THE ROLE OF STEREOTYPE THREAT AND IMPOSTOR PHENOMENON IN PREDICTING FEMALE UNDERGRADUATE STUDENTS' PERSISTENCE IN STEM

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

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There is a lack of literature that has investigated the relationships between stereotype threat, impostor phenomenon, and other related constructs on career development, particularly for women in STEM. While various resources (National Science Foundation, 2013; Sax, Kanny, Jacobs, Whang, Weintraub, & Hroch, 2016; US Department of Labor, 2014) have highlighted the gender gap and "leaky pipeline" in STEM, it is important to further investigate and understand why these phenomena occur and continue to persist. In this study, I used a mixed methods approach which used a quantitative SEM analyses and qualitative interview to further examine the paths between chilly climate, impostor phenomenon, stereotype threat, science self-efficacy, fear of failure, fear of success, academic major satisfaction, and persistence in STEM in a sample of undergraduate females. Several hypotheses were formed in order to better understand the mediation effects of these variables upon one another. Stereotype threat was found to be endorsed at a lesser rate than anticipated, while impostor phenomenon was endorsed at a higher rate. Science self-efficacy was also found to play an important role in the predicted relationships among variables, relating to both academic major satisfaction and persistence. These quantitative results were supported by data gathered in qualitative interviews. Implications for research and practice around concerns of impostor phenomenon, stereotype threat, and fears of failure and success are discussed.

CHAPTER 1. INTRODUCTION

Overview of the Problem

Although the number of women active in science, technology, engineering, and mathematics (STEM) fields has been growing since the 1970's, a gender gap within these fields persists. Women make up more than half of the national workforce and obtain more than half of United States undergraduate degrees in biology, chemistry, and mathematics degrees, yet they still earn less than 20% of the computer science, engineering, and physics degrees (National Science Foundation, 2013). Sax et al. (2016) report that although there is evidence of increases in female representation in STEM occupations between 1970 and 1990, this growth has slowed in recent decades. Many cultural forces have been studied to understand what maintains this gap in STEM. Social influences, such as stereotype threat (Steele & Aronson, 1995) and the impostor phenomenon (Clance & Imes, 1978) have gathered increased attention. This may be because as women enter traditionally male-dominated environments, they may feel as if they do not belong or do not have the support to perform to the best of their abilities.

Stereotype threat, impostorism, and fears of failure and success might help explain why fewer women persist in STEM fields. Because of life-long exposure to cultural stereotypes about gender and identity domains, women have been found to be less likely to gain interest in STEM. In an attempt to reduce the likelihood of judgment, women may disengage from and avoid these fields. While increased support for women in STEM and role models in these fields has been encouraged and found to be beneficial (Aronson et al., 2002; Good, Aronson, & Harder, 2008), there is still an underrepresentation of women in STEM fields makes this change difficult to maintain. Studies have shown that in science, engineering, and technology fields, women

demonstrate higher attrition rates than their male peers and women in other occupations (Hewlett et al., 2008; Simard et al., 2008). This becomes even more prevalent when working up the career ladder. Hewlett et al. (2008) found that females in STEM are fairly well represented on the lower rungs of corporate ladders (41%), but more than half (52%) quit their jobs by mid-career. In engineering in particular, women have higher attrition rates than their male peers, despite having similar educational backgrounds (Society of Women Engineers, 2007).

In a 2006 study, the Society of Women Engineers found that 25% of female engineers who earned a degree between 1985 and 2003 were either not employed at or not employed in engineering. This suggests that other factors most likely are playing a part in women's choices to leave STEM and likely do have an impact on their level of career satisfaction. Lent et al. (2015) suggest that domain satisfaction is highly correlated with life satisfaction. Therefore, if one is more satisfied with their work environment, they are more likely to be happier overall. Such can also be assumed about academic major satisfaction and its impact on college student's well-being. Literature has examined women's satisfaction with STEM in the workplace, however it is important to note that dissatisfaction in STEM domains can occur before one enters the workforce (Cox et al., 2015; Shapiro & Williams, 2012). As college is a time for exploration, many students may change their majors and choose to exit out of the STEM pipeline. For women entering STEM, they might find that the major is not what they expected or anticipated. Disidentification from STEM may then occur because of cues that make the environment seem unsupportive or cold, not finding female role models or mentors, and experiencing an overall lower sense of self-efficacy and motivation. Such factors can contribute to increased levels of stress, perceived discrimination, and lower overall satisfaction.

Stereotype Threat and Impostor Phenomenon

Many cultural forces have been examined to understand what maintains this gap in STEM. Social influences, such as stereotype threat (Steele & Aronson, 1995) and the impostor phenomenon (Clance & Imes, 1978) have gathered increased attention in recent years. This may be because as women enter traditionally male-dominated environments, they can begin to feel as if they do not belong or do not have the ability to perform to the best of their abilities. Stereotype threat, impostorism, and fears of failure and success might help explain why fewer women persist in STEM fields. Because of life-long exposure to cultural stereotypes about gender and identity domains, women have been found to be less likely to gain interest in STEM. Stereotype threat is a situational predicament in which people are or feel themselves to be at risk of conforming to stereotypes about their social group (Shih, Pittinsky, & Ho, 2011). Stereotypes such as "girls are not good at math", although disproven in various studies, still serve as consistent myths within our culture that have a debilitating impact on women's involvement and persistence in STEM fields (Stoet & Geary, 2012). When women believe that they have a fixed amount of intelligence, they are more likely to believe the stereotype, lose confidence, and disengage from STEM as a potential career. Literature suggests that being aware of stereotypes can negatively impact those affected, and thus does not always protect individuals, particularly women, from experiencing stereotype threat (Tomasetto & Appoloni, 2013). Buck et al. (2008) found that when girls and young women were aware of the stereotypical image of a scientist as a man, they suffered negative reactions. Even those who strongly identify with math and science domains are susceptible to a stereotype's effects (Nguyen & Ryan, 2008). In the past decade, more than 300 studies have found that stereotypes impact individuals under evaluative circumstances (AAUW, 2010). These findings suggest that negative stereotypes about women in STEM are common and salient in society, which has a large impact on women's persistence.

While stereotype threat can become salient when women enter an environment with threatening cues, feelings of impostorism might occur alongside of being stereotyped. In an environment where one feels threatened in the face of confirming a negative stereotype about oneself, impostor fears can become multifold. Often accompanied by faltering self-confidence and an over-focus on mistake, impostor phenomenon can become debilitating for women under situational threat. Feelings of impostorism can then cause rewards and recognition to become associated with anxiety (Cowman & Ferrari, 2002). For those who are the first in their families to exceed norms or expectations for success in career, financial, and educational goals, impostor phenomenon has been found to manifest more often (Harvey & Katz, 1985). Impostor feelings have also been found to increase in situations where one sex is predominant (Harvey & Katz, 1985). When experiencing impostor phenomenon consistently, individuals are also much more likely to experience anxiety (Clance & O'Toole, 1988), depression (Austin, Clarke, Ross, & Taylor, 2009), and overall psychological distress (Henning, Ey, & Shaw, 1988). In evaluative environments, such as the university context, such distressing feelings can quickly elevate. Thus, higher impostor phenomenon levels have been tied to attrition rates over time (Topping & Kimmel, 1985).

When evaluation is constant and imminent, a cycle of fear starts within those experiencing feelings of fraudulence and self-doubt. Two key aspects of this "impostor cycle" are the fear of failure and the fear of success. Although fear of failure has gathered more evidence in the literature, fear of success proves to be equally as intriguing because it is much more difficult to measure quantitatively. Because both fears are provoked without conscious knowledge, they are often misinterpreted as anger, confusion, low self-esteem, or anxiety. These phenomena arise when an individual's script, or sequence of expected behaviors in a specific

situation, does not include success of the type they have achieved. Thus, they become inhibited and negative consequences arise. For women in STEM, achievement needs may be more closely tied to self-image, and social devaluation might cause significant amounts of distress (Bardwick, 1971). Because both the fear of failure and fear of success impact women's relationships with others, the need for social approval becomes much more important. For individuals who highly value social acceptance, fears of success may become synonymous with fears of failure, suggesting considerable overlap between these two motives (Jackaway and Teevan, 1976).

Stereotypes and feelings of impostorism likely also impact women's self-efficacy beliefs. When one experiences feelings of impostorism, this may trigger changes in their perceptions about their own abilities, impacting their self-efficacy. Such changes in self-perception can also impact affect, thus potentially increasing fears of failure or success. Self-efficacy beliefs have been found to play a vital role in STEM workplaces, as self-efficacy in STEM careers is often measured in comparisons of self to peers (Cech et al., 2011), confidence in oneself (Cech et al., 2011), and anticipated success (Cheryan et al., 2009). Self-efficacy beliefs also strongly impact specific groups. Although women have been found to receive higher grades than their male peers, they still demonstrate lower levels of self-efficacy in STEM related fields (Huang & Brainard, 2001). While they realistically may be no less likely than men to do well, many women in STEM report perceiving their abilities as lower. A study by Sax et al. (1994) found that the average woman entering college assessed her math ability as lower, whereas men were more likely to rate their abilities higher. These perceptions of ability are likely impacted not only by stereotypes, but also past experiences both at home with family and in academic environments. Some studies have found that women do not underrate their abilities (Matskewisch & Cheryan, 2016), indicating that these self-efficacy confidence gaps are tied to specific fields in STEM.

Such gender disparities in self-efficacy might lead to lower levels of satisfaction and participation in STEM from women, both in academics and in the workforce.

Importance of the Study

This study contributes to the existing literature on the retention of women in STEM. Previous research on these factors has been focused on how these constructs work independently and can impact women already in the workforce. Impostor phenomenon has largely been demonstrated to be an internal experience of fraudulence, whereas stereotype threat occurs under threats from environmental cues. However, stereotype threat and impostor phenomenon have rarely been studied in unison. These constructs may have additive effects on self-efficacy beliefs. Additionally, science self-efficacy has never been examined as a mediator of the relationships between stereotype threat and fear of failure and fear of success, as well as the relationship between impostor phenomenon and fear of failure and fear of success. Such relationships may have an impact on individual's self-efficacy and major or career satisfaction. By examining how stereotype threat and impostor phenomenon work alongside one another, a better understanding of how factors such as fear of success and fear of failure might impact female students' science self-efficacy and overall satisfaction with their major may be formed. By understanding how stereotype threat and impostorism impact major satisfaction, there might also have a better indicator of what is contributing to the attrition of women from STEM careers. Thus, this study helps to examine the relationships between these constructs, while also extending our knowledge base by assessing how and if these relationships impact undergraduate women majoring in STEM fields (see Figure 1). This further understanding can contribute to clinical practice, as practitioners work with women in STEM, and can also impact how STEM environments provide support to their female members.

Statement of Purpose

The purpose of this study is to examine the joint effects of stereotype threat and impostor phenomenon on academic major satisfaction and persistence of women in STEM majors. Further, this study will also consider the relationship that stereotype threat and impostor phenomenon have with cognitive and affective factors which may be impacted by self-efficacy, fear of failure, and fear of success. The review of the literature reveals relationships between each of these variables, often involving some level of mediation (e.g., Woodcock et al., 2012; Stout, Dasgupta, Hunsinger, & McManus, 2011; Eccles, 1994). As women continue to enter STEM majors, it will be important to continue to study what factors influence their choices to persist within STEM. No previous study has examined the combined roles of stereotype threat and impostor phenomenon, as well as experiences of fear of failure and fear of success, on science self-efficacy, academic major satisfaction, and persistence amongst women majoring in STEM fields.

Terminology and Concepts

- STEM. An acronym for "Science, Technology, Engineering, and Mathematics," originally used by, but not defined by, the education related programs of the National Science Foundation (NSF). It has been defined in a variety of ways by different groups (Tsupros & Kohler, 2009).
- **Chilly Climate.** Chilly climate is defined as a barrier to women's achievement and advancement, often identified as exclusion, devaluation, and marginalization (Sandler, 1986).
- **Stereotype Threat**. Stereotype threat is a situational experience in which underrepresented individuals feel pressured by the possibility of being adversely judged

by prevailing negative gender and/or racial stereotypes associated with a particular performance context (Steele & Aronson, 1995).

- **Impostor Phenomenon.** The impostor phenomenon and its effect, "impostorism," is a feeling that is seemingly widely experienced by a wide range of people. Clance (1988) defined impostor phenomenon as "an internal experience of intellectual phoniness" which then impacts the psychological well-being of an individual (p. 71). Harvey and Katz (1985), define it as "a psychological pattern rooted in intense, concealed feelings of fraudulence when faced with achievement tasks."
- **Self-Efficacy.** Self-Efficacy as used in this study will be based on Bandura's (1997) definition. It is defined as a judgment about one's ability to organize and execute the courses of action necessary to attain a specific goal within a given domain.
- **Academic Satisfaction**. Academic satisfaction as conceptualized in this study is a student's satisfaction with their field of study. Nauta (2007) explained that for students, major satisfaction is similar to job satisfaction because, like work environments, academic environments provide opportunities in which students will have chances to implement their own self-concept.
- **Fear of Failure**. Defined as "a tendency to appraise threat and feel anxious during situations that involve the possibility of failing" (Conroy, Kaye, & Fifer, 2007, p. 239), fear of failure in particular has been linked to the impostor phenomenon. When impostors make mistakes or do not perform to the highest standards of their abilities, they feel shame and humiliation (Sakulku & Alexander, 2011).

- **Fear of Success**. Fear of success refers to avoiding threatening consequences associated with failure, which then strengthens the motivation to do well and succeed in evaluative situations (Conroy, Kaye, & Fifer, 2007).
- **Persistence**. Persistence has been conceptualized as a behavioral commitment to studies (Roland, De Clercq, Dupont, Parmentier, & Frenay, 2015). This behavior consists of continuing a task even if the individual encounters difficulties (Burres et al., 2013).

Relevance to Counseling Psychology

Examining the roles of stereotype threat, impostor phenomenon, and related constructs is consistent with the themes and roles of counseling psychologists. As a specialty, counseling psychology has long maintained a focus on facilitating personal and interpersonal functioning across the lifespan, paying attention to emotional, social, vocational, educational, heath-related, and organizational concerns.

The themes of counseling psychology, as presented by Gelso and Fretz (2001), outline five functions that counseling psychologists strive to perform regardless of work setting and population. These themes are a) focusing on intact personalities, b) focusing on client strengths and assets, c) an emphasis on brief interventions, d) an emphasis on person-environment fit, and e) an emphasis on educational and career development. The first several themes are represented in counseling psychologists' work with university students, as they focus on concerns closer to the normal-neurotic range which may contribute to distress in overall functioning. By focusing on strengths and assets, counseling psychologists help to remind clients of their abilities, which can help with many of the concerns college students navigate. Through the use of brief interventions, counseling aims to be supportive, as well as educative, as clinicians and clients work collaboratively to understand situational problems and problem solve.

Particularly relevant to this study are the themes of person-environment fit and the emphasis on educational and career development. As Gelso and Fretz (2001) state, it is important to understand how one's environment impacts their emotional state because the role of a situation often has a significant impact on the client's life. Thus, examining how academic performances and concerns impact individuals is crucial in understanding individual's well-being. By understanding how individuals experience their academic and vocational environments, psychologists can gain an understanding of career choice and offer services, which enhances career development. Because of its strong roots in vocational psychology, Heppner (2000) states that career development and vocational psychology have become one of the strongest and most empirically mature areas of research and practice within counseling psychology. Career development consists of a series of choices made over the life span and is not just one choice made early on in life (Fouad & Bynner, 2008). Career and personal issues are often intertwined, as most work is embedded in a social context (Lent, 2012). Work is often affected by and can create relationship concerns, making it a major force in the psychological health of individuals (Juntunen, 2006). Satisfying employment has been found to encourage positive mental and physical health, whereas underemployment and unemployment have been linked to poor health outcomes (Fouad and Bynner, 2008). In their work with clients, counseling psychologists offer integrated and holistic counseling which acknowledges both career and personal concerns as part of a whole, which can be of great benefit to clients. This is particularly important in adolescence and emerging adulthood, making college a critical stage for vocational development. Thus, it has become important to understand the role of social and contextual issues in career development, particularly college student populations.

A natural extension of counseling psychology's values, the sixth theme of multiculturalism, social justice, and advocacy is also relevant in research and clinical practice. As a specialty, counseling psychology has been led within the field of psychology in its incorporation of multiculturalism and diversity concerns into its training, science, and practice (Gelso & Fretz, 2001). Respect for diversity and values different than one's own have become an important part of the counseling psychologists' identity. Since the 1940's, social, cultural, economic, and governmental forces have impacted counseling psychology. These cultural changes have helped inform and brought special attention to specific concerns certain populations may face (Heppner, 2000). As awareness about neglected populations grows, we can learn more about what barriers individuals encounter and can understand concerns from a multisystemic perspective. For example, the college population, also known as emerging adults, have been of focus for counseling psychologists. As these individuals begin to form their independent identities, they are often faced with daunting decisions about their futures. Often, students are faced with barriers across cultures, social class, and sex. A key task of the vocational nature of counseling psychology has focused on assisting students as they navigate the complexities around conflicting career choices and resolve tensions. Thus, by understanding how individuals exist within a context of larger systems, counseling psychologists can provide support to these individuals as they progress in their career development. Overall, it is critical for counseling psychologists to develop an understanding of social justice, action, and advocacy, as when root concerns are understood, psychologists can work as change agents to prevent the emergence and maintenance of these problems.

This study also speaks to the three roles counseling psychologists encompass: a) remedial, b) preventative, and c) educative-developmental (Gelso & Fretz, 2001). Counseling

psychologists work with individuals and groups in a remedial nature, helping assist them as in remedying various types of concerns, such as psychotherapy and crisis intervention. Counseling psychologists also work at a preventative level, helping clients to anticipate, circumvent, and foresee difficulties that might arise in the future. In this way, counseling is psychoeducational and works to help clients adapt and change their personal and interpersonal environments to minimize the occurrence of problems. Finally, counseling psychologists also work to help individuals plan, obtain, and derive the maximum benefits from their experiences, which helps enable clients to discover and develop their potential. Thus by focusing on strength interventions, counseling psychologists encourage enhancement. This facilitates realistic attitudes which assist clients as they encounter everyday concerns. By further understanding how individuals encounter and understand problems within their environments, such as within a STEM lab, counseling psychologists can provide support as clients reflect on their experiences, can help them anticipate barriers and how to cope, and can encourage clients to use their strengths.

