questions

1. Confirm that you are female.
   - Yes
   - No (those not identified as female in the workplace will be excluded)
2. Confirm you work in the United States.
   - Yes
   - No (those working outside the United States cannot participate)
3. What is your age?
   - 20 - 25
   - 26 - 30
   - 31 - 35
   - 36 - 40
   - 41 – 45
   - 46 – 50
   - Over 50
   - Under 20 (if you are under 20 you are not able to participate)
4. Select the most appropriate description of your current or former STEM or STEM-related career (if the last response describes your situation you are not able to participate).
   - My primary experience is/was in **Science** as a scientist, or with a science focused company as a manager or a business professional or teaching in higher education in a science department. currently work in a STEM career as a scientist
   - My primary experience is/was in **Technology**, as a computer or IT specialist, or with a technology focused company as a manager or a business professional or teaching in higher education in a technology department.
   - My primary experience is/was in **Engineering** as an Engineer, or with an engineering focused company as a manager or a business professional or teaching in higher education in an engineering department.
   - My primary experience is/was in **Math/Statistics** as a mathematician/statistician, or with a math/statistics focused company as a manager or a business professional or teaching in higher education in a math/statistics department.
   - My experience fits none of the above (if this describes you, you are not eligible to participate in the survey)
5. Select the most appropriate description of your current or former role in STEM or STEM-related occupation.
   - Scientist, Technologist, Engineer or Mathematician/Statistician.
   - Manager
   - Business Professional
   - Teacher/Researcher in Higher Education
6. Confirm you work or have worked in a STEM or STEM-related career for at least one year.
   - Yes
   - No (you are not able to participate if your experience is/was less than a year)

7. Please select from one of the following.
   - I currently work in a STEM or STEM-related occupation as defined previously
   - I formerly worked in a STEM or STEM-related occupation as defined previously, and it was within the past 7 years.
   - I formerly worked in a STEM or STEM-related occupation as defined previously, but it was more than 7 years ago (If this describes you, you are not able to participate in the survey)
8. Select the option that best describes your directive for leaving STEM.
   - To pursue a non-STEM career
   - For retirement
   - For caregiving or other domestic reasons
   - To further my education in STEM
   - To further my education outside of STEM
   - I am only leaving STEM temporarily, and I plan to return at some point.
   - Other
   - To switch to a different area of STEM
9. Select the option that most closely describes your education level.
   - Trade/Technical School/Certification Training
   - Some college, no degree
   - Associates degree
   - Bachelor's degree
   - Master's Degree
   - Advanced degree beyond Master's (PhD, Doctorate, M.D.)
10. Is your primary training or degree in STEM or Non-STEM?
    - STEM
    - Non-STEM
11. How many years total have you worked in a STEM-related occupation?
    - 1 - 5 years
    - 6 -10 years
    - 11-15 years
    - 16-20 years
    - 21-25 years
    - 26–30 years
    - Over 30 years

Perceived Organizational Support Questions

The following are the 8 items for the perceived organizational support scale (note: Appendix D includes the participant's view of the full survey).

Participant instructions: Please indicate the degree of your agreement or disagreement (from strongly disagree to strongly agree) with each statement. Select the answer that best represents your point of view about your current, or former STEM employment experience for those no longer in STEM.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Moderately Agree	Strongly Agree
12. The organization values/valued my contribution to its well-being	1	2	3	4	5	6	7
13. The organization fails/failed to appreciate any extra effort from me (R)	1	2	3	4	5	6	7

14. The organization ignores/ignored any complaint from me (R)	1	2	3	4	5	6	7
15. The organization really cares/cared about my well-being	1	2	3	4	5	6	7
16. Even if I did the best job possible, the organization fails/failed to notice (R)	1	2	3	4	5	6	7
17. The organization cares/cared about my general satisfaction at work	1	2	3	4	5	6	7
18. The organization shows/showed very little concern for me (R)	1	2	3	4	5	6	7
19. The organization takes/took pride in my accomplishments at work	1	2	3	4	5	6	7

Items that are reverse scored are 2, 3, 5, and 7.

Note: This 8-item scale created by Eisenberger, Huntington, Hutchison, and Sowa (1986) assesses employee's feelings of being appreciated for their contributions and of the organization's overall interest in their well-being. This scale is publicly available on Dr. Eisenberger's website at http://classweb.uh.edu/eisenberger/perceived-organizational-support/. Singh et al. (2018) found a Cronbach's alpha of .95 using this scale in their study of the moderating effects of occupational commitment and turnover.

Perceived Supervisor and Coworker Support 16 -Item Survey Questions

The following are the 16 items for the perceived coworker and supervisor support scale (note: Appendix D includes the participant's view of the full survey).

Participant instructions: For the remainder of the survey please indicate the degree of your agreement or disagreement (from strongly disagree to strongly agree) with each statement. Select the answer that best represents your point of view about your current, or former STEM employment experience for those no longer in STEM.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Moderately Agree	Strongly Agree
20. My supervisor values/valued my contribution to his/her well- being	1	2	3	4	5	6	7
21. My supervisor fail/failed to appreciate any extra effort from me (R)	1	2	3	4	5	6	7
22. My supervisor ignores/ignored any complaint from me (R)	1	2	3	4	5	6	7
23. My supervisor really cares/cared about my well-being	1	2	3	4	5	6	7
24. Even if I did the best job possible, my supervisor fail/failed to notice (R)	1	2	3	4	5	6	7
25. My supervisor care/cared about my general satisfaction at work.	1	2	3	4	5	6	7
26. My supervisor show/showed very little concern for me (R)	1	2	3	4	5	6	7

27. My supervisor take/took pride in my accomplishments at work	1	2	3	4	5	6	7
28. My coworkers value/valued my contribution to their well-being	1	2	3	4	5	6	7
29. My coworkers fail/failed to appreciate any extra effort from me (R)	1	2	3	4	5	6	7
30. My coworkers ignore/ignored any complaint from me (R)	1	2	3	4	5	6	7
31. My coworkers really care/cared about my well-being	1	2	3	4	5	6	7
32. Even if I did the best job possible, my coworkers fail/failed to notice (R)	1	2	3	4	5	6	7
33. My coworkers care/cared about my general satisfaction at work	1	2	3	4	5	6	7
34. My coworkers show/showed very little concern for me (R)	1	2	3	4	5	6	7
35. My coworkers take/took pride in my accomplishments at work	1	2	3	4	5	6	7

Items that are reverse scored are 2, 3, 5, 7, 10, 11, 13, and 15.

Note: This scale adapted from the 8-item scale created by Eisenberger, Huntington, Hutchison, and Sowa (1986) assesses employee's feelings of being appreciated for their contributions and of the organization's overall interest in their well-being. The scale was modified, replacing the words "my organization" with "my supervisor" and "my coworkers," respectively. Eisenberger et al. (2002) testing this adapted version with employee retention and reported a Cronbach's alpha score between .72 and .80, which exceeds the recommended value of .70. This scale is publicly available on Dr. Eisenberger's website at http://classweb.uh.edu/eisenberger/perceived-organizational-support/.

Work–Family Support Survey Questions

Listed below are the 15 items for work–family support that make up the perceived work–family support (WFS) scale (note: Appendix D includes the participant's view of the full survey)

Participant instructions: For the remainder of the survey please indicate the degree of your agreement or disagreement (from strongly disagree to strongly agree) with each statement. Select the answer that best represents your point of view about your current, or former STEM employment experience for those no longer in STEM.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Moderately Agree	Strongly Agree
36. In the organization, it is/was very hard to leave during the workday to take care of personal or family matters (R)	1	2	3	4	5	6	7
37. The organization encourages/encouraged employees to set limits on where work stops and home life begins	1	2	3	4	5	6	7

38. To get ahead in the organization, employees are/were expected to work more than 50 hours a week, whether at the workplace or at home (R)	1	2	3	4	5	6	7
39. In the organization employees can/could easily balance their work and family lives	1	2	3	4	5	6	7
40. In the event of a conflict, managers are/were understanding when employees had to put their family first	1	2	3	4	5	6	7
41. Employees are/were regularly expected to put their jobs before their families (R)	1	2	3	4	5	6	7
42. In the organization, employees are/were encouraged to strike a balance between their work and family lives	1	2	3	4	5	6	7
43. Higher management in the organization encourages/encouraged supervisors to be sensitive to employees' family and personal concerns	1	2	3	4	5	6	7
44. Employees are/were often expected to take work home at night and/or on weekends (R)	1	2	3	4	5	6	7
45. In general, managers in this organization are/were quite accommodating of family-related needs	1	2	3	4	5	6	7
46. Middle managers and executives in the organization are/were sympathetic toward employees' childcare responsibilities	1	2	3	4	5	6	7
47. To be viewed favorably by top management, employees in the organization constantly place/put their jobs ahead of their families or personal lives (R)	1	2	3	4	5	6	7
48. In the organization, it is/was generally okay to talk about one's family at work.	1	2	3	4	5	6	7
49. The organization is/was supportive of employees who wanted to switch to less demanding jobs for family reasons	1	2	3	4	5	6	7
50. Middle managers and executives in the organization are/were sympathetic toward employees' eldercare responsibilities	1	2	3	4	5	6	7

This scale includes managerial support items and organization time demand items but combined scoring for this study for perceived work–family support. Managerial Support items are 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, and 15. Organizational Time Demand items are 3, 6, 9, and 12.

Items that are reverse scored are 1, 3, 6, 9, and 12.

Note: These items are from a work–family scale developed by Thompson, Beauvais, and Lyness (1999) to evaluate the impact of work–family culture on employees within an organization. O'Neill et al. (2009) conducted a more recent study on work–family climate and turnover using the same work–family conflict scale resulting in a Cronbach's alpha of .84 for managerial support and .81 for organizational time demands.

Turnover Intentions Survey Questions

Listed below are the 3 turnover intention items that make up the turnover intentions (TI) scale (note: Appendix D includes the participants view of the full survey)

Participant instructions: For the remainder of the survey please indicate the degree of your agreement or disagreement (from strongly disagree to strongly agree) with each statement. Select the answer that best represents your point of view about your current, or former STEM employment experience for those no longer in STEM.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Moderately Agree	Strongly Agree
51. I often think/thought about quitting my occupation in STEM	1	2	3	4	5	6	7
52. I plan/planned to stay in my STEM occupation for some time (R)	1	2	3	4	5	6	7
53. I intend/intended to look for a different occupation outside of STEM within one year.	1	2	3	4	5	6	7

Item 2 is reverse scored.