CHAPTER 2. LITERATURE REVIEW

Explanations for the Underrepresentation of Women in STEM

According to the United States Bureau of Labor Statistics, women make up 57% of the total United States workforce, however, they still earn less than 25% of science, technology, engineering, and match (STEM) occupations (US Department of Labor, 2014). Women are now also earning 37% of undergraduate degrees in STEM (National Science Foundation, 2013). As the number of women in science and engineering fields grows, there are still large differences in women's participation across STEM fields and men still outnumber women, especially in upper levels of these professions. Compared to men, women are less likely to enter STEM domains in education and work, and at each critical decision-making point in their careers, women demonstrate a higher attrition rate than men (Lubinski & Bebow, 2006; Society of Women Engineers, 2006). According to Ceci and Williams (2010), social commentators and other social scientists believe that a common reason why women are underrepresented in STEM is because they are not interested in these domains, choosing to pursue other paths. However, this general statement does not consider how women's interests and personal choices may be impacted by situational factors in how they were raised and the contexts they live in. Several themes emerge in the literature when examining why women are less represented in and across STEM fields, largely tied to implicit bias, believed differences in cognitive ability, women's interest in STEM fields, work-family conflict, the culture of the STEM environment, and the cultural stereotypes about STEM.

Implicit Stereotyping

Although the gender gap in STEM fields continues to close, research conducted by Green, Carney, Pallin, Ngo, Raymond, Iezzonia, and Banaji (2007) demonstrates that even individuals who consciously refute gender and science stereotypes still hold stereotypic beliefs at an unconscious level. Since being established in 1998, the implicit bias test has found that 70 percent of test takes more readily associated "male" with "science" and "female" with "arts" (Nosek, Smyth, Sriram, Lindner, Devos, Ayala, & Barn-Anan, 2002). This suggests that individuals largely hold strong implicit associations of male with science and female with arts and a high level of gender stereotyping at the unconscious level among both women and men of all races and ethnicities, which challenges the view that biases against women in STEM are nonexistent. Additionally, it has been found that test takers are also more likely to hold negative options of women in "masculine" positions (e.g., scientist, engineer). Correlational evidence in the literature has suggested that implicit, or automatic, associations between STEM and males may have negatively impacted women's science and math interests. It has also been found that undergraduate women who have stronger implicit biases (e.g., male-science associations) identify less with science and have weaker science career aspirations (Cundiff, Vescio, Loken, & Lo, 2013; Lane, Goh, & Driver-Linn, 2012). Because many of these stereotypes and biases are still impactful, it is likely they have an influence on how girls and women gain interest in and pursue positions in STEM. These implicit biases likely play a role in preventing girls and women from pursuing science, whether it be because of evaluation in STEM course work, from the messages they receive from caregivers while growing up, or from the work environment.

Cognitive Factors

While it has been demonstrated that the difference in average age math performance between boys and girls no longer exists in the general school population (Hyde, Lindberg, Linn, Ellis, & Williams, 2008), cognitive differences have been considered a reason for the difference of representation by gender in STEM. It has been found that girls and boys do have different cognitive strengths and abilities (Haier, Jung, Yeo, Head, & Alkire, 2005). For example, boys tend to perform better on tasks concerning spatial orientation and visualization, as well as certain quantitative tasks, whereas girls outperform boys on tests relying on verbal skills, memory, and perceptual speed (Hedges & Nowell, 1995; Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007). While it has been proposed that spatial skills are important for success in fields like engineering, the connection between spatial abilities and STEM careers has not been found to be definitive (Ceci et al., 2009). Ceci, Williams, and Barnett (2009) reviewed more than 400 articles exploring the causes of women's underrepresentation in STEM fields, including biological as well as social factors, and concluded that the research on sex differences in brain structure and hormones is inconclusive. Additionally, Lynn and Irwing (2004) found small or no differences in average IQ between the sexes; neither girls nor boys are the "smarter sex."

Given beliefs about differences in cognitive ability, it is not surprising that another major area of focus in female engagement in STEM examines self-concept. Historically, boys have been found to outperform girls in math, but this has changed throughout the past few decades and the gender gap has narrowed, with girls doing as well as boys on average (Hyde et al., 2008). Girls are also earning high school math and science credits at the same rate as boys and have slightly higher grades in these classes (U.S. Department of Education, National Center for Education Statistics, 2007). Despite the closing gender gap, gender differences in confidence exist. Gender differences in self-confidence in STEM subjects begins in middle school and tends

to increase in high school and college (Pajares, 1996). From adolescence, girls have been found to express less interest in math and science careers than boys (Lapan, Adams, Turner, & Hinkelman., 2000). High school girls tend to report larger discrepancies between their self-views and perceptions of the "typical" science student more often than boys do, leading to less interest in science (Lee, 1998). Typically, students who lack confidence in their math or science skills may be less likely to want to engage in tasks that require those skills and are more likely to give up when faced with difficulties. Thus, girls and women who endorse less self-confidence may be more vulnerable to losing confidence in STEM areas. However, even girls and women who excel in mathematics often do not pursue STEM fields. In studies of high mathematics achievers, for example, women are more likely to secure degrees in the humanities, life sciences, and social sciences than in math, computer science, engineering, or the physical sciences; the reverse is true for men (Lubinski & Benbow, 2006). Women with higher implicit male–math associations whose identity as women is important to them are also less likely to declare an interest in pursuing math-based careers than women who hold lower implicit math-male associations or identify less strongly with their gender (Kiefer & Sekaquaptewa, 2007).

The transition between high school and college is a critical moment when many young women turn away from a STEM career path. Although women are the majority of college students, they are far less likely than their male peers to plan to major in a STEM field. In 2011, the National Science Foundation found that approximately one-third (29%) of male first year students were planning to major in a STEM field, as compared to 15% of female first years. Work by Correll (2001) examined why female students chose to major in careers outside of STEM, particularly focusing on the cultural belief that math and science domains are for men. Among students with equivalent achievement in math, Correll (2001) found that males assessed

their mathematical ability higher than females did and were 1.2 times more likely than females to enroll in a calculus class. When controlling for actual ability, it was found that the higher students assessed their own mathematical ability, the greater the odds were that they would enroll in a high school calculus course and choose a college major in STEM (Correll, 2001). In the study, males were more likely than their equally accomplished female peers to enroll in a math class because they believed they were better in math. When mathematical self-assessment levels were controlled, the gender gap decreased and the higher enrollment of maxsles in math classes disappeared, also reducing the gender gap in college major choice. Thus, the gender difference in this study was attributed to differences in self-assessment. When males and females assess themselves as equally competent, gender differences may be less likely to exist. Additionally, in a follow-up study, it was found that when cultural beliefs about male superiority exist in any area, females are more likely to assess their abilities in that area lower, judge themselves by a higher standard, and express less desire to pursue a career in that area. The results of these studies suggest that cultural beliefs do play a role in career choice, influencing if one believes that career is "appropriate" for their gender. Cech et al. (2011) indicate that having a sense of belonging in a field is a strong predictor of interest. For many females, this cultural association with competency in STEM areas may negatively impact how females assess themselves as compared to males, and additionally puts more pressure on them to do well in areas not typically associated with females, especially if one believes she is not competence or qualified.

Work-Family Conflict

Ceci, Williams, and Barnett (2009) theorize that many women may be prevented from entering STEM because of the belief that pursuing a career is incompatible with having a family.

While women may perceive work-life balance as a problem for others, this belief may not strongly influence their own decisions early on in life. It has been found that while high school girls do rate having children as more important to them than do high school boys, this accounts for less than 2% of the gender gap in choosing a STEM major (Morgan, Gelbgiser, & Weeden, 2013). While first-year students did indicate that they could see possible conflicts between career and family responsibilities, first-year women's intentions to start a family did not appear to impact their persistence in engineering programs (Cech et al., 2011). However, because women have been found to be more family oriented than men, these work-life concerns may not become a prominent concern until later on in one's studies or career. Ferreira (2003) found that female graduate students in particular were less likely to see careers in STEM fields as compatible with having a family. Sax (2001) reported that female students majoring in STEM fields who reported that having a family was a high priority were more likely to leave the science and less likely to attend graduate school. Additionally, Xie and Shauman (2003) found that married women with children were more likely to leave science and engineering after receiving their master's degrees than women without children or married men with children. Thus, work/family conflict may become a bigger deterrent as women progress in STEM fields.

Once working in the field, women often refer to the culture of STEM as a "chilly climate" (Seymour & Hewitt, 1997), and depending on the specific field within STEM, the culture may vary (Cohoon & Aspray, 2006; Deemer, Thoman, Chase, & Smith, 2014). STEM fields may differ in the extent to which they are associated with masculine stereotypes (Matskewich & Cheryan, 2016). While the culture of a STEM environment may not be overtly hostile, women may be less likely to enter, persist, and be successful in the field if there is a mismatch between how they are expected to behave and the norms of the culture in that field

(Stephens, Fryberg, Markus, Johnson, & Covarrubias., 2012). While the belief that one can succeed in STEM is important in developing one's interest in pursuing a STEM career, for females especially, it is also critical to examine the cultural gender roles which influence occupational interest and choice (Low et al., 2005). A review of child vocational development (Hartung, Porfeli, & Vondracek, 2005), found that girls develop beliefs that they cannot pursue certain occupations because they are perceived as inappropriate for their gender. Research also has indicated that people tend to judge women to be less competent than men in "male" jobs unless they are clearly successful (Hartung, Porfeli, & Vondracek, 2005). However, if she is successful, the woman is then found in a double bind, as competent women in masculine jobs tend to be considered less likable. Because both likability and competence tend to be needed for success in the workplace, the loss of either can quickly lead to disinterest and a feeling of discomfort in the workplace. Individuals tend to view women in masculine fields as competent or likeable, but rarely both (Heilman et al., 2004). Heilman et al. (2004) ran a series of experiments which examined the double bind facing women in masculine fields. It was found that when success was ambiguous, women were rated as less competent than an identically described man. When described as successful, women and men were rated as equally competent, but women were rated as less likable and more interpersonally hostile. It was also found that both competence and likability matter in advancement, but women tend to be judged as less competent than men unless there is clear evidence of excellence. However when there is evidence of success, women are judged as less likable. Being both competent and well liked are important for advancement in the workplace, but this balance may be more difficult for women than men to achieve and maintain. This may partially explain why women working in STEM

occupations leave at higher rates than their male peers do, as one may not want to be assumed incompetent, or if thought competent, to be disliked.

Various explanations have been provided for the ever-persisting gender gap in STEM. Initially, differences in intelligence and personality between men and women were regarded as key factors in the difference in representation. However, such findings have been conflicting, as studies have found women to do equally as well as men or better in academic testing (Benbow & Stanley, 1982; Feingold, 1992). In studies that have found gender differences, these differences are generally small in magnitude and not likely to be consequential (Hyde et al., 2008). More recent findings have suggested that the underrepresentation of women may be due to innate differences in gender socialization and messages of which careers are appropriate for certain genders (Summers, 2005). Thus, certain fields may be marketed as more appropriate for one gender than the other. The process of persistence in STEM has been studied using a "pipeline model" (Kulis et al., 2002; Pell, 1996) to understand the "leakage" of women out of STEM fields. Other empirical evidence contends that while in the workforce, structural impediments create an environment in which discrimination becomes the norm. Women have reported discrimination at hire, the "glass ceiling" when pursuing promotion, inequity in salary, and a lack of support in the workplace (Settles, Cortina, Malley, & Stewart, 1996). Regardless of viewpoint, it does appear that the persistence of the gap may be due to a number of different factors working simultaneously. More information is needed to better understand the factors which hinder women's persistence in STEM.

Stereotype Threat: Definitions and Theory

In their initial studies, Steele and Aronson (1995) describe stereotype threat as a social-psychological predicament that rises from a widely-known negative stereotype about one's own

group. It is a "person-situation predicament: a person contending with the possibility of being negatively stereotyped" (Steele, Spencer, & Aronson, 2002, p. 391). They state "the existence of the stereotype means that anything one does or any of one's features that conform to it make the stereotype more plausible in self-characterization in the eyes of others, and perhaps one's own eyes" (Steele & Aronson, 1995, p. 797). Thus, when a negative stereotype about one's group becomes relevant, usually as an interpretation of one's behaviors or experiences, this results in a sense that one is being judged or treated in terms of the stereotype (Steele et al., 2002). However, stereotypes may impact their targets even before the behavior or judgment occurs, as the threat of discrimination and devaluation implied by the perceived relevance of a negative group stereotype can have effects.

Steele et al. (2002) conceptualize stereotype threat as "arousal, worrying thoughts, and temporary, cognitive deficits evoked in situations where a group member's performance can confirm the negative stereotypes about their group's ability in that domain" (p. 389). Although the particular state, trait, or beliefs about a target may exist, these are not necessary for one to experience stereotype threat. Steele et al. (2002) explain that stereotype threat is a threat in the sense that it is experienced in some setting or another and at some time or another by virtually all, as all people have some group or social identity for which negative stereotypes exist. In any situation where a stereotype might apply, one is at risk to experience stereotype threat. However, it is the nature of the threat that depends on the content of the negative stereotype. The level of threat one experiences varies considerably depending on the situation, people, and activities to which the stereotype is relevant. For example, a woman may experience stereotype threat in a math class, where the stereotype applies, but not in an English class (Steele et al., 2002). Steele et al. (2002) also explain the varying strengths of stereotype threat. Stereotype threat varies in

terms of degree of threat, as some stereotypes have more negative connotation than others (i.e., demeaning a group's integrity vs. demeaning a group's sense of humor). If one highly identifies with an activity to which the stereotype applies, this could also increase the degree to which one may be negatively stereotyped in a certain domain. In general, if one is highly identified with a group about whom there a negative stereotype exists, the more they feel a part of the group, the more threat they should feel in situations where the stereotype applies (Steele et al., 2002). Thus, to understand the effect of stereotype threat, it is important to consider the influence of the strength of the threat, its effect on behavior, and features of the situation and people involved.

Steele and Aronson (1995) based their initial research on theories and research that focused broadly on how immediate situational threats derive from negative stereotypes about one's group. If one is threatened by being judged or treated as a member of a stereotyped group, just the presence of a stereotype alone should be enough to activate this threat (Steele & Aronson, 1995). Additionally, if one experiences a faltering in performance because a negative stereotype was activated about their group, this could lower the individual's expectations about their abilities and performance levels. This "drop" in ability confidence may be faster under the influence of stereotype threat than it would normally be if the stereotype were not there (Steele & Aronson, 1995). Thus, undermined performance levels could cause lower motivation, less effort, and an overall disidentification with the domain.

Steele and Aronson (1995) examined how varying conditions and modifications to how stereotype threat was activated could impact Black and White college students' intellectual performances on a series of questions from the Graduate Record Examination (GRE). Based on past research conducted in the social psychological field, it was hypothesized that when Black students faced an explicitly scholastic or intellectual task, they would face another threat which

required conforming to or being judged by the negative societal stereotypes about their race's intellectual ability and competence. The internalized self-threat created was hypothesized to cause pressure on students to protectively disidentify with achievement in school domains. Thus, stereotype threat's effect was hypothesized to be protective but also disengaging, helping individuals to guard against the negative self-evaluative threat posed by stereotypes. This concurrently diminished their interest, motivation, and achievement in specific academic domains. The series of studies was significant in demonstrating that stereotype threat served as a mediator and how it can impair the intellectual performance of a targeted group, however the studies also suggest that stereotype threat could be used in a positive manner to also "life" participant's self-evaluation, which could improve performance.

Stereotype threat has also been described as occurring from two different types of sources: self-source and other as source. Shapiro and Williams (2012) explained how in stereotype relevant conditions, one's performance has the possibility of confirming in one's own mind that the stereotype is true of your own abilities. Negative stereotypes can also be transferred from the attitudes of others in our lives, such as parents and teachers, and this then becomes ingrained into a self-as-source stereotype threat. Thus, having been exposed to specific stereotypes across time, women may unconsciously believe these stereotypes are valid and endorse them. The others-as-source stereotype threat emerges when we consider how others might assess our performances. For example, one's performance has the possibility of confirming or denying a stereotype held about us in that person's mind (Shapiro & Williams, 2012). Although related, self-as-source and others-as-source differ because while self-as-source endorses a belief in the stereotype, in the others-as-source stereotype, individuals may not endorse the stereotype themselves, but may believe that other individuals do.

Given the contribution of various factors to the disproportionate number of women in STEM, it is important to consider the impact that stereotypes have on the outcome of female engagement and participation in these fields. When experiencing stereotype threat, individuals are threatened by a negative stereotype that exists about their group or fear doing something that would confirm that stereotype. This threat can be experienced both psychologically and physiologically. Blascovich et al. (2001) found that African Americans taking an intelligence test under stereotype threat had higher blood pressure levels than White individuals did. No difference in blood pressure levels of African Americans and White individuals occurred in the non-threat situation. Stereotype threat can also be induced when women are underrepresented in a situation (Sekaquaptewa & Thompson, 2003), suggesting that women may experience stereotype threat more often in fields in which the proportion of women is lower. Additionally, the possibility of encountering bias and discrimination because of negative stereotypes can reduce women's sense of belonging in STEM (Good et al., 2008). Thus, women in the "pipeline" of STEM majors and careers are likely to be susceptible to stereotype threat. When under threat conditions, women may perform worse than men on tasks, however when the threat is removed they can perform significantly better (Good et al., 2008). According to Lindemann, Britton, and Zundl (2016), when stereotypes intersect with performance, two threats are introduced for women interested in STEM: stereotype threat and the impostor phenomenon (p. 222). While stereotype threat causes women to be aware of negative stereotypes regarding their STEM abilities, negatively impacting their performance, the impostor phenomenon works conversely to cause successful women to attribute their success to factors outside of their own abilities, making them feel like frauds. Lindemann et al. (2016) argue that stereotype threat and the impostor phenomenon are connected at an institutional level, which directly contributes to women's

STEM attrition leading to a ‘weed-out’ culture (p. 236). Similarly, the idea of a “leaky pipeline” framework has emerged, which examines the decreasing number of women in higher STEM positions (Oakes, 1990). As such, stereotype threat and impostor phenomenon work both separately and in conjunction to produce barriers for women’s persistence and satisfaction within STEM domains, both at academic and occupational levels. Long-term threats to women’s abilities and confidence has also be linked to the process of disidentification. This process is described as a defense to avoid the risk of being judged by a stereotype. Thus, if one is faced with a stereotype, instead of confronting the negative stereotype repeatedly, they choose to avoid it by, for example, choosing to leave math and science altogether. Because women are negatively stereotyped as being less competent in mathematics and science, the knowledge that others are stereotyping them based on gender alone can prevent women from pursuing STEM.