Note: This scale is a modified subset of the broadly used turnover intention scale developed by Hom, Griffeth, and Sellaro (1984) and measures an individual's intentions to leave their occupation in STEM. Singh et al. (2018) tested this modified scale on a group of women engineers to focus on turnover intentions of leaving engineering occupations and received a Cronbach's alpha of .86. Higher values indicate higher likeliness to leave an occupation.

APPENDIX D

Survey Questions Participant View

APPENDIX D Survey Questions Participant View

The following is the participants view during the online survey.

Section 1: Screening and Demographic Questions

1. Confirm that you are female.
   - Yes
   - No (those not identified as female in the workplace will be excluded)
2. Confirm you work in the United States.
   - Yes
   - No (those working outside the United States cannot participate)
3. What is your age?
   - 20 - 25
   - 26 - 30
   - 31 - 35
   - 36 - 40
   - 41 – 45
   - 46 – 50
   - Over 50
   - Under 20 (if you are under 20 you are not able to participate)
4. Select the most appropriate description of your current or former STEM or STEM-related career (if the last response describes your situation you are not able to participate).
   - My primary experience is/was in **Science** as a scientist, or with a science focused company as a manager or a business professional, or teaching in higher education in a science department. currently work in a STEM career as a scientist
   - My primary experience is/was in **Technology**, as a computer or IT specialist, or with a technology focused company as a manager or a business professional, or teaching in higher education in a technology department.
   - My primary experience is/was in **Engineering** as an Engineer, or with an engineering focused company as a manager or a business professional, or teaching in higher education in an engineering department.
   - My primary experience is/was in **Math/Statistics** as a mathematician/statistician, or with a math/statistics focused company as a manager or a business professional, or teaching in higher education in a math/statistics department.
   - My experience fits none of the above (if this describes you, you are not eligible to participate in the survey)
5. Select the most appropriate description of your current or former role in STEM or STEM-related occupation.
   - Scientist, Technologist, Engineer or Mathematician/Statistician.
   - Manager
   - Business Professional
   - Teacher/Researcher in Higher Education
6. Confirm you work or have worked in a STEM or STEM-related career for at least one year.
   - Yes
   - No (you are not able to participate if your experience is/was less than a year)

7. Please select from one of the following.
   - I currently work in a STEM or STEM-related occupation as defined previously
   - I formerly worked in a STEM or STEM-related occupation as defined previously, and it was within the past 7 years.

- I formerly worked in a STEM or STEM-related occupation as defined previously, but it was more than 7 years ago (If this describes you, you are not able to participate in the survey)

8. Select the option that best describes your directive for leaving STEM.
   - To pursue a non-STEM career
   - For retirement
   - For caregiving or other domestic reasons
   - To further my education in STEM
   - To further my education outside of STEM
   - I am only leaving STEM temporarily, and I plan to return at some point.
   - Other
   - To switch to a different area of STEM
9. Select the option that most closely describes your education level.
   - Trade/Technical School/Certification Training
   - Some college, no degree
   - Associates degree
   - Bachelor's degree
   - Master's Degree
   - Advanced degree beyond Master's (PhD, Doctorate, M.D.)
10. Is your primary training or degree in STEM or Non-STEM?
   - STEM
   - Non-STEM
11. How many years total have you worked in a STEM-related occupation?
   - 1 - 5 years
   - 6 -10 years
   - 11-15 years
   - 16-20 years
   - 21-25 years
   - 26–30 years
   - Over 30 years

Section 2: Survey Content Questions

Participants, for the remainder of the survey please indicate the degree of your agreement or disagreement (from strongly disagree to strongly agree) with each statement. Select the answer that best represents your point of view about your current, or former STEM employment experience for those no longer in STEM.

Instructions: Please indicate the degree of your agreement or disagreement (7 options from strongly disagree to strongly agree) with each statement by selecting the answer that best represents your point of view about your current or former STEM employment experience.	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither Agree or Disagree	Slightly Agree	Moderately Agree	Strongly Agree
12. The organization values/valued my contribution to its well-being	1	2	3	4	5	6	7
13. The organization fails/failed to appreciate any extra effort from me	1	2	3	4	5	6	7
14. The organization ignores/ignored any complaint from me	1	2	3	4	5	6	7
15. The organization really cares/cared about my well-being	1	2	3	4	5	6	7
16. Even if I did the best job possible, the organization fails/failed to notice	1	2	3	4	5	6	7
17. The organization cares/cared about my general satisfaction at work	1	2	3	4	5	6	7
18. The organization shows/showed very little concern for me	1	2	3	4	5	6	7
19. The organization takes/took pride in my accomplishments at work	1	2	3	4	5	6	7
20. In the organization, it is/was very hard to leave during the workday to take care of personal or family matters.	1	2	3	4	5	6	7
21. The organization encourages/encouraged employees to set limits on where work stops and home life begins	1	2	3	4	5	6	7
22. To get ahead in the organization, employees are/were expected to work more than 50 hours a week, whether at the workplace or at home	1	2	3	4	5	6	7
23. In the organization employees can/could easily balance their work and family lives	1	2	3	4	5	6	7
24. In the event of a conflict, managers are/were understanding when employees had to put their family first	1	2	3	4	5	6	7
25. Employees are/were regularly expected to put their jobs before their families	1	2	3	4	5	6	7
26. In the organization, employees are/were encouraged to strike a balance between their work and family lives	1	2	3	4	5	6	7