Stereotype Threat and Situational Features

Inzlicht and Ben-Zeev (2000) predicted that being outnumbered by men in a setting would be enough to cause women to experience detrimental effects from the negative stereotypes about their mathematical ability. They stated that any such environment which activates the threatening effects of gender stereotypes is considered to be a “threatening intellectual environment” (Inzlicht & Ben-Zeev, 2000, p. 365). Drawing on distinctiveness theory, Inzlicht and Ben-Zeev suggest that any minority status evokes a group identity which is then incorporated into one’s self-concept (e.g., women being aware of their gender in a male dominate workplace). Tied to this theory, Inzlicht and Ben-Zeev (2000) also used tokenism theory (Lord & Saenz, 1985) to argue that having a token status in an otherwise homogenous group can elicit cognitive deficits in all domains and can invoke the feeling of being responsible for representing one’s minority group favorably in any given domain (p. 366). It was predicted

that having increased awareness about one's group, and thus the negative stereotypes associated with that group, would then cause poorer performance. The study examined if placing women in the minority was sufficient enough to create a threatening intellectual environment and to produce minority-induced performance deficits. Findings were consistent with their predictions for the activation of stereotype threat, but contrary to tokenism, as simply placing high achieving women in an environment in which men outnumbered them caused some performance deficits in problem-solving domains, such as mathematics. Interestingly, performance deficits also tended to increase as the relative number of males increased (Inzlicht & Ben-Zeev, 2000, p. 369). Thus, although individuals did not need to be specifically targeted by stereotypes to be impaired, being a minority within a larger group can cause someone to be more impaired by stereotypes than someone who is not continuously in the minority.

Kanter (1977) used the term "token" to examine how women who occupy this status feel when they are alone or nearly alone in a peer group comprised of men. It is explained that tokens are individuals who are identified by "ascribed characteristics (master statuses such as sex, race, religion, ethnic group, age, etc.) or other characteristics that carry with them a set of assumptions about culture, stats, and behavior highly salient for majority category members" (Kanter, 1977, p. 968). Thus, tokens bring these traits and assumptions into situations in which they differ from others. Kanter (1977) explains that the importance of the traits may be heightened if members of the majority group have a history of interacting with the token's category in ways that are different from the demands of the present situation, as is true of men with women. Thus, because the token in a category is rare, hyphenated titles appear, such as "woman-engineer" or "male-nurse" (p. 968).

Token status in a group has also been thought to dictate perceptions and interaction dynamics between “tokens” and “dominants”. Kanter (1977) describes a variety of interaction responses, which are associated with visibility, polarization, and assimilation. Because they are the minority in a group, token members often are aware of the public nature and increased visibility of their presence within the group. Being observed as a token member creates performance pressures, as relationships and mistakes serve as information about the token group. Token performance can also affect prospects for future members of the group, which creates the pressure of being the representative of one’s category. Token members may feel increased fear, which creates the responses of overachievement or wanting to have limited visibility (Kanter, 1977, p. 947). Kanter also explains role entrapment, where token members are shaped to fit the pre-existing generalizations about their group. This can create role inductions, which serve to further stereotype the group. Focusing specifically on women, Kanter lists several examples of role induction: (a) mother, (b) seductress, (c), pet, and (d) iron maiden. Because all of these pressures can create stress for the token members, it is often easier to accept a stereotyped role than to fight it, which may create safety within a position while also eliciting a certain degree of self-distortion (Kanter, 1977, p. 984).

It has been proposed that there may be individual differences in how much stereotype threat individuals perceive in their environments. Pinel (1999) developed the stigma consciousness measure which aimed to capture differences in perceived stereotype threat amongst individual members of negatively stereotyped groups. In a laboratory experiment, Pinel found that women who were high in stigma consciousness avoided male question categories when playing against males more than women who were low in stigma consciousness. This avoidance could suggest a greater experience of stereotype threat as well as the presumption that

men might be more difficult competition on male questions. Brown et al. (2001) provided more suggestive evidence for stigma consciousness in a study that demonstrated how remedial students performed worse on standardized tests when they were more stigma-conscious. Thus, individual differences within groups may play a part in the difference of sensitivity to stereotype threat that individual's experience.

A study by Bergeron, Block, & Echtenkamp (2006) examined how negative stereotypes influenced women's behavior in the workplace, especially in higher managerial positions. It was found that women in higher positions do seem to be affected by stereotype threat, showing a significant difference when compared to male peers (Bergeron, Block, & Echtenkamp, 2006). All women were impacted by stereotype threat but not to the same extent. Women who identified with masculine gender roles appeared to have a buffer against the negative effects of stereotype threat on their performance. Interestingly, even when placed in a feminine sex-typed condition, stereotype threat played a role, triggering a concern about proving the stereotype of incompetence. Women in this study experienced stereotype threat in both masculine and feminine conditions, which demonstrated that the higher position of authority, typically associated with males, was enough to trigger this response. Women also were found to experience more negative affect in the masculine sex-typed condition. These results are interesting in that they demonstrate how even in situations where stereotypes may not be explicitly made clear, they still manifest and impact performance.

Women who have persisted in male-dominated fields or have risen to leadership positions within their chosen professions also face barriers which may make the work environment challenging. Because stereotypic expectations and implicit biases exist in which women are expected to be subordinate to men and to appease traditional gender relations, women may face

challenges in the workplace which differ from challenges men face. Although women have increasing moved into the paid workforce and are starting to view themselves and each other as more agentic (Diekman & Eagly, 2000), the threat to the status quo creates a challenge for women as they move forward and combat stereotypes of female communality (Rudman & Glick, 2001). Women in occupations or positions that have been historically considered "male" may be seen as stepping outside of gender bounds. Rudman (1998) describes a phenomenon known as the backlash effect, which occurs when an individual violates a stereotype, resulting in social and economic reprisals. While backlash can be a protective function for perpetrators, for perceivers it can be highly detrimental. Backlash can be damaging as it may curb individual's success and visibility and may reinforce stereotypes within the culture at large (Rudman & Fairchild, 2004). In the workplace, a common example of the backlash effect consists of the "agentic woman" who is perceived as highly qualified, but is also then seen as socially deficient and unlikable, which can result in hiring discrimination. This effect is also seen in the reverse with men; communal men are perceived as highly likable, but are viewed as less competent and hirable compared to agentic men (Rudman, 1998). Thus it appears that one is unable to be both agentic and communal at work, especially in environments where one's gender may be in the minority or outside of the expected norm.

However, this effect is penalizing for women as it prevents women from being successful, diminishes the amount of successful role models women have, and promotes the stereotype that women do not belong in these settings. Additionally, women who act "atypically" in settings continue to receive negative feedback for taking on behaviors or actions that are typically more masculine. Costrich et al. (1975) found that assertiveness is viewed negatively in women even when it involves self-defense. In environments where women need to be assertive

and less communal the opposite of the female stereotype, this can be detrimental to their work. This also places women in a double bind where in order to succeed at work they need to enact masculine competencies to be viewed as qualified for high-status roles, however if they are perceived as qualified, they receive backlash from those around them. They may also choose to enact communal behaviors and be liked but not respected. In either case, there is a risk of being disqualified for leadership roles. Backlash has been shown to result in higher demonstrations of self-defeating behaviors on the job (Riordan, Gross, & Maloney, 1994), being bypassed for promotions (Fiske Bersoff, Borgida, Deaux, & Heilman, 1991), and overall disadvantages in job interviews and hiring negotiations (Janoff- Bulman, & Wade, 1996). A study by Rudman and Glick (2001) demonstrated that agentic women can avoid backlash by exhibiting agentic traits that are associated with competence and not with social dominance, provided communality is also displayed. This is problematic because it can become challenging for women to monitor a subset of agentic traits and demonstrates that there is a fine line of how to appear competent, ambitious, and competitive. All of this must be done but not at the expense of others, which is challenging for any person to maintain. This creates a difficult situation for women and also means that they must pay increased attention to impression management, especially in spaces where they are the minority.

Environmental Cues

The cues hypothesis proposes that situational cues, such as a setting's features and organization, can make potential targets vulnerable to social identity threat (Murphy, Steele, & Gross, 2007). When aware of situational cues, individuals may be more alert and aware of the possibility of psychological threat. In the case of stereotypes, these cues may make individuals more aware of isolation or ostracism. Murphy et al. (2007) proposed that an individual's

vulnerability to identity threat is not inherent or within the individual and is instead the result of such situational cues. When specific cues occur, this may result in experiences of stereotype threat in specific settings. Testing the cues hypothesis, Murphy et al. (2007) showed a population of undergraduate students studying mechanical engineering conference videos which were either gender balanced or gender imbalanced. Results found that women who watched gender imbalanced women were more likely to be vigilant to both details of the video and cues in the physical context, as compared to women who watched the gender balanced video. Physical responses were also recorded. Women who watched the gender imbalanced videos demonstrated faster heart rates, greater skin conductance, and greater sympathetic activation of the cardiovascular system. Additionally, women also reported anticipation of a lower sense of belonging and less desire to participate in a conference after watching the unbalanced video. These results indicate that women may evaluate situations as threatening by looking at cues, such as numerical representation of their gender. Thus, how environments are organized can have a significant impact in signaling threat to stigmatized groups and may decrease motivation of those groups to participate in certain contexts.

Threats related to underrepresentation can be viewed as a career barrier, inhibiting career development (Lent, Brown, & Hackett, 2000). Because barriers can influence learning experiences, and thus impact career interests and choices (Lent et al., 2000), it is critical to understand how these process impact women in STEM majors. A study by Master et al., (2016) specifically investigated how under-representation and stereotypes about career prototypes impact female undergraduate students in computer sciences. Computer sciences are an area of STEM which has one of the lowest percentages of women (National Science Foundation, 2013). Stereotypes about computer science include the perception that it requires brilliance, is isolating,

and does not involve communal goals. Previous studies examining this environment have found that when stereotypes about an academic environment are made salient, women's interest in computer sciences decreases (Cheryan et al., 2009). Just as individuals evaluate the gender distribution, they also evaluate objects, as they can signal the culture of the people, materials, and activities in that environment. Cheryan et al. (2009) gave the example of women not being as interested in computer science in classrooms which promoted computer science stereotypes (i.e., science posters) as opposed to classrooms containing items like general interest books or art posters. These results were replicated in Master et al.'s (2016) work; there were gender differences in how much males and females felt they belonged in a computer science classroom. Girls who felt that fit with the stereotype of a computer scientist were more likely to express interest in the stereotypical classroom environment than those who did not. Reactions to environments might also impact students' sense of belonging. If individuals perceive a mismatch between themselves and academic environment, they might think they are less compatible for that space. Thus for females, environmental cues might act as barriers which lead to a lower sense of belonging in STEM.

At this point in time, stereotype threat and its effects on various groups, especially underrepresented groups in STEM, has been widely investigated and discussed. While having knowledge and information about stereotype threat can be beneficial in increasing awareness about its impact, studies have also examined if providing information about stereotype threat to targeted groups is helpful. It has been shown that the implicit impact of stereotype threat, such as chronic negative effects of stereotypes on women's own appraisal of their abilities, can be detrimental over time (Wigfield, Battle, Keller, & Eccles, 2002). When provided with information about stereotypes, girls have been shown to engage in affirmative action policies

against gender discrimination and have had an increased valuing of science (Pahlke, Bigler, & Green, 2010; Weisgram & Bigler, 2007). When individuals are informed about the stereotype that exists about their group, the impact of that stereotype is more likely to be lessened or non-existent. A study by Johns et al. (2005) informed women about stereotype threat before a math exam. After being told about the mechanism of stereotype threat, the sample of women were shown to have significantly improved scores which equaled those of men. Thus, sharing information about the stereotype can actually alleviate anxiety associated with the threat, by making it more external than internal (Johns et al., 2008).

A study by McGlone and Aronson (2007) examined the various coping strategies which may harm or protect math performance when stereotype threat is present. After providing participants with information on stereotype threat, participants were asked to either suppress stereotype threat related thoughts or were invited to replace their threatened gender identity with alternative identification. When given the coping strategy of replacing gender identity with a more positive identification, stereotype threat was successfully avoided, whereas in conditions where participants were asked to suppress stereotype threat, the suppression was ineffective. Wegner (1994) proposed that when individuals suppress a stereotype, the opposite may occur: the stereotype becomes more salient and increase at either a conscious or unconscious level. A study by Tomasetto and Appoloni (2013) found opposite results. They decided to present information about stereotype threat to a sample of women, with no other interventions present. For women who understood the concept and thus became knowledgeable about stereotype threat, they actually performed worse at a calculus task as compared to women who received the same information but failed to understand it. Thus, in this study, actually learning about stereotype threat beforehand exacerbated the effects of the stereotype, instead of the expected result of

lessening the effects. Thus, sharing information on stereotype threat with threatened groups may or may not be beneficial or protective. Increased knowledge about the stereotypes may be helpful for some but might also trigger internal doubts about their abilities and competencies.

Gender Composition in the Achievement Environment

Cohen and Swim (1995) found that women have negative reactions to anticipated solo status, whereas men do not, which Sekaquaptew and Thompson (2003) predicted may lower performance, due to lower expectations about how one will do prior to engaging in a task. Sekaquapetew and Thompson closely examined the influence of stereotype threat and solo status on the oral performance of both men and women in an examination, predicting that both factors would demonstrate performance deficits relative to a control group within female, but not male, participant groups. It was found that both solo status and stereotype threat negatively influenced the performance of women, but not men and that performance was in fact lower when both factors were present (Sekaquapetew & Thompson, 2003). This supports previous work (Cohen & Swin, 1995) and suggests that even when gender stereotypes are considered irrelevant, the idea of giving a public performance to an opposite sex audience activates negative consequences for women than for men. While stereotype threat may not be consciously recognized by women during a situation, it still may impair their performance (Sekaquaptew & Thompson, 2003).

Research on the effects of stereotype threat has long been studied and has been found to be a predicament that affects a broad array of groups (e.g. African Americans, Latinos, the socio-economically disadvantaged). A study by Blascovich et al. (2001) examined whether increased blood pressure accompanied stress African Americans participants experienced under stereotype threat. It was hypothesized that as African Americans are stereotyped more often than European Americans, their higher levels of blood pressure may stem from multiple episodes of stereotype

threat. It was found that African Americans who were open to stereotype threat on a cognitive task were more likely to exhibit greater blood pressure increases than European Americans (Blascovich et al., 2001, p. 228). When stereotypes were low, they did not have greater blood pressure. Thus, even though stereotypes may not fully account for higher blood pressure, the threat associated with being stereotyped might result in more situations in which their blood pressure is elevated, which could lead to chronic health problems in the future. Similarly, in a study examining differences in scholastic achievement between low and high socioeconomic status (SES) individuals, Croizet and Claire (1998) tested the impact of stereotype threat theory on social class in a sample of students taking the Graduate Record Examination (GRE). It was predicted that students from lower SES backgrounds would be more likely to doubt their intellectual abilities and that being part of this minority group would demonstrate the disruptive effects of stereotype threat on performance. Results supported the hypothesis, showing that participants from low SES backgrounds were more likely to perform worse than participants from high SES backgrounds. However, when the test was not predicted as a test of intellectual ability, lower SES students performed as well as higher SES participants. These results suggest that prolonged exposure to stereotypes could produce a vulnerability to impaired performance in certain situations, which may also impact lower SES students' interpretation of their own abilities.

As women tend to be outnumbered by men in positions of authority or leadership, especially in male-dominated fields, it has been proposed that this environmental factor of the workplace may elicit stereotype threat. Because stereotype threat effects those who are faced with the threat of confirming a negative stereotype, this could possibly create performance deficits in environments like the workplace. Because individuals often compare themselves to

others to learn and advance in their field of work, women comparing themselves to male counterparts might be detrimental. Von Hippel, Issa, Ma, and Stokes (2011) suggest that by engaging in social comparison, women may be more likely to realize that they are paid less, climb the corporate ladder at a slower pace, and may be assigned less projects. While not all women compare themselves to their male counterparts, men still set the standards of success sin most workplaces, which can be threatening to women's self-evaluations. Von Hippel et al. (2011) examined the effects of social comparison in women who compared themselves to successful male versus successful female peers, predicting that increased feelings of stereotype threat would be prevalent when compared to men but not women. Results indicated that women who experience stereotype threat in work settings experienced a separation between their female and work identities, were less confident that they would reach their career aspirations and demonstrated reduced job dissatisfaction and elevated intentions to turn over. These results indicated that social comparison with men could in fact ellicit more stereotype threat.

The Effect of Stereotype Threat on Women in STEM

While women have started to close the gender gap in the sciences, earning almost 40% of undergraduate degrees in STEM (American Physical Society, 2011), women still are underrepresented in specific fields, such as engineering and computer science (National Science Foundation, 2011). In engineering for example, less than 20% of the degrees awarded in the United States are given to women, and this trend decreases yearly (The National Academic Press, 2010; NSF, 2013). Women are also twice as likely to switch from engineering to other STEM majors (Cech et al., 2011). In fields such as biology however, women are overrepresented, with 59.7% of degrees in biology and 72% of premedical degrees being awarded to women (American Physical Society, 2011). At the doctoral level, these findings are

paralleled, with women earning 54.5% of degrees in biology but less in the physical sciences (e.g., physics, engineering) (Heilbronner, 2013; National Science Foundation, 2010). Looking at the workforce in STEM, women represent 25-26%, even though their representation continues to decline despite the number of degrees awarded in STEM each year (U.S. Department of Commerce, 2011). Landivar (2013) reported that women represent fewer than 11% of practicing engineers, which has been a stable figure for 20 years. Although women continue to pursue STEM fields and work, the growth of women in such fields has slowed since the 1990's (Landivar, 2013), which indicates that numerous factors may be at work which may be a persistent hindrance on women's participation in STEM. Much research has examined why women do not continue to pursue STEM fields after graduation. A wide range of determinants exist, such as demographic background characteristics like race and ethnicity (Ohland, Brawner, Camacho, Layton, Long, & Lord, 2011) and past schooling experiences (Tully & Jacobs, 2010). It appears that potential determinants related to participation in STEM all seem to consider experiences, contexts, and time frames. This is important as women in different fields and cohorts may have varying experiences in STEM depending on when they were engaged in the field and the experiences they had during these times. Such literature also informs and supports the theory of the "leaky pipeline" which speaks to women's STEM attrition across time.

When individuals do not perceive that they fit with a dominant occupational identity, they are more likely to leave the occupation (Peters et al., 2012). Peters et al. (2012) argue that identity-fit dynamics likely play a large role in why women may be underrepresented in traditionally masculine occupations. While person-environment fit dynamics can have positive effects on individuals who identify with their careers, these dynamics may also play a role in why some may leave. Sampling trainees in a surgery program, a masculine-dominated

environment, Peters et al. (2012) found women in the training program were more likely than male peers to believe that they differed from the student prototype. Because of this lack of fit, they also reported lower levels of occupational identification than their male counterparts. Although subtle, comparison to the prototype of what a surgeon in training should look like had an effect on women trainees. These findings are important, in that past literature has reported that when individuals report lower occupational identification, they also have higher intentions to exit their career (Olkkonen & Lipponen, 2006). This is detrimental for women in male-dominated careers because if women do not perceive themselves to be the typical student to enter a STEM field, this may dissuade many women from pursuing such careers, leading to the persistence of the gender gap in STEM. Diekman, Brown, Johnston, and Clark (2010) proposed that often individuals perceive STEM careers as being incompatible with communal goals. Thus, when women have communal goals, they may be more likely to opt out of STEM careers which may not afford them a sense of communion in their work. In their sample, they found that general STEM careers were indeed perceived as inhibiting communal goals, which then led to less interest in STEM careers, while the opposite was found in women who endorsed agentic goals. In the sample, gender also predicted communal goal endorsement, as more women endorsed communal goals than men.

It is important to examine women's perceptions of STEM fields because these perceptions can inform women's choices, especially when it comes to person-environment fit and work-life balance (Fouad, Fitzpatrick, & Liu, 2011; Williams & Ceci, 2012). Women's perceptions of STEM as masculine fields because of the gender imbalance have resulted in women being less likely to report long-term career plans in fields like engineering (Amelink & Creamer, 2010). While for men, planning for a family increases the odds that men will pursue

engineering, it decreases those odds for women (Williams & Ceci, 2012). This suggests that women do not think that working in a traditionally male field will support traditional family orientations they might have. Reis (1998) found that because of an anticipated conflict between work and family plans, many women may never enter STEM. Women who choose pursue STEM while also balancing familial responsibilities may also experience dissatisfaction with their environment or interactions with colleagues. Historically, it has been found that women who experience more cooperation and less competition are more likely to remain STEM (Ash et al., 2004). For women whose work experiences do not match these experiences, they may experience less career satisfaction.

Being faced with barriers because of gender stereotyping and solo status also likely leads to women's perceptions of STEM as being unwelcoming or an environment where they do not fit. Inzlicht and Ben-Zeev (2000) stated that being one of few women in a field that is stereotypically male can make gender stereotypes salient. A study by Simard (2007) examined specific barriers that exist for women in Information Technology, as this is a STEM field where the number of women in the industry has declined since 1996 (Information Technology Association of America, 2005) and women are much more likely to be seen as token members. Because women are much more likely to be solo members in fields like Technology, they also may be more likely to be stereotyped as out-group members. Simard (2007) explains that Technology is a field whose culture is "masculine, white, and heterosexual in nature" and is associated with "hard programming, obsessive behavior, and extensive working hours" (Turkle, 1995; Margolis, Fisher, & Miller, 1999). Not only are women token members in such a setting, additionally work-life balance might also be difficult to achieve in such a setting. Because work-life balance can be difficult to achieve, women might also experience more difficulties in career

growth and may experience a “double push” where they must split time between being the ideal-type mother and a devoted worker (Simard, 2007, p.8). Another difficulty women may face in masculine-dominant fields are stereotypes which promote the idea that women are less competent than men. When salient, this stereotype can promote a sense of threat and can reduce women’s motivation in a domain, leading to its abandonment (Davies, Spencer, Quinn, & Gerhardstein, 2002). Because gender stereotypes may be salient before women enter a workplace, it is likely that women’s perceptions of a field may influence how they feel entering the workspace. A study by Schuster and Martiny (2016) examined how women’s anticipation of how they would feel in a stereotype activating context would impact their affect. It was hypothesized that anticipated positive and negative emotions likely would predict women’s career aspirations. Testing a sample of women in high school and college, they assessed how women’s anticipated affects in stereotypically male domains predicted their STEM career aspirations, with the anticipated affect serving as a mediator. It was found that women anticipated negative affect in imagined scenarios which contained stereotype activating cues and positive affect in situations where stereotypes about their majors were not prevalent. While the impact of visualizing the scenarios was relatively small, this may suggest that negative stereotyping over time could be detrimental to women considering STEM fields. Schuster and Martiny (2016) also found that the anticipated affect that women in the sample demonstrated varied with the presence of stereotype activating cues. When participants anticipated positive affect, they were more likely to want to major in a subject, independent of their gender. The authors suggest that anticipated positive affect likely goes beyond confidence in the ability to do well or because they expect to do well; self-efficacy likely plays a role in choice as well.

Stereotype Threat presence and impact on Undergraduate Women in STEM

Although the number of female undergraduate students in STEM majors continues to rise, women's perceptions of STEM may impact their decisions to pursue or stay in STEM majors. Literature has found that many societal and psychological factors may work together to explain why undergraduate women are more likely to switch out of STEM fields than males (Eccles, 1987). When a female student chooses to pursue a major in a STEM field, she becomes part of a marginalized and often stereotyped group. Stereotypes often can lead to sex discrimination, which may be more likely to occur when female are the minority group. Although not always intentional, biases against women in the physical sciences exist, as the sciences tend to be gender-typed. Similar to the common "women are worse at math" stereotype, women also are perceived as less competent in science fields. Such stereotypes might lead to increased discrimination against fields in STEM. Stephan and Stephan (1996) describe sex discrimination "an unjustifiable negative behavior directed at a person on the basis of his or her sex". In contexts where sex discrimination is more likely to occur, such as being the only female student in an engineering lab, any occurrence or anticipation of sexist behavior may cause a female in the environment to lose confidence in the area and to choose to pursue a different major. It is also highly likely that in contexts where females are the minority, stereotype threat is more likely to occur, whether it be an expression of outright discrimination or an implicit bias others hold. Female engineering students have been found to be much more likely to report greater discrimination than males (e.g., not feeling respected as equals, having discouraging interactions with faculty) (Haines, Wallace, & Cannon, 2001). A study by Logel et al. (2009) found that female students in engineering experienced stereotype threat and performed lower on engineering tests after interacting with sexist male colleagues. These same students also perceived differential treatment in prospective engineering programs and felt they were in hostile

environments. When combined, gender discrimination and stereotype threat may elicit a double threat which continues to decrease the presence of women in STEM.

Discrimination based on gender may be linked to implicit biases that both students and faculty hold. A study by Moss-Racusin et al. (2012) investigated whether science faculty, those whom one would least expect to endorse stereotypes, contributed to the gender disparities we see in STEM fields by endorsing certain biases. Moss-Racusin et al. (2012) investigated if faculty perceptions of students' competencies would impact if they hired a male or female student as a laboratory manager. Pre-existing biases were also examined to understand what processes might contribute to biases. It was found that both male and female faculty were more likely to judge female students to be less competent and less worthy of being hired than their identical male peers. Because both male and female faculty members demonstrated these biases, this suggests that biases are less intentional and are more likely the result of widespread cultural stereotypes. Such biases can impact training and evaluation. It was also found that if offered manager positions, female students were offered smaller starting salaries and less career mentoring. It is important to understand if and how undergraduate women in STEM experience discrimination via stereotype threat from both men and women, because the occurrence of such threat can produce negative affects and perceptions of STEM fields. Having such experiences in undergraduate years can be detrimental to persistence in STEM, as those are the years where women decide if they want to pursue graduate work and occupations in STEM. For women who stay in STEM, such biases might also be harmful and may result in real-world disadvantages in the workplace.

Disidentification from STEM

The impact of stereotype threat on women who already may feel disadvantaged in an academic setting might deter women from completing STEM programs. If one feels highly threatened in an area they previously had interest in or identified with, the process of disidentification may occur. Steele (1997) defines disidentification as a "reconceptualization of the self an one's values as to remove the domain as a self0identity, as a basis of self-evaluation" (p. 614). This process has been documented as occurring with several groups who are the minority in specific settings. For example, a study by Major et al. (1998) found that African American students who felt threatened by negative stereotypes about their race (i.e., intellectual inferiority because they were Black) were more likely to disidentify with academic areas. Students who used to derive their self-esteem from academics felt threatened in this realm, and thus separated themselves, seeking to gain self-esteem from another area. Considering female undergraduate students in STEM, if such a process occurs, the student is much more likely to protect herself and switch into a major where she feels she belongs and is less likely to be threatened.

In a study by Steele et al. (2012), such results were found to be true. Examining the experiences of undergraduate women in male dominated academic areas (e.g., math, science, engineering), Steele et al. (2012) proposed that these students would report discrimination in their major because of their sex, anticipated discrimination because of their sex if they were to pursue a career in their major, felt more threatened by negative gender stereotypes, were less inclined to identify with their majors, and were more likely to think about changing majors. All of these hypotheses were confirmed, although ratings on the scales were relatively low. Steele et al. (2012) indicated that having tested a sample of first-year students discrimination might have still been evident to a lower extent and may actually rise as students progress in their majors.

This is troubling, because if first-year students already experience stereotype threat and the threat of a hostile environment, more advanced students and women in the field likely experience these threats to a greater extent.

Literature on interest in STEM across genders has also focused on the concepts of perceptions of STEM, role congruity, and lack of fit. The way in which women view STEM in college, graduate school, and the workplace likely impacts their interest and decision to pursue such fields. Past research has indicated that women may have a negative view of STEM because of its male-dominated nature (Fouad et al., 2011; Xie & Shauman, 2003). However, this may not be an accurate assumption, as women do continue to major and pursue STEM. To examine perceptions of the field, Sax et al. (2016) used national data on incoming college students over a 40 year period to examine the gender gap in intent to major in engineering, determinants in majoring in engineering over all other fields, and the extent to which the gender gap was due to gender differences in student attributes or the salience of those attributes (p. 576). This broad sample found that a persistent gender gap has existed over time. Although students interest in engineering has fluctuated across time, the sample indicated that men's interest in the field remained stronger than women's. While the percentage of women who intended to major in engineering grew across time, to 20.9% in 2010, the number was still low. Interestingly, this study also measured intent and not actual pursuit, which may suggest that something changes in the college environment which may impact women's pursuit of a STEM major.

As the gender gap in STEM has closed, literature has examined if the experience of women in STEM has changed over time and if women have chosen to stay in STEM positions as they progressed in their careers. A study by Heilbronner (2013) used survey methodology to explore the experiences of males and females in two different cohorts who were part of the

Science Talent Search, a national competition. These two cohorts were selected in order to investigate if males and females had differing experiences in STEM, exploring the affective, academic, and occupational patterns and experiences of these participants across time and gender. While some of these factors were internal (e.g., ability, interest, self-efficacy), other factors were external (e.g., mentors, academic experiences, workplace experiences). A similar study was also completed by Subotnik, Stone, and Steiner in 1993. In that study, men and women demonstrated different reasons for leaving STEM. Men were more likely to leave because of differing interests, the perception that STEM lead to an unappealing lifestyle, or the realization that they entered STEM to please parents or their school. Women however showed more regret about leaving STEM, citing health reasons, impersonal classes, and impersonal life styles in laboratories (Subotnik, Stone, & Steiner, 1993). Subotnik et al. (2001) followed up with this same sample a decade later and found that women continued to site disillusionment with the scientist lifestyle, had few job prospects, had little encouragement from faculty or mentors, and found other domains more appealing. The sample in Heilbronner's (2013) sample echoed these results; it was also found that interest appeared to be the most influential factor in both men and women's decision to stay in STEM. Heilbronner (2013) explains that interest tends to develop based on mediating influences, like academic experiences and self-efficacy. Thus, if men report higher self-efficacy in STEM, they would also be more likely to persist in the field after many years, something which previous research (Dweck, 2007) supports. Heilbronner's sample echoed national trends; women were found more likely to select biology as a major and fewer selected engineering and physics/astronomy.

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Impostor Phenomenon

Given the nature of gender socialization within culture, it is not surprising that such socialization has transferred over into the career domain. Despite achievements and honors, many women do not experience an internalized sense of success. In samples of high achieving women, many express experiencing generalized anxiety, lack of self-confidence, depression, and frustration related to an inability to meet self-imposed standards of achievement (Clance & Imes, 1978; Clance & O'Toole, 1988). Many women may not share their emotions because they fear criticism or a lack of understanding from others about their experiences.

Clance and Imes (1978) put a name to these experiences, labeling them as the impostor phenomenon. Studying a sample of 150 women, they were able to focus on understanding the personal and experiential effects of impostor feelings while also confirming observations made by theorists about how men and women make attributions. They state, "women who experience

the impostor phenomenon maintain a strong belief that they are not intelligent; in fact, they are convinced that they have fooled anyone who thinks otherwise" (Clance & Imes, 1978, p. 1). Because feeling like an impostor is an internal experience, those experiencing the impostor phenomenon will try to hide what they are experiencing, fearing that someone will indeed confirm that they are an intellectual impostor. Those who experience this phenomenon share a terror of failure and go to great lengths to avoid mistakes. Research has found that men and women experience the impostor phenomenon at the same frequency, however men do not acknowledge it as openly as women do (Razmjoo and Samahnejad, 2014). Although men experience the impostor phenomenon as often as women do, Clance and O'Toole (1988) postulated that for women, experiences of impostor phenomenon come at a higher cost.

High levels of impostor phenomenon have also been proposed to limit the acceptance of success as an outcome of one's own ability, which can influence feelings of self-doubt and anxiety. Clance (1985) describes six different characteristics which can impact one's feelings of impostorism: (a) the impostor cycle, (b) the need to be special or the "very best", (c) "superwoman/superman" aspects, (d) fear of failure, (e) denial of competence and discounting praise, and (f) fear of guilt about success. Clance (1985) stated that while the impostor phenomenon is marked by all six of these characteristics, a minimum of two are necessary for one to experience feelings of impostorism.

One of the signature aspects of the impostor phenomenon, the impostor cycle, starts when an individual engages in an achievement- related task (Clance, 1985). Individuals with fears of impostorism begin to experience anxiety, which then results in either over-preparation or initial procrastination, followed by frenzied preparation. After the completion of the task, there is an initial sense of relief and accomplishment, feelings that do not persist. Even when receiving

positive feedback, individuals will deny that success is due to their abilities and instead will reject these messages. If one over prepares, they attribute success to hard work; if they procrastinate, success is due to luck. Regardless of preparation style, impostors do not believe success is reflective of their true ability. Thus, this combination of individual beliefs about the mechanics of success and their perceptions of luck begin to reinforce a cycle of self-doubt, one that is repeated each time a new task is introduced. This cycle quickly becomes problematic, as it interferes with other priorities and causes individuals to work harder than necessary or causes them to experience increased anxiety with the associated belief that breaking the cycle means one is a failure. Each time one is successful, feelings of fraudulence are also reinforced, as impostors have high expectations for their goals and ideals of what success is. If there is any gap between actual performance and the idealized standard that has been set, positive feedback is quickly discounted.

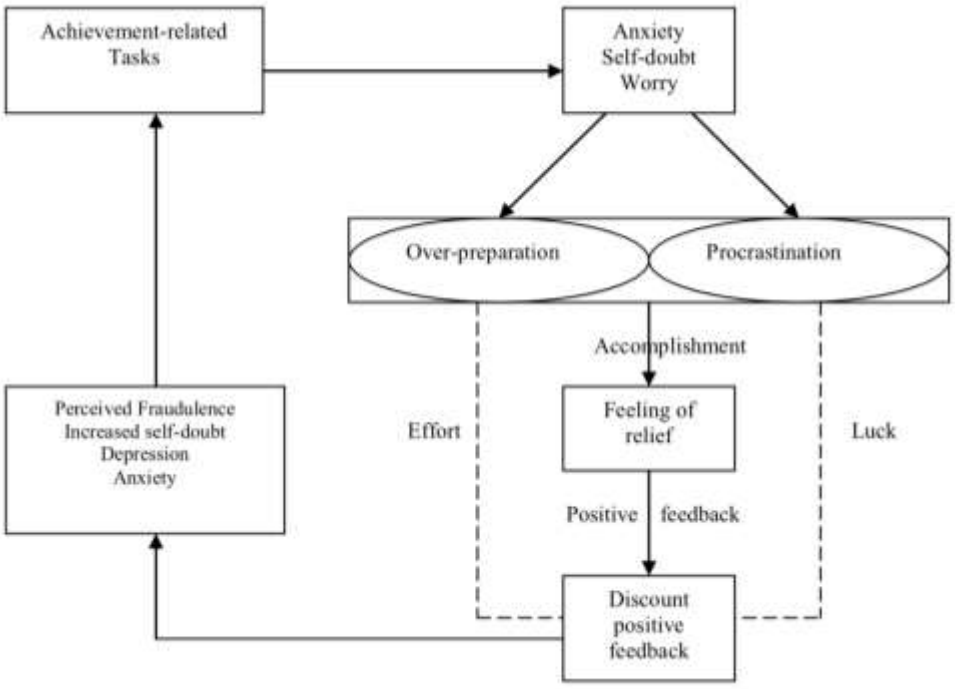

Figure 1. Diagram depicting the Imposter Cycle based on Clance (1985), as illustrated by Sakulku and Alexander (2011)

In addition to the impostor cycle, Sakulku and Alexander (2011) provide information on the five additional aspects of the impostor phenomenon. Those who experience impostorism often experience a need to be "special or the best". Often, these individuals are at the top of their class. When placed in larger settings, these individuals start to realize that many individuals excel in similar areas, which promotes the idea that one's own talents and abilities are not exceptional. Thus, the assumption that persists is that if one is not the very best, he/she is stupid. An interrelated aspect, the superman/superwoman aspect of the impostor phenomenon consists of many perfectionistic tendencies. Impostors expect to complete all tasks perfectly and set high, and almost impossible, standards. Thus, they often feel overwhelmed, disappointed, and begin to overgeneralize themselves as failures when goals are not completed. Even when successful, impostors also have difficulty internalizing their success and accepting praise as valid. By denying their competence and discounting praise, impostors discount any objective evidence of success and instead focus on evidence which "proves" that they do not deserve praise or credit for their achievements.

Two fears associated with impostorism are the fear of failure and fear of success. Fear of failure produces high levels of anxiety when one is exposed to an achievement-related task because they could possibly fail. Impostors associate failure with making mistakes, not performing at one's highest standards, shame, and humiliation. Clance and O'Toole (1988) proposed that fear of failure may be the underlying motive of most impostors. Thus, to reduce the risk of failure, most impostors overwork. Similarly, a fear of success also relates to the negative consequences of successfully completing an achievement related task. If success is unusual in the individual's workplace or social circle, success will cause them to feel less connected and more distant from their peers. Because success can cause them to feel different

from others, they will also begin to worry about rejection. Fear of success also links to how individuals react to future tasks. After completing tasks successfully, individuals will begin to worry about higher demands and greater expectations from those around them. If one doubts their own ability to maintain their current level of performance, they will then become more reluctant to accept additional responsibilities. Those higher demands or expectations are risks, as they might reveal one's intellectual phoniness.