27. Higher management in the organization encourages/encouraged supervisors to be sensitive to employees' family and personal concerns	1	2	3	4	5	6	7
28. Employees are/were often expected to take work home at night and/or on weekends	1	2	3	4	5	6	7
29. In general, managers in this organization are/were quite accommodating of family-related needs	1	2	3	4	5	6	7
30. Middle managers and executives in the organization are/were sympathetic toward employees' childcare responsibilities	1	2	3	4	5	6	7
31. To be viewed favorably by top management, employees in the organization constantly place/put their jobs ahead of their families or personal lives	1	2	3	4	5	6	7
32. In the organization, it is/was generally okay to talk about one's family at work.	1	2	3	4	5	6	7
33. The organization is/was supportive of employees who wanted to switch to less demanding jobs for family reasons	1	2	3	4	5	6	7
34. Middle managers and executives in the organization are/were sympathetic toward employees' eldercare responsibilities	1	2	3	4	5	6	7
35. My supervisor values/valued my contribution to his/her well- being.	1	2	3	4	5	6	7
36. My supervisor fail/failed to appreciate any extra effort from me.	1	2	3	4	5	6	7
37. My supervisor ignores/ignored any complaint from me	1	2	3	4	5	6	7
38. My supervisor really cares/cared about my well-being	1	2	3	4	5	6	7
39. Even if I did the best job possible, my supervisor fail/failed to notice	1	2	3	4	5	6	7
40. My supervisor care/cared about my general satisfaction at work.	1	2	3	4	5	6	7
41. My supervisor show/showed very little concern for me	1	2	3	4	5	6	7
42. My supervisor take/took pride in my accomplishments at work	1	2	3	4	5	6	7
43. My coworkers value/valued my contribution to their well-being	1	2	3	4	5	6	7
44. My coworkers fail/failed to appreciate any extra effort from me.	1	2	3	4	5	6	7
45. My coworkers ignore/ignored any complaint from me	1	2	3	4	5	6	7
46. My coworkers really care/cared about my well-being	1	2	3	4	5	6	7
47. Even if I did the best job possible, my coworkers fail/failed to notice	1	2	3	4	5	6	7
48. My coworkers care/cared about my general satisfaction at work	1	2	3	4	5	6	7
49. My coworkers show/showed very little concern for me	1	2	3	4	5	6	7
50. My coworkers take/took pride in my accomplishments at work	1	2	3	4	5	6	7
51. I often think/thought about quitting my occupation in	1	2	3	4	5	6	7

	STEM							
52.	I plan/planned to stay in my STEM occupation for some time.	1	2	3	4	5	6	7
53.	I intend/intended to look for a different occupation outside of STEM within one year.	1	2	3	4	5	6	7

APPENDIX E

Cronbach's Item Statistics

APPENDIX E

Cronbach's Item Statistics

This includes the Item-Total Statistics results for the four Liker Scales (POC, SCS, WFS, TI).

Perceived Organizational Support (POS)

POS Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
pos1 org values my contribution to its well-being	35.13	98.452	.655	.457	.921
pos2_R org fails to appreciate extra effort from me	36.23	90.740	.718	.565	.917
pos3_R org ignores any complaint from me	35.96	92.410	.705	.527	.918
pos4 org really cares about my well-being	35.65	92.324	.746	.624	.914
pos5_R Even if I did best job possible org fails to notice	35.74	88.778	.782	.668	.912
pos6 org cares about my gen satisfaction at work	35.84	90.676	.803	.693	.910
pos7_R org shows very little concern for me	35.62	87.986	.858	.759	.905
pos8 org takes pride in my accomplishments at work	35.49	96.372	.696	.510	.918

Perceived Supervisor and Coworker Organizational Support (SCS)

SCS Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
scs1 supervisor values my contribution to her well- being	81.954	311.327	.701	.710	.940
scs2_R supervisor fails to appreciate extra effort from me	82.122	307.638	.695	.716	.940
scs3_R supervisor ignores any complaint from me	82.093	309.212	.678	.654	.941
scs4 supervisor really cares about my well-being	81.866	307.028	.776	.825	.938
scs5_R Even if I did best job possible supervisor fails to notice	81.970	305.920	.740	.758	.939
scs6 supervisor cares about my gen satisfaction at work	82.023	309.336	.748	.761	.939
scs7_R supervisor shows very little concern for me	81.836	305.866	.763	.814	.939
scs8 supervisor takes pride in my accomplishments at work	81.839	313.721	.733	.666	.939
scs9 coworkers value my contribution to their well-being	81.639	324.146	.623	.610	.942
scs10_R coworkers fail to appreciate extra effort from me	81.907	317.154	.626	.635	.942
scs11_R coworkers ignore any complaint from me	81.913	319.345	.636	.625	.941
scs12 coworkers really care about my well-being	81.718	320.151	.655	.681	.941
scs13_R Even if I did best job possible coworkers fail to notice	81.839	313.526	.720	.774	.940
scs14 coworkers care about my gen satisfaction at work	82.050	318.228	.646	.678	.941
scs15_R coworkers show very little concern for me	81.706	315.921	.697	.743	.940
scs16 coworkers take pride in my accomplishments at work	82.096	317.160	.683	.714	.940