Those who experience the impostor phenomenon likely do not achieve all that they are capable of, do not enjoy their successes, do not have a realistic sense of their own competence, are not fully empowered to internalize their strengths, and have difficulty accepting their own deficits (Clance & O'Toole, 1988, p. 52). Hutchison et al. (2006) speculated that impostor phenomenon likely causes individuals to define their success by a single factor. Thus despite success in past performance, this one factor weighs heavily in the minds of impostors and can have several implications. Those who experience the impostor phenomenon are more likely to turn down opportunities to advance, which can have a significant impact on job advancement and self-confidence. Combined with gender stereotypes, this can significantly prevent women in particular from achieving their highest potential. Whereas men may be encouraged by mentors and faculty to pursue goals in spite of their fears, women in similar positions may lack these support systems, and effectively be handicapped. Thus, women are torn between the solidarity of their identities as women and the autonomy that would accompany their success. Women's roles as nurturers are more broadly supported by society, and thus women are more likely to have many responsibilities that their male counterparts are less tied to (i.e., caring for parents, caring for children, home upkeep). When barriers in support and responsibilities combine with

symptoms of the impostor phenomenon, women are much less likely to pursue their goals, which can impact their level of accomplishment and satisfaction.

Clance and Imes (1978) found that women tended to have lower expectations than men about their ability to perform successfully in a wide variety of tasks, attributed success to luck or effort and tended to explain failure as being a lack of ability. As women shared their lower expectancies, they also demonstrated an internalized self-stereotype of societal sex role stereotypes which do not consider women to be competent. Although women want to consider themselves successful and intelligent, they experience a state of discordance when societal expectations and their own internalized self-evaluations are activated. This then leads women to find explanations for their accomplishments other than their own abilities. Thus we see that women are more likely to project the cause of their success outward toward luck or effort.

Developmental Antecedents of Impostor Phenomenon

Clance and Imes (1978) propose that the impostor phenomenon in women is influenced by familial interactions as one is raised. In one family, a woman may be compared to her "smarter" siblings and is indirectly told that she is more sensitive or socially adept. This leads to the woman thinking that her family will never believe she is as bright as her siblings, no matter what she accomplishes intellectually. The woman may believe this message because it comes from her family, but this does not mean that she does not want to disprove it. Thus, women in this group will work diligently in academics to succeed in hopes that their family members will acknowledge their intellectual competence. If the family does not acknowledge this, the woman will be driven to find ways to attain validation from others. Each time she is doubted, the woman's self-doubt may increase and she may wonder if her family was right, assuming that any good marks can be accounted for by something else, like "teachers' expectations, social skills, or

feminine charms" (Clance & Imes, 1978, p.3). Conversely, women in the other impostor group will grow up believing that they can accomplish anything they set their minds to and should be able to do so easily. When the family sets up this dynamic, women are constantly given examples of how they have demonstrated their abilities in the past. As the woman starts to realize that she does struggle with some tasks and cannot actually do everything she would like to, this causes an obligation to fill the expectations of family members. This is an obligation the woman knows she cannot meet forever. Eventually this causes self-doubt, distrust in others' perceptions of her, and a harder work ethic to make sure she does well. A woman in this group may think dichotomously, assuming that because she is not a genius, she must be stupid. In these explanations of how family influences the impostor phenomenon, Clance and Imes (1978) effectively tie the root of the problem to societal expectations of women.

As women experience the impostor phenomenon, they quickly begin to maintain it by engaging in cycles in which they unsuccessfully try to overcome the phenomenon, instead perpetuating it. Clance and Imes (1978) proposed four behaviors which maintain the impostor phenomenon: diligence and hard work, a sense of phoniness, using charm and perceptiveness to win the approval of others, and the awareness of what it means to be a confident woman. Because those experiencing the impostor phenomenon fear being "discovered" and seen as stupid, they work hard academically, leading to success and excellence in academic performance and approval from others. However, this diligent work reinforces the cycle of the impostor phenomenon and leads to a success where "positive feelings are short lived and a sense of phoniness remains" (Clance & Imes, 1978, p. 5). This sense of phoniness leads them to downplay their own intellectual abilities, flattering others in a way, which takes attention off of them. When women do this, they avoid sharing their own thoughts and opinions, which protects

them from any chance of seeming unintelligent. However, by engaging in this, women also lose the chance to get any feedback on their opinions. The sense of phoniness impostors then feel links to how they aim to be liked and seen as intellectually special by others. Women experiencing the impostor phenomenon may actively believe they are stupid, but they crave for others to tell them they are "brilliant, creative, and special" (Clance & Imes, 1978, p. 5). This information is even more valuable when received from someone the woman admires and can temporarily serve to help boost the woman's confidence in her own intellect. However, engaging in this process long-term does not aid one in removing impostor feelings. The longer one engages in this cycle of seeking positive feedback, the more likely a woman is to eventually discount or discredit feedback from that one "special" person and to quickly look for someone else's approval. Finally, Clance and Imes (1978) also address a larger societal issue about the consequences related to being a smart, high achieving woman. Theorists have stated that when a woman is successful, it may call her femininity into question. It has been proposed that many women try to avoid success, as they fear rejection or to be considered less feminine. If a woman is to maintain that she is an intellectual phony and is not as intelligent as others say she is, she can protect herself from these negative and harmful stereotypes, engaging in avoidance of societal rejection.

It has been found that 70% of individuals will experience at least one episode of the impostor phenomenon in their lives (Sakulku & Alexander, 2011). With the rate being so high, one may wonder what differentiates expected levels of anxiety from the impostor phenomenon. Those who experience the impostor phenomenon likely also experience anxiety in situations where they may be perceived as intellectual frauds. If these feelings persist, they could lead to the experience of clinical levels of anxiety and depression. Kets de Vries (2005) proposed that

individuals normally do try to conceal their weaknesses within socially acceptable limits. However, such fears fall on a continuum. Two extremes lie outside of these limits: real imposture and neurotic imposture. While anyone can feel like an impostor when displaying a façade or presenting oneself differently in order to meet social expectations, it is problematic when people begin to behave outside of normal limits. For neurotic impostors, the problem lies in one's subjective experience of fraudulence and not with realistic social unacceptability. Neurotic impostors begin to feel inauthentic regardless of the opinions of their objective observers.

The Persistence of Impostorism

As impostorism develops, it is maintained over time. Because of its evidence in situations where the prospect of failure is evident, impostor phenomenon has been compared to protective and defensive behaviors, such as self-handicapping (Hermann, Leonardelli, & Arkin, 2002). Previous work has linked such protective behaviors to how individuals understand their competence and self-worth. Berglas and Jones (1978) found that individuals who faced doubts about their abilities often sought a handicap in their performance, as a way to protect themselves from the implications of failure, which often reflect a lack of ability. In individuals who have perfectionistic tendencies and who want to perform successfully, such as those with impostorism, they might be more likely to follow an opposite strategy. Although they still doubt their ability, impostors may view their fear of failure as something which ensures a successful outcome, as it inspires an increased effort to do well (Arkin & Oleson, 1998; Oleson, Poehlmann, Yost, Lynch, & Arkin, 2000). Research by Feick and Rhodewall (1997) demonstrates that as individuals engage in protective behaviors, their self-esteem is maintained over time. After failure, those who recognized self-handicapping were more like to have higher self-esteem than those who did

not (Feick & Rhodewall, 1997). Typically, individuals see threats to their self-worth as coming from external sources, but with processes like impostorism, the source appears to have become internalized after exposure to environmental threats. Thus, in the case of impostor phenomenon, it seems that individuals must make difficult assessments and choices in the moment, weighing the consequences of failure or achievement while also trying to preserve their self-esteem in the face of self-doubt. The more often such a thought process occurs, the more likely that individuals will engage in self-handicapping (Hermann et al., 2002).

Hermann et al. (2002) investigated the meta-cognitive process that occurs when individuals engage in self-reflection while performing a task. It was predicted that when feeling doubtful about one's performance, it may be difficult or impossible to set aside or alleviate such feelings, especially if they are elicited by certain cues. Thus, when exposed to such cues, self-esteem is also likely to be damaged or will decline in the situation. After asking participants to recall examples of their self-confidence, Hermann et al. (2002) assessed how participants reacted to the reflection process versus the content of the reflection. It was found that participants high in self-doubt were more sensitive in the process of recall, marking a drop in self-esteem and increased difficulty in remembering. Those high in self-doubt also were more focused on the recall process and less on the content of the memory, while those with low self-doubt demonstrated an opposite process. These results exhibit a relationship between self-doubt and self-esteem, and suggest that if individuals high in self-doubt had focused on the content of their memories rather than the process, perhaps their self-doubt could have been alleviated, rather than raised. These results also suggest that the information individuals process each day can serve as cues which may bear judgment on one's competence (Hermann et al., 2002; Crocker & Wolfe, 2000). The more often they are exposed to cues, the more likely these individuals are to

experience a threat to self-esteem. Once stuck in a process of increased reflection, this threat may become more self-perpetrating and intrusive.

Impostorism in the Workforce

For those in environments where cues that activate stereotype threat and the self-doubt found in the impostor cycle are found, impostorism may be more likely to occur in certain populations or settings. Impostorism can be fairly common, especially in first jobs and when new challenges are encountered. Such was evident in a report by Kets de Vries (2005): "To some extent, of course, we are all impostors. We play roles on the stage of life, presenting a public self that differs from the private self we share with intimates and morphing both selves as circumstances demand. Displaying a façade is part and parcel of the human condition" (p. 110). However, when these feelings persist, the feelings may never dissipate and can have damaging consequences. Topping and Kimmel (1985) found that in young faculty members, a lower faculty rank is associated with higher levels of impostorism, which may be a reason for dropout at early career stages. In professions where one sex is dominate, individuals of the opposite sex are more likely to demonstrate impostor behaviors (Harvey & Katz, 1985). Impostor phenomenon has thus been documented across a variety professions: a) K-12 education, b) health care, c) accountancy, d) finance, law, and marketing, and e) higher education (Arena & Page, 1992; Byrnes & Lester, 1995; Clance & Imes, 1978; Crouch, Powell, Grant, Posner-Cahill & Rose, 1991; Fried-Buchalter, 1997; Huffstutler & Varnell, 2006; Mattie, Gietzen, Davis & Prata, 2008; Parkman & Beard, 2008; Zorn, 2005).

Impostorism in Academia

Impostor phenomenon has been found to be especially prevalent in university contexts, which has the potential to negatively impact the retention of students, faculty, and staff (Parkman & Beard, 2009). Klinkhammer and Saul-Soprun (2009) named four factors that make the university environment likely to contribute to impostor feelings, for both faculty and students. First, the evaluative nature of universities creates a testing situation, which can evoke feelings of deficiency. Diminished self-confidence and low-self efficacy have been found to accompany impostor tendencies (Dahvlig, 2013). Second, increased levels of competition lead individuals to be more likely to conceal their struggles (i.e., writing blocks, motivational problems). Instead, this leads to an environment where individuals do not share their struggles and may be more likely to secretly foster feelings of inadequacy. When faced with faltering self-confidence, students may be more likely to internalize failures, over focus on mistakes, and have increased stress and anxiety (Parkman & Beard, 2009). Third, individuals are faced with the "myth of the ingenious scholar" (Macha, 1992), which leads individuals to believe they must work without needing recreational time. Instead of a reprieve from stress, rewards and recognition become associated with anxiety, stress, and work-life balance issues (Cowman & Ferrari, 2002). Finally, individuals are also faced with needing to adapt to new role expectations and increased challenges, many situations which may foster feelings of impostorism.

Research on a relationship between impostorism in faculty and sex has been inconclusive. While some studies have reported higher indices of impostorism in one sex over the other (Topping, 1983), the majority of studies have not found much clear indication that sex plays a part in developing impostor tendencies. This may suggest that other factors are at work. Hutchins (2015) noted that impostorism may be more likely to be seen with in those who have advanced degrees, as the academic environment may attract them based on their personality

traits. Impostors tend to have the traits of conscientiousness, achievement orientation, and have perfectionistic expectations. Thus, impostors are accustomed to working in highly competitive and stressful occupations. In academia, impostor traits may be further heightened in the "publish or perish" academic culture (Hutchins, 2015, p. 4). Because of the often vague and inconsistent expectations in academia, the highly competitive atmosphere might also create a setting conducive to feelings of self-doubt and fraudulence.

Hutchins (2015) reported that academic discipline does not usually appear to be a factor in the development of impostorism unless the individual is within the minority with regards to sex. This could impactful in that if a faculty member experiences feelings of impostorism due to their sex, this may impact how they interact with students. Davis and Namvniuk (1994) stated that "the presence of impostor feelings can impact how faculty interacts with students; how available they make themselves to advising, supervision, and research activities; and how faculty are related by students on teaching effectiveness" (p. 184). Thus, faculty who experience impostorism may be less likely to answer questions, to spend time in classroom, and to have fewer interactions with their students. Brems et al. (1994) findings support this, as they found that faculty who encouraged questions and ideas were less likely to have impostor tendencies. Their impostor phenomenon scores were found to decrease as the number of advisees increased. Such relationships between teaching effectiveness and impostorism are important to understand, as female students in STEM may be seeking advising or mentorship from female faculty members often, but do not receive it, either due to a lack of female faculty or a lack of support/opportunity for such relationships to occur.

Impostorism in Graduate Students

Previous research (Kaiser, 2005) has demonstrated that students tend to exhibit higher levels of impostorism than those in the workforce. Many studies have indicated that doctoral students exhibit higher levels of impostorism in fields such as physician assistant studies (Mattie, et al., 2008; Prata & Gietzen, 2007), psychology (Bernard, Dollinger & Ramaniah, 2002; Castro, Jones, & Mirasalimi, 2004; Gibson-Beverly & Schwartz, 2008) nurse practitioner (Huffstutler & Varnell, 2006; Sutliff, 1998), medical residency (Legassi, Zibrowski, & Goldszmdt, 2008; Oriel, Plane, & Mundt, 2004), molecular biology (Pinker, 2009), and in doctoral programs (Gibson-Beverly & Schwartz, 2008; Long, Jenkins & Bracken, 2000). This indicates that impostor feelings may be relevant in understanding motivation and career persistence in students.

Students may experience intense feelings related to intellectual inadequacy and worry about being exposed as academic frauds (Craddock et al., 2011). While students who experience impostorism are often energetic, bright, and hard-working (Thompson, Foreman, & Martin, 2000), their habitual fears or disbelief in their skills may be persistent and difficult to change. Such worries then may manifest in anxiety, self-doubt, self-handicapping, or a fear of failure in light of previous success. They might experience guilt about their success (Sightler & Wilson, 2001) or that they were lucky in admissions or on standardized tests (Clance & Imes, 1978). Craddock et al. (2011) were interested in understanding how a group of doctoral students experienced impostorism. Participants in the sample all noted experiences of impostorism during their first academic semester, feeling challenged by adjusting to coursework and new knowledge, and finding work-life balance. Interestingly, although each participant stated that they believed faculty worked to create an environment that discouraged competition, it still existed among peers and left some feeling academically unprepared (Craddock et al., 2011). Many participants reported feeling inadequate before entering their programs and being uncertain about their

abilities to succeed, although they had a sense of what they wanted to accomplish. Students also entered the program at different levels, with some having a range of professional experiences and degrees. Those without advanced experiences and degrees indicated that they felt they did not belong in the program alongside their peers, felt less intelligent, and questioned their decisions to enter a doctoral program. In students who indicated impostorism in their programs, many also indicated experiencing such feelings as a trend throughout their education, starting in grade school. Several themes also emerged in this study: race, family, and fear of failure. Students of color were more likely to indicate how their marginalized racial identities increased their impostor phenomenon. Family environments and parental expectations were noted to raise the need for achieve, also promoting impostor feelings. Fear of failure was noted as evolving throughout the completion of coursework and investment of time into the program. While this study indicates that impostorism is fairly common in graduate students and during times of transition, it also demonstrates that previous experiences and expectations by self and others can have a significant impact on one's experience of impostor symptoms.

Jöstl, Bergsmann, Luffenegger, Schnober, and Spiel (2012) examined doctoral students who were interested in becoming faculty members. It was found that 82% of the sample reported at least low levels of impostorism, demonstrating that such feelings are relevant in a student sample. A significant path model also demonstrated that there is a relationship between sex and impostor phenomenon. Female students were more likely to report impostor symptoms than male students, and often these feelings were related to research self-efficacy. When paired with evidence that women endorse more fear of success and fear of failure (Fried-Buchalter, 1997) and lower self-esteem (Kling, Hyde, Showers, & Buswell, 1999) than men, this suggests that impostorism can be detrimental for women in academia. Jöstl et al. (2012) suggest that because

female doctoral students experience the impostor phenomenon more often, impostorism may be a psychological barrier in their university careers.

A study by Fraenza (2016) examined the differences in impostor phenomenon scores between a sample of traditional graduate students and online graduate students. Because anxiety is a key aspect of the impostor cycle and graduate school is full of situations where students must complete anxiety-provoking assignments and tasks, the levels of anxiety were compared in each of these two groups. Previous research by Horne & Steadman (2001) indicated that often, graduate students with impostor feelings may believe they have been admitted to their programs by mistake. Fraenza (2016) found that online graduate students showed significantly lower levels of impostorism than their traditional graduate student counterparts. There was also a significant positive correlation found between impostorism and anxiety. Although results indicated that traditional graduate students had significantly higher impostor phenomenon scores than the online students, there were no significant difference in anxiety level. Fraenza suggests that this means that when considering impostorism in graduate students, it is also important to consider other factors which may impact their performance anxiety, such as perfectionism. These different factors may be what is impacting students perceptions of their own abilities and behaviors. These perceptions might also be likely impacted by the environment students are in.

Impostorism amongst Undergraduate Students

At the undergraduate level, impostorism has been documented across many majors and disciplines, such as psychology, engineering, medical, dental, nursing, and pharmacy (Ferrari & Thompson, 2006; Felder, 1988; Henning et al., 1998). Impostor phenomenon's role in academia can be understood in a variety of ways, as impostorism has been linked to academic success (Harvey & Katz, 1985), anxiety (Cozzaelli & Major, 199), neuroticism (Bernard, Dollinger, &

Ramaniah, 2002), achievement orientation (King & Cooley, 1995), perfectionism (Cusak et al., 2013), self-esteem (Kolligan & Sternberg, 1991), academic self-efficacy (Thompson et al., 2000), and academic dishonesty (Ferrari, 2005). Interestingly, it has been found that students who do not have impostor tendencies are more likely to cheat and commit plagiarism (Ferrari, 2005).