Perceived Work–family Support (WFS)

WFS Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
wfs1_R In the org very hard leave to take care of pers/family matters	65.05	323.436	.563	.363	.938
wfs2 org encourages employ to set limits where work stops and home life begins	66.54	311.560	.701	.550	.934
wfs3_R To get ahead in the org empl are expected to work > 50 hours a wk	66.59	313.166	.654	.556	.936
wfs4 In the org empl can easily balance their work and fam lives	66.09	312.045	.773	.631	.932
wfs5 In event of conflict mgrs understanding when empl had to put fam first	65.09	322.002	.713	.608	.934
wfs6_R Empl are regularly expected to put job before their family	65.50	313.241	.804	.687	.931
wfs7 In org empl encoura strike a balance between work and fam lives	65.56	317.912	.760	.635	.932
wfs8 Higher mgt in org enc sup's to be sensitive to empl fam/pers concerns	65.51	317.177	.749	.608	.933
wfs9_R Empl are often expected to take work home at nights/weekends	67.02	321.029	.585	.460	.937
wfs10 in general mgrs in org are accommodating of family-related needs	65.18	317.434	.814	.734	.931
wfs11 Mid mgrs/execs in org are sympathetic toward empl childcare resp	65.39	320.567	.760	.643	.933
wfs12_R to be viewed fav by top mgt empl constantly place job ahead of fam/pers lives	66.50	314.058	.714	.562	.934
wfs13 In the org it is generally okay to talk about family at work	64.42	340.259	.549	.390	.938
wfs14 org is supp of empl wanting to switch to less demanding jobs for fam reasons	66.27	332.525	.547	.337	.938
wfs15 Mid mgrs and execs are sympathetic toward empl eldercare resp	65.69	326.112	.709	.572	.934

Turnover Intentions (TI)

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
TI1 I often think about quitting my occupation in STEM	3.86	6.795	.635	.403	.736
TI2_R plan to stay in my STEM occupation for some time	5.10	11.441	.646	.427	.719
TI3 I intend to look for a different occup outside of STEM within 1 year	4.97	9.217	.662	.452	.653

APPENDIX F

Multiple Regression Results

APPENDIX F

Multiple Regression Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.535[a]	.286	.283	1.21541	1.917

a. Predictors: (Constant), WFS mean, SCS mean, POS mean

b. Dependent Variable: TI mean

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	386.500	3	128.833	87.213	.000[b]
	Residual	964.633	653	1.477		
	Total	1351.133	656			

a. Dependent Variable: TI mean

b. Predictors: (Constant), WFS mean, SCS mean, POS mean

Correlations

		TI mean	POS mean	SCS mean	WFS mean
Pearson Correlation	TI mean	1.000	-.500	-.426	-.473
	POS mean	-.500	1.000	.781	.676
	SCS mean	-.426	.781	1.000	.555
	WFS mean	-.473	.676	.555	1.000
Sig. (1-tailed)	TI mean	.	.000	.000	.000
	POS mean	.000	.	.000	.000
	SCS mean	.000	.000	.	.000
	WFS mean	.000	.000	.000	.
N	TI mean	657	657	657	657
	POS mean	657	657	657	657
	SCS mean	657	657	657	657
	WFS mean	657	657	657	657

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	.9953	4.5583	2.3217	.76758	657
Std. Predicted Value	-1.728	2.914	.000	1.000	657
Standard Error of Predicted Value	.048	.286	.090	.029	657
Adjusted Predicted Value	.9953	4.5567	2.3216	.76793	657
Residual	-3.04382	4.11584	.00000	1.21263	657
Std. Residual	-2.504	3.386	.000	.998	657
Stud. Residual	-2.517	3.395	.000	1.001	657
Deleted Residual	-3.07577	4.13710	.00002	1.22105	657
Stud. Deleted Residual	-2.528	3.423	.001	1.003	657
Mahal. Distance	.014	35.340	2.995	3.125	657
Cook's Distance	.000	.052	.002	.004	657
Centered Leverage Value	.000	.054	.005	.005	657

a. Dependent Variable: TI mean

APPENDIX G

Alternate Regression Analysis

APPENDIX G

Alternate Regression Analysis

Results for the regression analysis testing whether POS, Supervisor (instead of SCS which was supervisor and coworker support), and WFS predict turnover intentions.