Impostorism has been found to occur amongst underrepresented minority students (Ewing, Richardson, James-Myers, & Russell., 1996). Research on minority students at primarily white institutions has found that minority students often believe they need to prove themselves by working harder (Solorzano, Ceja, & Yosso, 2000). Minority students have also reported less support, less academic integration, and extreme environmental distress (Smith, Hung, & Franklin, 2011). Ewing et al. (1996) found that when Black undergraduate and graduate students endorsed an Afrocentric view and maintained a positive academic self-concept, they were less likely to experience the impostor phenomenon. Ethier and Deaux (1990) support the hypothesis that the strength of one's cultural background may serve as a protective factor against perceived academic threat. Because of its link to anxiety (Clance & O'Toole, 1987; Cokley et al., 2013), depression (Bernanrd et al., 2002; Clance & Imes, 1978), and overall psychological distress (Henning et al., 1998), it is important to understand how having constant feeling of impostorism can impact students. Impostorism can impact students at multiple levels, but when faced with minority status, whether it is racial/ethnic or by sex within their major, students may be more likely to be stuck in the impostor cycle and experienced increased distress. A study by Cokley et al. (2013) compared impostor phenomenon and minority student status stress amongst three groups: African American, Asian, and Latino students. While African American students reported experiencing the highest levels of minority student status stress, it was the Asian

American group that reported more impostorism. Cokley et al., (2013) reported a strong correlation between minority student status stress and impostorism with psychological stress and psychological well-being. Their findings indicated that impostor phenomenon was the strongest predictor in these relationships.

Peteet, Montgomery, and Weeks (2015) explored the extent to which measures of first generation status, psychological well-being, and ethnic identity predict impostorism amongst high achieving underrepresented minority students. Historically, first generation students have been found to experience impostorism more often and at higher levels (Martinez et al., 2009; Terenzini, Springer, Yaeger, Pascarella, & Nora, 1996). This can be due to the additional challenges that their non-first-generation counterparts do not experience. Such challenges include feelings of self-doubt and inadequacy, insufficient familial support from family who lack college experience, distress, high expectations from self and family, and feeling unsupported in the college atmosphere (Terenzini et al., 1996; Inman & Mayes, 1999; Hurtado, 1994). Supporting prior research, Peteet et al. (2015) found that first generation status was correlated to impostor phenomenon scores. Although first generation status was not a significant predictor of impostorism, this does suggest that there may be other factors which influence students experiences in higher education environments. Peteet et al. (2015) also suggest that differences in samples (i.e., class standing, racial/ethnic background) may produce differences in the level of impostorism detected in students.

Relationship between Stereotype Threat and Impostor Phenomenon

Past research on how cultural stereotypes shape individual's attitudes toward STEM have linked to how performance in STEM majors can be impacted to two major threats: impostor phenomenon and stereotype threat. While stereotype threat causes women to become aware of

negative stereotypes and avoid confirming them, impostor phenomenon is threatening in that women may not attribute their success to themselves, creating an internal threat of fraudulence and impostorism. Whereas impostor phenomenon can result from a variety of factors (e.g., family influences, perfectionism, personality traits) and can cause women to engage in an impostor cycle which promotes internally feeling like a fraud, stereotype threat is more likely to impact women by feeling threatened in certain situations. These two threats in combination can produce disengagement from STEM and a rejection of the STEM identity.

Ellis (1994) developed the "ABC(DE)" model to explain that it is not just an event which can cause disturbance or dysfunctional behaviors. In this model, Ellis explains how often individuals can experience undesirable activating events (A), about which they have rational and irrational beliefs or cognitions (B). Such beliefs then lead to emotional, behavioral, and cognitive consequences (C). Ellis proposes that while rational beliefs lead to adaptive and healthy consequences, irrational beliefs can lead to maladaptive and unhealthy consequences. Once created, these consequences can become activating events themselves, producing more consequences. Such processes can be replicated in situations where an individual is under stereotype threat or the impostor phenomenon. Under the influence of each concept, individuals engage in cycles where comparison to others in a situation can elicit rational or irrational beliefs about oneself, which then produces specific changes emotionally, behaviorally, and cognitively.

Tesser (1986) proposed a self-evaluation model, in which psychological closeness can lead to two different evaluation processes: the comparison process and the reflection process. In the comparison process, individuals use those close to them as a standard of comparison and evaluate their self. The individual then may either feel enhanced by downward comparison or diminished by upward comparison. In the reflection process, other are not viewed as someone to

compare oneself to but are instead viewed as presenting the self through their actions. In this process, the individual feels enhanced by upward comparison and diminished by downward comparison. Understanding how one views his or herself in comparison to others is important, because whether one is experiencing stereotype threat or impostorism, comparisons to others is occurring in each process. Under stereotype threat, individuals may be threatened by negative stereotypes about groups they belong to. When experiencing the impostor phenomenon, individuals are also comparing themselves to others and avoiding being found out as a fraud.

Because of these factors, Tesser's (1986) relevance variable is also key. Tesser states that comparison begins when individuals self-evaluate in terms of abilities that are esteem-relevant. This variable is based on the notion that individuals want to believe they are competent on esteem-relevant dimensions. Individuals then will compare themselves to others to know where they stand in terms of ability and competence. Interestingly, the performance of a target can impact if one feel uplifted by their association with a group member or diminished by the connection. A study by Blanton, Crocker, and Miller (2000) sought to understand the effects of social comparison on self-esteem in a sample of African American women. Participants were exposed to upward and downward social comparison about the performance of a Black or White confederate counterpart on a bogus IQ test. It was predicted that when the confederate was white, upward comparison would result in lower self-evaluation, whereas when the confederate was African American upward comparison would result in higher self-evaluation. Results indicated that psychological closeness to another can impact self-evaluation. It was found that when compared to white confederates, participants wanted to do well and were more likely to assimilate with an African American confederate. When the African American confederate did well, participants still had high self-esteem, even if they did worse on the test than the

confederate. Blanton, Crocker, and Miller (2000) explain this by sharing how participants stopped comparing their own abilities but instead compared the ability of the group, which was then enhanced by a member of the in-group. Results from this study are significant in that when in the context of a negative stereotype or threatening situation, self-esteem can be raised through upward comparison. This then results in more optimism about one's own competence and can benefit overall performance. Overall, it seems that when in an environment that elicits social comparison, especially on a competency related task, there is strength in representation.

Literature has demonstrated that certain domains of academic performance (i.e., math performance) among women can be negatively impacted when there is a high awareness that women are stigmatized (Kiefer and Sekaquaptewa, 2007). One concept related to stereotype threat and impostor phenomenon is gender stigma consciousness. Gender stigma consciousness refers to the extent to which one is aware of his/her gender's stigmatized status (Pinel, 1999). Previous research (Brown & Pinel, 2003) has examined whether gender stigma consciousness impacts math achievement, and results indicated that women higher in gender stigma consciousness performed significantly less well in high threat conditions as compared to those with low gender stigma consciousness. Additionally, women with higher gender stigma consciousness are also more likely to attribute negative evaluations to being stereotyped, rather than lower ability or overall competence (Pinel, 1999). In academic domains, gender stigma consciousness may impact females more than men, which can then lead to higher levels of impostorism, and can impact academic achievement and career choice.

Cokley, McClain, Enciso, and Martinez (2013) sought to further examine the relationship between stereotype threat, gender stigma consciousness, and academic outcomes. Using a sample of female and male college students, Cokley et al. (2013) tested a hypothesized

model of academic outcomes which examined the relationship of gender stigma consciousness, impostor phenomenon, and academic self-concept. It was found that gender stigma consciousness was a positive predictor of impostor phenomenon in both men and women, and that it was stronger in women. Thus, those who have higher levels of gender stigma consciousness may be more likely to internalize feelings of being a fraud. These individuals are also more likely to be concerned that the stereotypes about their gender are being used to judge their intellectual competence. This is consistent with research by Brown and Pinel (2003), which demonstrated that individuals high in gender stigma consciousness were more likely to believe those in the out-group and were using social stereotypes to interpret their behaviors. Thus, those with higher levels of gender stigma consciousness might also have greater feelings of impostorism because of their gender. Cokley et al. (2013) indicate that this is important because for women and men who hold strong gender-typed attitudes and have internalized negative stereotypes, as they may be then be more likely to pursue gender-typical majors and careers. Additionally, it was found that there was significant relationship between impostor phenomenon and GPA among women, but not men, when other factors, such as academic self-concept, were added into the path model (Cokley et al., 2013). For men, lower levels of impostor phenomenon produced higher levels of academic self-concept and higher grades. Thus, although there were no significant mean gender differences in impostor phenomenon, the findings show that impostor phenomenon plays an important role in academic achievement for women.

In an effort to understand the impact of single sex programs designed to develop and sustain women's interest in STEM within a broader coeducational environment, Lindemann, Britton, & Zundl (2016) conducted a multi-year and multi-method study at a large university. By specifically examining women in chemistry, computer and information technology science,

engineering, geosciences, life sciences, mathematical sciences, and physics, they were able to find evidence for both the impostor phenomenon and stereotype threat that was reinforced through specific institutional level factors. By using a variety of methods (i.e., institutional records, intake survey, follow-up survey, and focus groups), Lindemann et al. (2016) examined how gender stereotypes interact with the culture of an institution to play a role in how women select and persist in STEM majors (p.222). By using these different methods, it was found that gender inequalities in STEM majors relate in an intersectional way. While some gender stereotypes may encourage women to choose and remain in STEM, other stereotypes may deter women from joining these fields (Lindemann et al., 2016, p. 227). Lindemann et al. (2016) found that when women link their feelings of inadequacy (i.e., impostor phenomenon) to how they feel in their large classroom environments, they are likely to experience stereotype threat. Women reported uncertainty in themselves, feeling disheartened, and expressed a belief that others understand the material better than they did (Lindemann et al., 2016, p. 231). Relatedly, these reported experiences link to "weed out culture" in higher education, where students are encouraged to drop difficult courses. Minority students, such as women in traditionally male-dominated majors, who already may believe they are prone to failure, may have increased feelings of inadequacy in such an environment.

Fear of Failure

Fear of failure has been conceptualized as an internal experience related to achievement which can occur with or without a pre-occurring event (Yuen & Depper, 1988). Fear of failure has been defined and measured in various ways over the past decades, such as a fear of gender-inappropriate behavior (Cherry & Deauz, 1978) or as a conceot reflecting cultural stereotypes about gender-appropriate occupations (Feather & Raphaelson, 1974). Primarily, it has been seen

as an avoidance achievement motive that is activated in situations where failure to perform adequately is perceived to threaten an individual's ability to accomplish personally meaningful goals (Conroy, Willow, & Metzler, 2002), creating a sense of shame to motivate the individual to avoid failure. In an early contribution, Birney, Burdick, and Teevan (1969) suggested that fear of failure was a reaction to perceived threatening and aversive consequences of not reaching goals. This implies that fear of failure should be defined as a hierarchical and multidimensional construct that measures fear of the aversive consequences of not reaching one's goals, including fear of self- devaluation, social devaluation and non-ego punishment (e.g., losing rewards; Birney, Burdick, and Teevan 1969).

Often, fear of failure has been minimalized or denied as being part of the human experience because society is more focused on achievement and success. Several studies (Birney, Burdick, & Teevan, 1969; Beery, 1975; Burka & Yuen, 1983) have emphasized that the fear of failure is an internal experience of failure, not an objective failure itself. For some, they might try to find an objective failure in order to displace feelings of internal failure (Yuen & Depper, 1988). Additionally, Birney, Burdick, and Teevan (1969) have suggested that individuals who fear failure do not want to feel responsible for possible non-attainment of goals, because this would lead to lower self-esteem. Thus, fear of failure might actually be a function of losing social approval.

While some individuals may fear failure fail in actuality and not have internal conflict about the results, those with a higher fear of failure tend to maintain this fear, even after achieving success. Fear of failure has also been presented as a multifaceted form of avoidance that is linked to an acute affective sensitivity to experience shame and embarrassment (McGregor & Elliot, 2005). Self-esteem has been emphasized as being the foundation for the

problem of fear of failure (Beery, 1975). It has been suggested that there is a link between a person's feelings of self-worth and their perceived level of ability. Because ability is also viewed as a part of success and inability as a major cause of failure, the value of ability increases and makes protecting one's sense of competency a high priority for many individuals. Covington and Omclich (1984) proposed that protecting one's sense of competence might become more important than the actual achievement itself. Thus, fear of failure can be seen as not only a reaction to external consequences, but also a protection of an internal need.

Golden (1987) proposed that fear of failure is multifold and can be divided into two broad categories: (a) fears pertaining to academic or intellectual failure, and (b) fears pertaining to interpersonal failure. Golden (1987) refers to the fear of failure as a "contradiction of stereotypic feminine behavior", meaning that women are expected not to achieve (p. 48). Thus, in a patriarchal society, women should fear success more than failure. However, when women express higher fears of failure they are against the prescribed feminine behavior that is expected of them. Sherman (1987) states that fear of failure results when one cannot reach a particular goal or expectation. This may prevent a woman from attempting to reach goals, or if she does attempt, she then may become self-handicapped by anxiety. This fear of failure may apply to many goals, both inside and outside of the career domain. Although men may experience fear of failure as well, males are socialized to consistently be more confident than females, and this pervasive difference is evident in all areas, except for some which may be more traditionally female (Sherman, 1987). The fear of failure can have negative effects on women. For many, the fear of failure produces more pressure to be perfect. In high-achieving women, this perfectionism can result in thoughts of "I can never make a mistake" or "If I'm not number one, then I'm nothing" (Yuen & Depper, 1988, p. 24). Such constant thoughts can have many effects: a sense

of guilt, self-recrimination, lament, indecisiveness (i.e., fear of making the wrong decision), inability to commit, intolerance of not knowing or not understanding, and attempting to do all things. When the fear of failure is high and individuals disengage, they often subtly become apathetic or disinterested, devaluing a specific area of their life which they pretend not to care about but actually care about a great deal (Yuen & Depper, 1988).

Yuen and Depper (1988) describe a variety of ways in which women cope with their fears of failure. Typically, an individual with a fear of failure has one of two reactions. They may choose to underachieve and retreat from competition, not make a full effort, avoid new challenges, procrastinate, or maintain a disinterested or apathetic attitude. Alternatively, individuals might overachieve by taking on too much responsibility, being overly conscientious and compliant. Regardless of choice, each has a significant toll on the individual. For high-achieving women especially, this may add pressure as women are stereotypically held to a standard that demands perfection. When individuals are already apprehensive, cautious, and irrational in their achievement-related needs, being in a setting which encourages competition might result in a higher motive to avoid failure (Hancock & Teevan, 1964).

Achievement-Related Fear of Failure

Fear of failure has often been cited as being one of the primary motives for the need for achievement, the other being hope of success (McClleland, Atkinson, Clark, & Lowell, 1953). When the fear of failure exceeds hope of success, individuals tend to choose activities that are perceived as either easy or difficult in an attempt to minimize any anxiety about failure. When examining the role of fear of failure in women's achievement, women's norms for achievement are often framed as being compared to male achievement (Yuen & Depper, 1988). Failure at such tasks may produce dissatisfaction with one's work. Traditional accomplishments may be

thought of as male in nature: success in work or academic settings, independent tasks, and following one's own priorities instead of being concerned about others (Yuen & Depper, 1988).

Fields (1951) proposed that men and women maintain differences in the nature of their achievement motivation. Several studies have indicated that women who are highly competitive, academically achieving, and intellectually-oriented display achievement patterns similar to men, whereas underachieving samples of women were more likely to show dissimilar achievement patterns (Lesser, Krawitz, & Packard, 1963; French & Lesser, 1964). Interestingly, this again points to a distinction between achievement patterns that are deemed "female appropriate" and some that are not (Stein & Bailey, 1973).

In evaluative situations, the fear of failure might also increase. Based on the cognitive-motivational-relational theory of emotion (Lazarus, 1991), a threatening context may activate beliefs or cognitive schemas about aversive consequences of not succeeding, which in turn results in fear of failure. As a professional, Golden (1987) worked with several students and clients and in her own observations reported that the fear of failure clearly manifested when females did not express their opinions or did not ask questions for fear of looking unintelligent or stupid. Golden (1987) reported hearing students preface comments with "I know this is stupid but…" (p. 43). Such prefacing comments lead Golden to believe that the fear of failure (i.e., looking unintelligent) appeared to be more common than the fear of success (i.e., looking smart). However, this could be due to the fact that fear of success does tend to be more difficult to acknowledge and express.

Fear of failure has also been linked to increases in procrastination and has been proposed to even be the main cause of procrastination (Bura & Yuen, 1983; Solomon & Rothblum 1984). Research has found that individuals who procrastinate tend to irrationally believe they are

inadequate or incapable and that the world has numerous demands and difficulties (Ellis & Knaus, 1977). In a sample of students who scored high on trait procrastination and fear of failure, Schowenburg (1995) found that the traits highly correlated. A study by Haghbin and Pychyl (2006) found that fear of failure as a reported reason for procrastination was significantly correlated with reporting procrastination as a problem (r = .24) and with negative emotions related to procrastination (r = .36), but not with the prevalence of procrastination. Relatedly, Solomon and Rothblum (1984) completed a factor analysis of college student's procrastination on academic tasks and found that fear of failure and aversiveness of tasks related for most of the variance. These results suggest that procrastination is more than a deficit in study habits or bad time management and instead likely is also affected by cognitive factors. Often, responses to anticipated failure tend to elicit shame because one was not able to meet situational demands. Feelings of shame might be tied to further disidentification with a domain and lowered levels of satisfaction with one's academic work. Previous studies have found that the fear of failure results in high levels of worry, low levels of optimism, defensive pessimism, self-handicapping, and test anxiety (Conroy, 2001; Conroy Willow, & Metzler, 2002). When one focuses on avoiding these effects, they might actually be at a higher risk of experiencing them because they are not focused on positive achievement strategies, which generally leads to poorer academic outcomes, such as low or failing grades and displeasure with one's choice of study.

Fear of Failure in Interpersonal Relationships

Contemporary views of women's development have challenged male views of achievement and have suggested achievement for women cannot simply be framed in terms of individual accomplishment. Instead, it is suggested that achievement for women should incorporate the domain of interpersonal affiliation, which includes commitment in relationships

and maintenance of intimacy. Women's concerns about the impact of their actions on others has been long studied. Feminine development has been characterized by how women develop and maintain relationships with others (Miller, 1983). Gilligan's (1982) work has proposed that a women's sense of self is often centered around her connection to others. Thus, it is important to consider how one's achievement or success in academics of the workplace can have an effect on her personal relationships. Studies have emphasized how women's conflicts about achievement have been strongly influenced by socialized gender-appropriate behaviors (Gilligan, 1982; Hoffman, 1972). While a woman's pursuit of success might be motivated by an internal standard of success, external achievement standards might frame these values as being unfeminine (Person, 1982). Because social relationship shave been stereotypically framed as "women's work", an inability to achieve such relationships might be experienced as failure.