Model Summary[b]

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.540[a]	.292	.288	1.21062	.292	89.633	3	653	.000

a. Predictors: (Constant), WFS mean, Sup mean, POS mean

b. Dependent Variable: TI mean

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	394.098	3	131.366	89.633	.000[b]
	Residual	957.035	653	1.466		
	Total	1351.133	656			

a. Dependent Variable: TI mean

b. Predictors: (Constant), WFS mean, Sup mean, POS mean

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	5.542	.203		27.343	.000		
	POS mean	-.238	.063	-.227	-3.793	.000	.304	3.292
	Supervisor mean	-.138	.052	-.144	-2.671	.008	.376	2.662
	WFS mean	-.267	.051	-.238	-5.293	.000	.538	1.858

a. Dependent Variable: TI mean

APPENDIX H

Mann-Whitney U Test (Non-Parametric)

APPENDIX H

Mann-Whitney U Test (non-parametric)

Ranks

	Current or Former STEM	N	Mean Rank	Sum of Ranks
POS mean	Current STEM	606	339.72	205869.50
	Former STEM	51	201.64	10283.50
	Total	657		
SCS mean	Current STEM	606	339.54	205761.50
	Former STEM	51	203.75	10391.50
	Total	657		
WFS mean	Current STEM	606	341.77	207110.00
	Former STEM	51	177.31	9043.00
	Total	657		
TI mean	Current STEM	606	317.88	192633.50
	Former STEM	51	461.17	23519.50
	Total	657		

Test Statistics[a]

	POS mean	SCS mean	WFS mean	TI mean
Mann-Whitney U	8957.500	9065.500	7717.000	8712.500
Wilcoxon W	10283.500	10391.500	9043.000	192633.500
Z	-4.992	-4.908	-5.943	-5.286
Asymp. Sig. (2-tailed)	.000	.000	.000	.000

a. Grouping Variable: Current or Former STEM

APPENDIX I

ANOVA Results

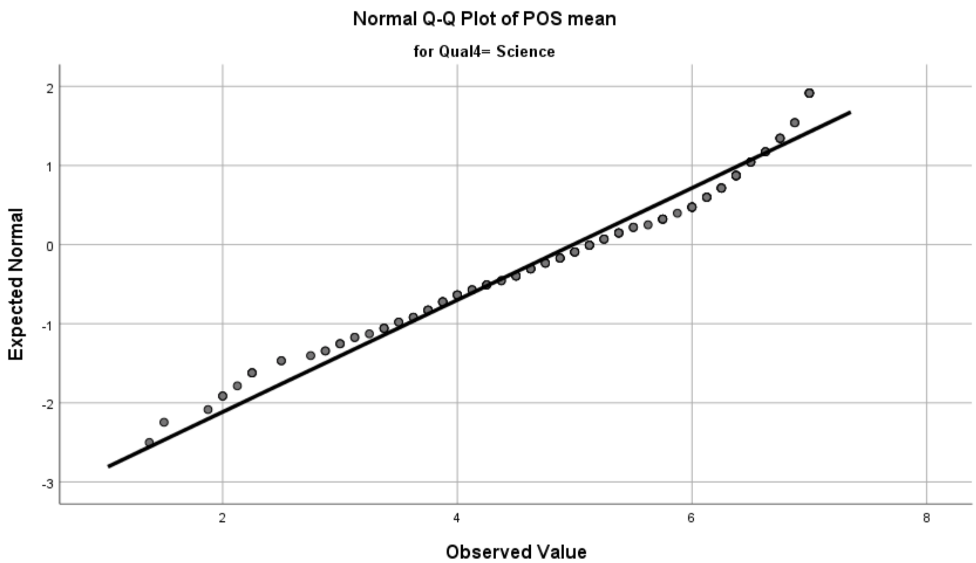
APPENDIX I

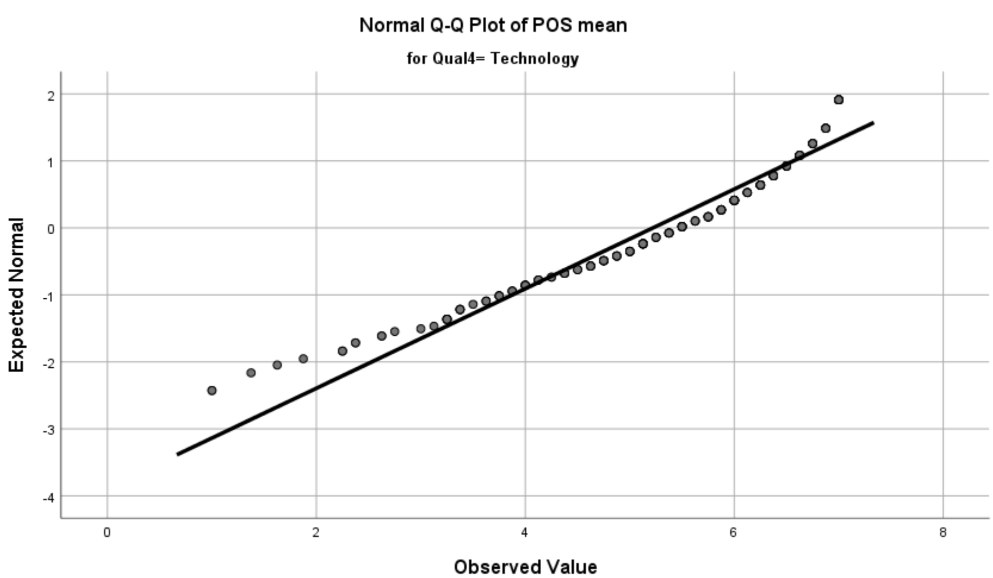
ANOVA Results

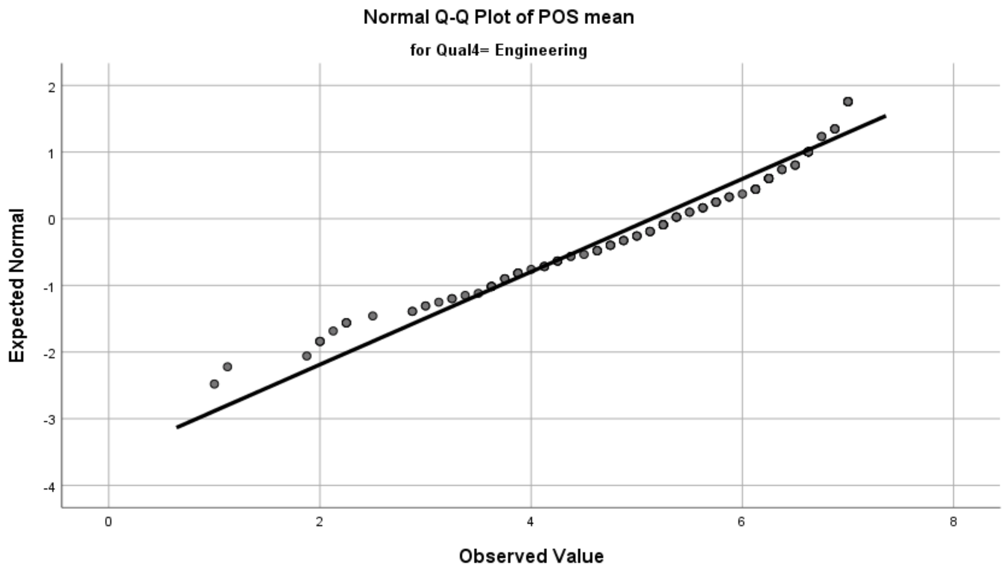
Descriptives

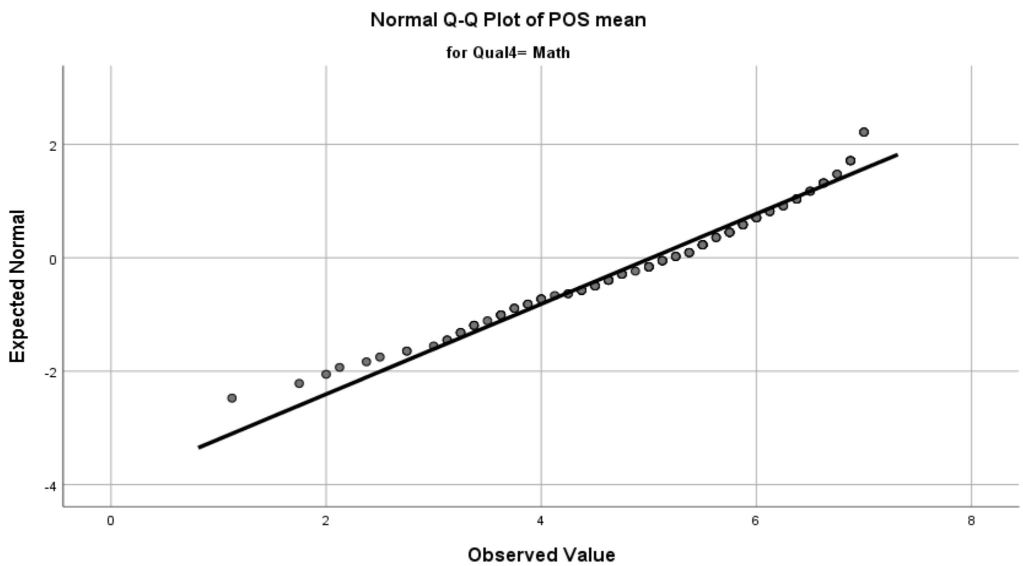
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
POS mean	Science	161	4.9884	1.41247	.11132	4.7685	5.2082	1.38	7.00
	Technology	196	5.2213	1.34536	.09610	5.0318	5.4108	1.00	7.00
	Engineering	151	5.1416	1.43568	.11683	4.9107	5.3724	1.00	7.00
	Math	149	5.0243	1.25755	.10302	4.8207	5.2279	1.13	7.00
	Total	657	5.1012	1.36451	.05323	4.9967	5.2057	1.00	7.00
SCS mean	Science	161	5.4790	1.12535	.08869	5.3039	5.6542	1.88	7.00
	Technology	196	5.5191	1.17543	.08396	5.3535	5.6847	1.19	7.00
	Engineering	151	5.4723	1.21092	.09854	5.2776	5.6670	1.56	7.00
	Math	149	5.3523	1.20826	.09898	5.1567	5.5480	1.13	7.00
	Total	657	5.4607	1.17815	.04596	5.3705	5.5510	1.13	7.00
WFS mean	Science	161	4.6435	1.23572	.09739	4.4511	4.8358	1.07	7.00
	Technology	196	4.9459	1.34948	.09639	4.7558	5.1360	1.53	7.00
	Engineering	151	4.5669	1.38159	.11243	4.3447	4.7890	1.47	7.00
	Math	149	4.5597	1.04998	.08602	4.3898	4.7297	1.13	6.80
	Total	657	4.6971	1.27528	.04975	4.5994	4.7948	1.07	7.00
TI mean	Science	161	2.1222	1.35743	.10698	1.9109	2.3334	1.00	6.67
	Technology	196	2.5204	1.54113	.11008	2.3033	2.7375	1.00	7.00
	Engineering	151	2.4547	1.56843	.12764	2.2025	2.7069	1.00	7.00
	Math	149	2.1409	1.16968	.09582	1.9516	2.3303	1.00	5.00
	Total	657	2.3217	1.43515	.05599	2.2117	2.4316	1.00	7.00