While fear of failure tends to be acknowledged more often than a fear of success, the fear of interpersonal failure might also be more prevalent in women than the fear of academic failure. In a study of first-year graduate students, Golden (1987) found that several students referred to concerns about not making close friends, failing others by not being able to meet their needs, and failing parental figures by asking for help. Relatedly, after working with many women, Golden (1987) observed that many high achieving women chose not to pursue demanding higher education in graduate school because they wanted to pursue careers which allowed the time and flexibility for a lifestyle in which family commitments were put at the forefront. Thus, in the academic realm, women tend to face many social pressures and make choices about which routes to pursue. Anxiety related to being uncertain about which path to follow is often also impacted by one's social relationships, which influence how women define and see achievement.

Impostor Phenomenon and the Fear of Failure

Clance and O'Toole (1988) believed that fear of failure underlies the impostor phenomenon and can account for many negative experiences individuals have while having these maladaptive cognitions. Despite mixed evidence in the literature, it appears that women may be more vulnerable to impostor fears, as they typically report lower performance expectancies and lower self-assessment of ability than men (Maccoby & Jacklin, 1974).

Kumar and Jagacinski (2006) investigated the parallels between ability-avoid achievement goals and impostor fears, as both endorse similar negative underlying motives, cognitive reactions, and affective states. As Clance and O'Toole (1988) speculated that women are more adversely affected by impostor fears than men, Kumar and Jagacinski (2006) explored whether achievement goals associated with impostor fear differed for men and women. They believed that women with impostor fears would be more likely to endorse an entity theory of intelligence and ability-based goals to a greater extent than male impostors and that women would be more vulnerable to maladaptive behaviors. Because impostors tend to be concerned with how their abilities compare to those around them, it was proposed that they would adopt approach and avoidance ability-oriented goals and would view any failure as a potential indication of low ability. This is troubling because as Thompson, Foreman, and Martin (2000) found, impostors were more likely to overgeneralize the implications of a single failure into their global self-concept. Using a student sample, Kumar and Jagacinski (2006) found that test anxiety and confidence were related to impostor fears for both sexes, however there were marked differences as well. Overall, women endorsed more impostor fears than men in all areas. Men were found to have greater impostor fears when motivated to avoid a failure, whereas women had higher impostor fears when they had greater ability-approach goals and weaker task goals (Kumar and Jagacinski, 2006). It was also found that women associated their theory of

intelligence (i.e., intelligence is a fixed entity) more with impostor fears and achievement goals. Although women were no more likely to report holding an entity theory of intelligence than men, the pattern of relationships suggested that the theory of intelligence was related to their achievement goals and their confidence in their intelligence. Thus, women were more likely to doubt their competence. For men, it was found that there was virtually no relationship between the theory of intelligence and achievement goals of impostor fears. Impostor fears seemed to be purely driven by their fear of failure. This study suggested that although they have different implications, impostor fears structure men and women's goals differently. Impostor fears may be greater for women than men in areas assessing competence and intelligence.

Fear of Success

The concept of fear of success was first proposed by Horner (1972), who stated that among high-achieving women, there exists a motive to avoid success because it may be associated with social consequences. Horner suggests that many women are in conflict about intellectual and professional achievement. If females seek achievement goals that are different from the culturally defined masculine achievement goals, then the differences between masculine and feminine achievement goals should produce conflict. Thus, women are proposed to avoid success when they expect negative consequences, such as social rejection. Fear of success has been proposed to occur in a specific sequence based on studies of women (Popp & Muhs, 1982). The individual must seek success using an achievement behavior, which then can lead to competitive and aggressive behavior. Such behaviors are seen as aggressive and unfeminine, which results in anxiety and avoidance, which can prevent present or future success.

Horner (1972) assessed women's fear of success by using a projective technique to measure men's and women's attitudes toward success among students in medical school. She

then coded stories written to a single verbal cue depicting a woman's success in a masculine field. An example of a scenario would be: "After first term finals, Anne finds herself at the top of her medical school class." Men were asked to respond to an identical cue with a male protagonist (e.g., "John"). Horner (1972) found that 65% of college women but only 9% of men showed fear of success in their stories. Horner used this for her basis that competitive situations can impair women's intellectual performance if they fear success. Additionally, Horner (1972) also found that women with fear of success performed better on a verbal skill task when working alone as opposed to when they worked in a mixed-sex competition. Women who did not fear success demonstrated an opposite pattern. When fear of success is measured on an objective scale, there has been evidence that high achievement-oriented women reduce their performance in certain situations (Pappo, 1983; Piedmont, 1988). Horner (1972) suggests that females can be impacted by the presence of anxiety, which is aroused in achievement-oriented situations where success might imply a loss of femininity or negative social consequence. So for some women, even though they are competent, they also have a fear of success which impacts their behavior. For women in traditionally masculine fields, success can then be detrimental. Although it brings the attainment of a desired goal, it can also lead to greater negative outcomes, such as social rejection, because of acting against traditional sex roles. This suggests that women have conflicts between being productive in a competitive environment and maintaining their sense of femininity.

Much literature in the 1970's continued to examine the fear of success, but produced mixed results. A study by Good and Good (1973a) developed their own Fear of Success Scale and reported that female students in psychology scored significantly higher than male students. They also constructed a Fear of Appearing Incompetent Scale (Good and Good, 1973b), and

noted that female psychology students also scored significantly higher than male students. A study by Brenner and Tomkiewicz (1982) used the Good and Good scales to investigate the constructs in business students and found different results. They found that female business students did not score significantly different from men on fear of success, but did on fear of appearing incompetent. Interestingly, when measuring men's attitudes toward women on both scales, they found no relationship, but did find negative reactions from women for both scales. These results suggest that fear of success may present differently among women in different samples. Additionally, women who are more liberal may be more likely to score higher on fear of looking incompetent scales than those in more gender-normative fields.

There has been some criticism regarding the measurement and conceptualization of Horner's definition, as well as limited support which replicates her findings, (Hoffman, 1972), which has led to an unclear picture about what fear of success is. Thus, research on fear of success has slowed. While Horne's theoretical conceptualization resembles Freudian work and classical psychoanalytic interpretations, it poses that fear of success is a personality characteristic, which many do not agree with. Although not much is understood, there is a general consensus that the concept exists and that Horner introduced a new way of understanding problems present in women's achievement and inhibition (Peplau, 1976). Although there is not one consensus on what fear of success is, several theories and ideas have added to its conceptualization over time.

Karabenick and Marshall (1973) explain that in early literature the fear of success was postulated to be a stable personality characteristic learned early in life as part of the female sex-role standard. In this view, women are conditioned to feel uncomfortable when successful in achievement-oriented tasks that are by nature competitive and involve aggressive behavior, an

unfeminine attribute (Karabenick & Marshall, 1973). Similarly, Fried-Buchalter (1992) explained how Horney's (1936) research highlighted that competitiveness results from unfavorable childhood environments in which too much emphasis is placed on competition and winning (p. 368). When children, particularly females, have a desire to be "first", this is coupled with anxiety and fear that success will lead to hostility and loss of affection from others, and thus a concern about negative consequences of success is formed. Conversely, fear of failure results from the realization that striving may not always result in success, and failure may then lead to a loss of self-esteem and loss of value in the eyes of others (Birney, Burdick, & Teevan, 1969). Thus, those who fear failure may establish goals for themselves which are unrealistically high or unrealistically low, precluding any real need to test one's actual ability (Fried-Buchalter, 1992). Although definitions vary, the shift from fear of success being viewed as a personality trait to a consequence of environment has been beneficial, as it shows that fear of success can be changed.

Fear of Success as Fear of Deviance

Social conditions and sex-appropriate views appear to have affected the fear of success aspect of achievement motivation in women. Psychodynamic writers have long viewed fear of success as stemming from guilt, fears of future failure, and conflicts around independence (Cavenar & Werman, 1981). Based on Horner's (1972) conceptualization, women who choose less traditional feminine roles are more likely to risk the chance of being seem as unfeminine in society if they succeed in untraditional feminine roles. If she succeeds in a traditional feminine role, a woman may need to reject hope of intellectual attainment. Thus, the choices women make are all seen as risks which can impact how they are seen by others. Maccoby (1963) states that women who are dominant, independent, and active in analytic thinking defy the conventions of sex-appropriate behavior. Mead and Kaplan (1965) indicate that women who succeed in male

careers are made to feel unfeminine and termed aggressive, brash, and pushy. This can result in what some have defined as fear of deviance (Person, 1982) and it has also been proposed that women may seek social approval from others as an achievement goal (Sternberg et al., 1983). Because affiliate and achievement needs are more closely tied in females than males, a fear of social devaluation or social rejection might be of greater significance to females (Jackaway & Teevan, 1976).

The fear of success is associated with the negative consequences one anticipates after success, such as social rejection from one's colleagues (Jöstl et al., 2012). Clance and O'Toole (1978) found that impostors feared rejection stemming from achievements that are perceived as inappropriate (i.e., being a successful female in a male dominated environment). The many facets of fear of success may strengthen the motivation to fail in order to protect one's social support network. Impostors fear losing connections to other people when success is noted, an underlying fear which may stem from the belief that success will result in dislike and resentment by others, and thereby a loss of affection and approval (Horney, 1936). If success occurs, impostors are more likely to deny it or to self-handicap in a variety of ways (Clance and O'Toole, 1988).

Popp & Muhs (1982) used a sample of female employees to examine if they experience greater fear of success than their male counterparts. They questioned if career of work environment expectations impacted feelings of self-esteem. It was found that fear of success might not be a function of sex and instead might have to deal with one's status. Younger employees demonstrated higher fear of success scores, so uncertainty early in one's career might impact fear of success, as those who were more advanced and had higher salaries had lower fear of success scores. Popp and Muhs (1982) also found that ethnicity could play a role in fear of

success. In their sample, Mexican American employees demonstrates higher fear of success scores. They speculated that this could be because of communal group values and less exposure to role models. Such results have also been supported by Ramirez and Castaneda (1974), which suggests that less exposure to a minority group in a setting could increase fear of success. Taken together, these findings suggest that perhaps assessments of fear of success have been inconclusive thus far because several different factors other than gender could be playing a role in the presence of fear of success.

Situation Specific Fears of Success

Makovsky (1976) proposed that Horner's measure for fear of success was a more appropriate measure of gender role orientation and predicted that performance in some situations that are incompatible with gender role will lead to role conflict. Fear of success could also be seen as a behavior which stems from environmental cues. A study by Midgley and Abrams (1974) used undergraduate students to examine the relationship between the motive to avoid success and feelings of being controlled externally in women. Subjects with higher external control scores felt more victimized by circumstances and less able to act positively in their environments than subjects who received lower scores on internal-external locus of control scales. Higher scores also indicated less autonomy and less likelihood of challenging social barriers which obstructed successful achievement.

A study by Breedlove and Cicirelli (1974) examined whether fear of success occurred when women faced the prospect of succeeding in traditionally feminine occupations or if it was cued mainly by competition in masculine occupations. It was predicted that if fear of success was composed of fears of rejection and power struggles with men, then one would expect to find less fear of entering a feminine field. However if fear of success is comprised of general social

disapproval, then one would expect fear of success in entering any field. Results were consistent with Horner's hypotheses, in that a high frequency of fear of success was observed in women who were in non-traditional, masculine occupations. When in traditional occupations, women still experienced fear of failure, but the fear dropped significantly. However, no significant relationships were found between fear of success and college major or occupational aspiration, which suggests that other factors may be at work (Breedlove and Cicirelli, 1974).

Fear of Failure, Fear of Success, and Impostor Phenomenon in Career Development

Fear of failure and fear of success are often categorized either as separate concepts or together as one. This may be because fear of failure has more literature supporting it as a construct. Regardless, it can often become difficult to tease the two apart. Jackaway and Teevan (1976) propose that fear of failure and fear of success are two dimensions of the same motive, as both constructs exist beneath one's conscious awareness and may be aroused without one's knowledge. Each construct is also not something that is easily interpreted by the individual who is experiencing it. Often, both result in a lack of confidence, low self-esteem, depression, anxiety, confusion, and anger. Therefore, fear of failure and fear of success should be associated with academic satisfaction. Although they are defined separately, it can be difficult to separate fear of failure from fear of success, as both demonstrate many of the same qualities and are connected to fear. When one or both are activated, they may link to the female sex role and stereotypes that accompany it.

While all individuals experience such concerns at some point in their lives, especially in times of adjustment, the problems become greater when we include gender differences. Sherman (1987) reports that while all people demonstrate these fears, males tend to overestimate how well they can cope, whereas females underestimate their abilities. While each sex is inaccurate, one is

more likely to take risks and try new goals, whereas the other's fears contribute to fears of failure in many endeavors. Tresemer (1976) states that because these fears are linked to the female sex role, it is not possible for men to experience it more than women do.

Jackaway and Teevan (1976) also suggest that for individuals for whom acceptance is a large component of achievement orientation, fear of success and fear of failure may be nearly synonymous. This might even be more likely in females, since social relationships seem to be more closely related to their achievement needs than men. Bardwick (1971) suggested that females remain highly dependent on the reactions of others for esteem, and that achievement is used as a method of obtaining affection. While this is beneficial, it can also be detrimental when social approval becomes the achievement goal (Stein & Bailey, 1973). Tying the construct back to psychoanalysis, in the framework of self-preservation, Freud's (1924) work also demonstrates why fears of failure and success may be beneficial to the individual. Such fears help individuals avoid losing love, being abandoned, and being alone.

Further evidence also demonstrates how it can be difficult to tease apart these constructs. Mulig, Haggerty, Carballosa, Cinnicak, and Madden (1985) used several different inventories to assess both fear of success and fear of failure. It was found that fear of failure was best predicted from subject's gender, but fear of success was best predicted from the subject's gender role. Macdonald and Hyde (1980) conducted a factor analysis and analyzed female college students' responses to several measures of fear of success, fear of failure, a TAT, and an anxiety score. They found that on every measure, females score higher on fear of success than males, and that fear of failure did not appear to be distinct as a construct. Thus, despite problems with methodology and inconsistencies in results, it appears that fear of failure and fear of success do have some impact on one another and one's overall achievement.

Neureiter and Traut-Mattausch (2016) hypothesized that fear of failure and the impostor phenomenon are positively related. Based on previous research which found that impostors tend to score highly on neuroticism and low on conscientiousness, the authors speculated that fear of failure developed as a tendency to help individuals appraise threat and protectively remain anxious in situations where failure is a possibility. Although seemingly protective, fear of failure also serves as a self-handicapping mechanism, helping individuals to avoid potential failure. Likewise, a fear of success contributes to losing connections with others when success is noticed or highlighted. Neureiter and Taunt-Mattausch (2016) found that fear of success was likely to become more relevant and was a strong predictor of impostor feelings within their sample. It is likely that impostor phenomenon may predict fear of success because fear of success is an affective consequence of a cognitive distortion of low self-esteem. Thus, it is believed that a high fear of failure and low self-esteem correlate and are nearly constant predictors of the impostor phenomenon within areas of career development. Impostor phenomenon was also found to be a negative predictor of career planning and was predicted by core self-evaluation. The lack of literature on how impostor phenomenon and related concept impact career development suggests that this is an area that needs further development. Many women might have several career opportunities but may fear using resources in the career development process because they might not realize their own levels of competence or fear the repercussions of having this competence be acknowledged by others. The conceptualization of the impostor phenomenon tends to overlap with fear of failure, as described by Horney (1936) and fear of failure, as described by Birney, Burdick, and Teevam (1969) and this overlap could result in an overall lack of self-confidence (Fried-Buchalter, 1992).

Academic and Career-Related Self-Efficacy

Self-efficacy refers to one's belief in their ability to perform a specific task (Badura, 1994). One judges their ability to organize and execute appropriate courses of action that will allow them to achieve specific goals. Specifically, STEM self-efficacy predicts academic performance beyond one's own ability or previous achievements, as individuals with higher self-efficacy are motivated to achieve higher levels of success. Thus, on average, STEM self-efficacy tends to be positively related to STEM task performance (Rittmayer & Beier, 2008).

Bandura (1997) postulated that the relationship between self-efficacy and performance is reciprocal and on-going. When one successfully completes a task, their self-efficacy should rise, which should lead to the adoption of more difficult goals. The adoption of these difficult goals can lead to greater effort in completing a task, which also should positively affect performance. When one successfully performs a new and more difficult task, then their self-efficacy should increase again, leading to a continuation of this cycle. Because of the reciprocal nature of this self-efficacy-performance cycle, it is important that one's beliefs about their own capabilities is accurate in order to produce positive results and not undermine one's own performance. For example if one student has high math self-efficacy while the other has low math self-efficacy, the way that they study for and perform on an exam will differ (Vancouver & Kendall, 2006; Eccles, 1994). The student with higher math self-efficacy will set high goals for his or herself, likely spending less time studying for an exam and overestimating their ability to perform well on the exam. The student with a lower math self-efficacy however may set the goal of a low grade. This student would likely only study enough to get the grade he or she believes they deserve, which might actually be a lower grade than what they could have earned had they studied more. Receiving lower grades could perpetuate their lower self-efficacy and a belief that they are not adept at math, leading them to be less likely to pursue advanced math classes.

Self-efficacy has also been linked to levels of self-esteem. A study by Seymour and Hewitt (1997) found that in women who left science, engineering, and technology majors, 77.9% cited discouragement and a loss of self-esteem as factors related in their decision. Thus, although self-esteem is a global concept whereas self-efficacy refers to an individual's confidence about a particular subject area or set of tasks, general self-esteem tends to be related to an individual's feelings of self-efficacy. Somers (1986) suggests that decreased self-esteem and self-efficacy are significant obstacles to persistence for women in engineering. Hackett and Betz (1981) were the first to use self-efficacy as a way to understand women's career development in male-dominated fields. They found that societal factors may play a role in creating gender differences which make it more difficult for women to gain access to primary sources of self-efficacy information, such as less exposure to role models, less encouragement for career pursuits, and higher levels of anxiety which decrease perceptions of self-efficacy (Somers, 1986). Several other studies have supported these findings and lead to the thought that self-efficacy beliefs impact retention in STEM for all students (Lent, Brown, & Larkin, 1984; Lent, Brown, & Larkin, 1986; Post-Kammer & Smith, 1985). Several longitudinal studies (Brainard and Carlin, 1998; Seymour & Hewitt, 1997) of women engineer's levels of self-esteem have also found that women who switch out of STEM majors tend to lose self-esteem throughout their course of study. Burger et al. (2010) indicate that such attrition rates might be attributable to a lack of working experiences of support for females in untraditional fields. A lack of support (e.g. mentoring, co-ops) might lead to a higher risk of female students prematurely terminating their STEM careers.