Normal Q-Q Plots






Normal Q-Q Plot of POS mean
for Qual4= Engineering
Expected Normal
Observed Value


Normal Q-Q Plot of POS mean
for Qual4= Math
Expected Normal
Observed Value

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Area of STEM	(J) Area of STEM	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
WFS mean	Science	Technology	-.30244	.13481	.113	-.6497	.0448
		Engineering	.07659	.14358	.951	-.2932	.4464
		Math	.08375	.14407	.938	-.2873	.4548
	Technology	Science	.30244	.13481	.113	-.0448	.6497
		Engineering	.37903*	.13723	.030	.0256	.7325
		Math	.38619*	.13775	.027	.0314	.7410
	Engineering	Science	-.07659	.14358	.951	-.4464	.2932
		Technology	-.37903*	.13723	.030	-.7325	-.0256
		Math	.00716	.14635	1.000	-.3698	.3841
	Math	Science	-.08375	.14407	.938	-.4548	.2873
		Technology	-.38619*	.13775	.027	-.7410	-.0314
		Engineering	-.00716	.14635	1.000	-.3841	.3698
TI mean	Science	Technology	-.39825*	.15176	.044	-.7891	-.0074
		Engineering	-.33259	.16164	.168	-.7489	.0837
		Math	-.01879	.16220	.999	-.4366	.3990
	Technology	Science	.39825*	.15176	.044	.0074	.7891
		Engineering	.06566	.15450	.974	-.3323	.4636
		Math	.37947	.15508	.070	-.0200	.7789
	Engineering	Science	.33259	.16164	.168	-.0837	.7489
		Technology	-.06566	.15450	.974	-.4636	.3323
		Math	.31381	.16476	.227	-.1106	.7382
	Math	Science	.01879	.16220	.999	-.3990	.4366
		Technology	-.37947	.15508	.070	-.7789	.0200
		Engineering	-.31381	.16476	.227	-.7382	.1106

*. The mean difference is significant at the 0.05 level.

APPENDIX J

Kruskal-Wallis H Test (Non-Parametric)

APPENDIX J

Kruskal-Wallis H Test (non-parametric)

Mean Ranks

Ranks

	Area of STEM	N	Mean Rank
POS mean	Science	161	314.32
	Technology	196	346.83
	Engineering	151	338.84
	Math	149	311.43
	Total	657	
SCS mean	Science	161	329.45
	Technology	196	338.92
	Engineering	151	333.20
	Math	149	311.20
	Total	657	
WFS mean	Science	161	321.64
	Technology	196	368.49
	Engineering	151	312.75
	Math	149	301.47
	Total	657	
TI mean	Science	161	301.21
	Technology	196	351.01
	Engineering	151	342.69
	Math	149	316.20
	Total	657	

Test Statistics[a,b]

	POS mean	SCS mean	WFS mean	TI mean
Kruskal-Wallis H	4.380	1.922	12.974	7.867
df	3	3	3	3
Asymp. Sig.	.223	.589	.005	.049

a. Kruskal Wallis Test

b. Grouping Variable: Area of STEM

APPENDIX K

Additional Demographics and Decriptives

APPENDIX K

Additional Demographics and Decriptives

Original Education levels * Area of STEM Crosstabulation

Count

		Area of STEM				
		Science	Technology	Engineering	Math	Total
Education level	Trade/Tech School	0	2	0	0	2
	Some college	0	6	4	0	10
	Associates degree	0	1	1	0	2
	Bachelor's degree	34	99	72	4	209
	Master's Degree	40	78	55	36	209
	Beyond Master's (Ph.D., Doctorate, M.D.)	87	10	19	109	225
Total		161	196	151	149	657

Role in STEM * Area of STEM Crosstabulation

Count

		Area of STEM				
		Science	Technology	Engineering	Math	Total
Role in STEM	Sci, Tech, Eng, Math	68	65	96	30	259
	Manager	16	53	29	5	103
	Bus Prof	15	73	15	4	107
	Teac/Res Higher Ed	62	5	11	110	188
Total		161	196	151	149	657

APPENDIX L

ANOVA Analysis Role Significance

APPENDIX L

ANOVA Analysis Role Significance

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Role in STEM	(J) Role in STEM	Mean Difference (I-J)	Std. Error	Sig.	95% Conf. Interval Lower Bound	95% Conf. Interval Upper Bound
Work family support	Scientist, Technologist, Engineer or Mathematician	Manager	.23895	.14537	.355	-.1356	.6134
		Business Professional	-.03535	.14591	.995	-.4112	.3405
		Teacher/Res Higher Ed	.44893*	.11858	.001	.1435	.7544