Career Development in Women and its impact on Science Self-Efficacy

At every stage of development, girls and women are exposed to messages that their in-group is worse in science and math as compared to their male peers (Stout et al., 2011; Osipow,

1973). From grade school to high school, such connections might be endorsed by family members and teachers, reminding girls that "science is for boys". Girls are also less likely to be exposed to female scientists in textbooks and curricula (Sadker & Sadker, 1994). Research has demonstrated that subtle situation cues in STEM environments send messages to girls that they are out of place in STEM fields (Murphy, Steele, & Gross, 2007; Cheryan et al., 2009). This reduces girl's sense of belonging in these fields and lowers interest in pursuing STEM majors. Often, girls may also experience sex discrimination and stereotyping (Steel, James, & Barnett, 2002). By the time women enter college, they have received the message that their in-group does not belong in STEM profession (Walton & Cohen, 2007), and thus the gender gap remains clear and often stark, especially in the physical sciences and related disciplines. This can result in women's failure to fully utilize their individual capabilities, talents, and interests in career pursuits (Farmer, 1976).

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For women who do pursue STEM fields, more women than men change majors and opt out of STEM (Seymour & Hewitt, 1997). Neureiter & Traut-Mattausch (2016) tested several models that examined the preconditions and consequences of the impostor phenomenon's development and impact on different phases of the career development process. Both university students and working professionals were examined and it was found that self-esteem, fear of failure, and fear of success all played prominent roles in how individuals in these roles were impacted by their experiences of impostorism. While impostor feelings were most powerfully predicted by low self-esteem and fear of failure in the student sample, fear of success played a much more prominent role in the working professionals sample (Neureiter & Traut-Mattausch, 2016). Results for the student sample are in line with previous literature, which suggest high correlations between impostor feelings and self-esteem. The evaluative nature of a university setting makes the fear of failure prevalent and understandable. However, the impact of the fear of

failure is important to note, because if students fail to attribute their achievements to internal factors and continue to foster a fear of failure, this fear will grow and continue to impact self-esteem, and relatedly, self-efficacy. Clance (1985) suggests that this even may foster the development of impostor feelings in students. In a sample of working professional, the increased fear of failure may have been attributable to the increased awareness these individuals developed about their colleagues' opinions. Working professionals might also be more affected by judgments from peers than students are. Across both samples, it was found that impostor feelings were likely to impair the career-planning component in individuals' lives. When career planning is affected, individuals are less likely to have clear plans for the future and have fewer strategies to accomplish goals. Those with increased impostor feelings also are less likely to be aware of their competencies, which makes planning for the future difficult as well. This impact of the impostor phenomenon is a barrier for women pursuing degrees in STEM in that these feelings could impact their successful career planning, self-efficacy, and could result in a significant loss of competent and capable workers in STEM fields.

Self-Efficacy in STEM Major Choice

Self-efficacy is largely linked to interest, achievement, and retention in STEM fields. Thus, there is a potential relationship between the impostor phenomenon, stereotype threat, and self-efficacy (Hutchinson, Follman, & Antoine, 2006). Hutchinson et al. (2006) sought to understand this relationship by studying males and females enrolled in a summer research program. Hutchinson et al. (2006) examined the impostor phenomenon and self-efficacy simultaneously, as many factors measured by the Clance Impostor Phenomenon Scale (1985) suggest strong ties to self-efficacy theory. A central fear in the impostor phenomenon is that success cannot be repeated or takes more effort to repeat. In Hutchinson's study, this was

examined in students' own assessments of their mastery experiences during a summer research program. Students' comparisons of their capabilities to those of their peers also demonstrate how vicarious experiences can be influential for forming self-efficacy beliefs. Hutchison et al. (2006) also propose that individuals with impostorism might be more likely to associate negative feelings with mastery tasks, leading to a susceptibility to the phenomenon, which may lead to a lack of efficacy. It was found that those who experienced symptoms of impostorism were then likely to view opportunities for achievements as "double the chance" to succeed or to be exposed as a fraud and were more likely to shy away from situations in which they could be exposed as an impostor. Interestingly, while those who experienced the impostor phenomenon and non-sufferers, male and female, expressed efficacy in task-related goals, those who suffered with impostor phenomenon feelings were more likely to rate a lower degree of achievement and success than those who were not expressing similar feelings. This suggests that the impostor phenomenon might not be specifically tied to self-efficacy and definitions of success, as the authors hypothesized, and instead might be linked more directly to a variety of single, and personal factors in each individual students' case. This suggests that there may be other aspects to the impostor phenomenon, which can impact an individual's self-efficacy, and overall confidence in task-oriented situations and settings. Hutchison et al. (2006) also noted responses between current and future expectations of success. Differences in ratings between current ability and future success could indicate that although those with impostor feelings might currently struggle, they still maintain a belief that they can achieve success in the future.

Differences in self-efficacy have been found on STEM related tasks across genders. Sadker and Sadker (1994) and Watt (2006) proposed that a "confidence gap," which despite comparable prior accomplishments in STEM course grades between male and female students,

exists. Largely this gap exists in math and science abilities. A study by the American Association of University Women (1991) found that girls' confidence in their academic abilities, specifically in math and science, drops dramatically across time, from elementary to high school. It was also found that at every age, boys are more confident in their math abilities than girls. This confidence gap has been found to be closing across time, with increased levels of self-efficacy in STEM fields for female students, however there still appear to be differences in levels of STEM self-efficacy and overall persistence in STEM. Self-efficacy has also been linked to the relationship between interest and engagement, another reciprocal relationship. Self-efficacy predicts initial engagement and task performance and the experience of success can lead to more intrinsic interest and more likelihood of engaging in the task at a more challenging level (Rottmayer & Beier, 2008). Farmer et al. (1976) indicated that when females engage in STEM courses during schooling, their engagement with STEM had a long-term influence on maintaining an interest in such careers. Thus, females who have a higher self-efficacy in skills related to STEM should be more likely to study a STEM career. Thus, many young girls and women might lose interest in STEM even though they do not lack STEM abilities. What they lack is the belief that they are capable of attaining their STEM goals (i.e., grades, majors, professions), which then may lead to a decreased interest in pursuing STEM. Eccles (1994) found that STEM self-efficacy might be a stronger predictor of vocational choice for females than for male students. Because self-efficacy can influence interests, goals, performance, and persistence, messages which promote a lower probability of success might deter female students from developing higher self-efficacy in STEM related subjects. Thus, the shortage of women in STEM classes and careers might be tied to this confidence gap (Eccles, 1994).

Exploring psychological barriers in women's university careers, Jöstl, Bergsmann, Lüftenegger, Schober, and Spiel (2012) examined a sample of doctoral students and found that those with impostor feelings were also more likely to have a negative research self-efficacy, which has a large impact for successful university careers. Such a relationship is significant to note because a negative self-efficacy thus likely impacts women's full pursuit of their interests and potential. They found that impostor phenomenon's impact on self-efficacy is a barrier variable which is relevant within academic contexts. In this study, it was found that of 631 Australian doctoral students, female doctoral students demonstrated more effects of the impostor phenomenon than male doctoral students. Thus, the higher the impostor feelings, the lower the research self-efficacy was, which can serve as a significant barrier in women's university careers (Jöstl et al., 2012). Women interested in STEM may not recognize their own competencies and might also be less likely to use resources available to them during the career-development phase. These individuals might also be less likely to develop clear career goals or to pursue them, which could impact their beliefs in their capacity to successfully manage career-related tasks as required in higher positions, such as leadership roles (Neureiter & Traut-Mattausch, 2016).

A lack of self-efficacy and/or self-esteem can impact one's levels of both internal and external motivation, which then can impact success and retention within a major or field. Deemer, Martens, and Podchaski (2007) examined the relationship between achievement goals and interest in research in a sample of counseling psychology graduate students. Interest in research was examined as an outcome, as it was proposed to have a positive relation to intrinsic motivation and could be predictive of long-term involvement in research. It was found that mastery approach and performance avoidance goals were significant and negative predictors of interest in research and performance approach goals were not predictive of increased interest in

research. These results indicate that achievement goals are important in how we understand the motivational mechanisms which facilitate a student's interest in research. Interest in research was strongly associated with student's motivation to demonstrate skill improvement and to master research tasks. Thus for students who have higher avoidance motivation, this may be suggestive of other factors which may decrease one's self-efficacy and interest in research, such as contextual variables.

Self-Efficacy's Impact on STEM Persistence

Based on such findings, it seems that early experiences in STEM and identification with others in such fields can impact motivation, satisfaction, and overall persistence in STEM fields. For women further along in the STEM pipeline who are already working in the industry, frustrations may have built over time, leading to women leaving STEM later in their lives. Although women have been found to be as academically prepared and successful as men (Brainard & Carlin, 1998), studies find that women are more likely to self-report lower levels of academic satisfaction and a greater lack of self-confidence (Felder, 1988). Such drops in self-efficacy have also been evident as women spend more time in training programs (Brainard & Carlin, 1998). Beyond college, as the academic path becomes more advanced, the number of women in STEM drops significantly. Only about 18% of engineering graduates are women and 11% of engineers (NSF, 2011). The Society of Women Engineers reports that about half of women who are trained to be engineers leave the field, whereas only 10% of men leave (Society of Women Engineers, 2007). Such low representation and exposure of women experts and scientists may further promote the idea that women are not welcome in STEM, and additionally, that they are not satisfied with career paths in such fields. Because self-efficacy and goals have been found to impact the early phases of individual's career development (Betz & Hackett,

2006), it is important to understand how the experiences and satisfaction women have in STEM majors impact their persistence, or lack of, into STEM fields.

A large part of persistence in STEM has been tied to environmental cues. For many women in STEM, they are part of a small group of women in their field, if not the only woman. The number of women in a field likely impacts satisfaction with STEM and can be tied to women's persistence in these fields. Deemer (2015) used the critical mass hypothesis to examine how the lack of women in STEM might motivation to persist in certain STEM fields but not others. The critical mass hypothesis provides an explanation for why this might occur, with women being more likely to enter fields where their in-group is well represented, as opposed to fields where they are more likely to be part of the minority group or a token. Minority or token status increases one's risk of gender stereotyping and can decrease performance in career situations (Kanter, 1977). The anxiety produced in such situations likely impacts how women perceive STEM fields, their motivation to pursue such fields, and informs their goals (Deemer, 2015). Thus, being one of many women in a STEM field might be adaptive and might lead to more positive outcomes, increasing motivation and academic major satisfaction. Deemer's (2015) findings provided indirect evidence that classroom representation can have motivational benefits for women, increasing their academic well-being in science majors. When there are more women in a field, such as biology, women might feel more connected with other students and feel more at ease with their choice of major, which results in more satisfaction with their major and an overall greater sense of motivation. In this study, academic satisfaction was an important mediator, which indicates that a lack of satisfaction in STEM majors could be directly tied to the lack of women in STEM.

Relatedly, in an effort to understand what factors might be impacting women's ability to identify with and be confident in their abilities in STEM, Stout et al. (2011) developed a stereotype inoculation model to empirically assess whether a hypothesized inoculating factor (seeing in-group experts in STEM) had an immediate effect on women and whether the benefits of such an effect persisted longitudinally. They proposed that if female students in STEM fields were exposed to more successful examples of female experts in science and engineering, they would experiences less of the negative psychological effects and frustrations with their majors. In a series of three studies the stereotype inoculation model tested whether, when, and why exposure to same-sex role models in STEM protected women's intentions to purse STEM careers. Each of their studies consistently showed that seeing same-sex experts in STEM did not change their implicit or explicit stereotypes about STEM disciplines, but did act as a "metaphorical antibody" to protect female student's self-conceptions in STEM, helping them not become vulnerable to societal stereotypes (Stout et al., 2011, p. 268). When they were exposed to same-sex experts, female students demonstrated higher self-efficacy levels and greater implicit identification with STEM, which also predicted more commitment to pursue STEM paths. Thus, seeing an example of a successful woman in STEM helping female students envision themselves as successful experts in their chosen fields. Female students longitudinally demonstrated changes in classroom behavior as well, participating more in class and seeking after-class help from professors. It was proposed that over time, such behavioral changes would also be likely to increase female students' commitment to STEM disciplines. The series of studies by Stout et al. (2011) demonstrate how important role models in STEM fields are for undergraduate students. Independent of actual test performance, women in STEM may be unsatisfied with their chosen fields because of the visual lack of same-sex experts. When in an environment where one is the

minority, stereotype threat and feelings of impostorism might be more likely to occur. Exposure to female experts in STEM fields could dramatically impact women's satisfaction in STEM fields and could lower attrition rates dramatically by adding a sense of belonging and increasing self-efficacy.

Additionally, it has been suggested that increasing opportunities for women in STEM could also impact satisfaction. A study by Singh, Fouad, Fitzpatrick, Liu, Cappaert, & Figuereido (2013) used Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994) to examine how women choose to leave STEM fields. SCCT predicts that self-efficacy beliefs and outcome expectations influence choice by acting on interests and goals and that contextual supports and barriers influence the choice making process at different stages. Singh et al. (2013) developed a model integrating key aspects of SCCT and turnover models to deepen their understanding of why women might choose to leave STEM fields, especially since women who do well in STEM fields would be expected to persist and be successful. Additionally, they examined how contextual factors, such as supportive HR practices, might have influenced these outcomes. Using a large, national sample, they found that self-efficacy and outcome expectations play a large role on women engineers' job satisfaction and commitment (Singh et al., 2013). Interestingly, their results demonstrated that supportive organizational practices play a positive role in increasing women's self-efficacy and increasing women's expectations of positive outcomes. Outcome expectations were found to be positive related to job attitudes and demonstrated lower intentions to leave their organizations. Thus, at different levels in choice-making process, workplace support can have a dramatic impact on how women experience their work environment. Additionally, this study found that developmental experiences at work played a pivotal role in helping engineers develop the self-confidence they needed to perform

engineering tasks, which also influenced their outcome expectations over time. This study demonstrates how important the role of the work environment actually is, as experiences individuals have at work can largely impact their satisfaction and levels of self-efficacy as employees who choose to persist in these fields over time.

Academic Major Satisfaction

Allen (1996) stated that for college students, major satisfaction is analogous to job satisfaction. Much like the work environment, academic settings offer individuals a chance to use their various skills and interests, reinforce patterns, and give individuals the opportunity to implement one's self-concept. Literature on major satisfaction has indicated that it is associated with academic performance (Graunke & Woosley, 2005), increases certainty of career plans (Ware & Pogge, 1980), and can serve as a proxy for later job satisfaction (Astin, 1965). Holland (1997) proposed that job satisfaction results from congruence between a person's interests and their work environment, and this could increase the successful implementation of one's self-concept (Super, 1953).

In an attempt to specifically measure global major satisfaction, Naruta (2007) created the Academic Major Satisfaction Scale (AMSS). In designing this measure, Naruta (2007) stated that major satisfaction and persistence in a major are not equivalent constructs, as students may opt to change majors for reasons other than dissatisfaction and may persist within a major despite being dissatisfied. Because satisfaction and academic persistence have been empirically linked, Naruta used persistence in a major to validate the AMSS. Consisting of six items, the scale was able to successfully distinguish between students who persisted in their majors over time or not. After completing two studies, it was found that high scores were associated with higher grade point averages, better career decisions elf-efficacy, and a high degree of accomplishment. Most

importantly, scores were found to increase over time if students changed their majors or sought environments that were congruent with environments they sought.

Literature has found that self-efficacy beliefs are significantly related to choice and performance in academic behaviors (Bandura, 1997). Multon, Brown, and Lent (1991) performed a meat-analysis in which they also demonstrated that there is a positive and statistically significant relationship between self-efficacy and academic performance and persistence. DeWitz and Walsh (2002) examined the relationship between perceived self-efficacy and college student satisfaction. Because studies have found that dissatisfaction is significantly related to high job turnover rates (Hellman, 1997), it was important to also examine this relationship in academic settings. Results indicated that there was a substantial difference between satisfaction ratings in students with high or low self-efficacy. Students with higher self-efficacy were found to have more satisfaction in major components of their academic life (i.e., studying, grades). These students were also found to be happier with their social lives and were more involved in campus or local events and reported higher levels of satisfaction with the quality of their education (DeWitz & Walsh, 2002).

Satisfaction in STEM Majors

There has been some inconsistency in why there are sex differences in persistence of college students in STEM majors. Sax, Kanny, Jacobs, Whang, Weintraub, and Hroch (2016) discussed the implications of the underrepresentation of female students in STEM majors. Given that STEM majors are distinct, these majors should attract a wide variety of students. Sax et al. (2016) found that since 2007, noticeably more male students than female students have demonstrated an interest to major in STEM, and trends also revealed that over time, the gender gap in undergraduate engineering programs tended to expand as overall interest in engineering as

a field grew. The environmental cues and experiences students have in these majors may be an indication of why this gap has occurred. Stinebrickner and Stinebrickner (2011) measured college students' stated majors at the beginning and end of their college years. While they found that more men (28.1%) than women (16%) indicated as first year students that they were intending to major in STEM fields, more men actually left STEM than women at a small college. This was attributed to increased confidence and perhaps a sense of over optimism, but low actual performance in classes. In other studies, grades have been attributed to gender differences in STEM persistence. Seymour and Hewitt (1997) found that female students may attach greater importance to getting good grades than do males. While this may lead to the persistence of some women, other women might find dissatisfaction in classes where their grades are lower, leading to dropping classes. Women in difficult classes may also experience a loss of self-esteem because of low grades. Thus in many introductory classes, females may be victims of the "weed-out culture" which leads to their leaving science and math majors. Similar results were found in work by Strenta, Elliot, Adair, Matier, and Scott (1994). They found that the strongest cognitive predictor of attrition from science majors among those initially interested in science were low grades in science courses during the first two years of college but did not differentiate its impact between women and men. Jackson, Gardner, and Sullivan (1993) found a similar importance of grades for engineering.

In 1972, Starr, Betz, and Menne used the theory of work adjustment (Dawis et al., 1968), which proposes a relationship between work environment and individual satisfaction and tested how overall levels of satisfaction with the college environment impacted college students satisfaction. The College Student Satisfaction Scale was used to examine the differences in satisfaction levels between students who remained in college, students who left by choice, and

students who left because of failure to meet academic standards. It was hypothesized that satisfaction is a function of the correspondence between the system of the environment and the individual's needs. Overall, it was found that satisfaction with the college environment was inversely related to whether or not students stayed in college. Students who dropped out were more likely to have felt they "put in more than the received" and felt less accepted by other students and faculty (Starr et al., 1972, p. 321). Students who did not drop out, differed significantly from their counterparts in their scores on compensation, recognition, and quality of education. The students who chose to leave the university but had adequate grades related their decision to leave to requirements of the university and experiences with staff. Their satisfaction did not seem to result from difficulty in meeting the performance requirements of the university. Thus, it appears that factors outside of pure academic requirements created a sense of dissatisfaction with their experiences while in school.

A study by Seymour and Hewitt (1994) proposed that students in science and engineering programs were likely to leave either because they were bored or disappointed with the curriculum or forced to leave due to a loss of academic self-confidence in a competitive environment. Their study placed the majority of female participants in the second category. In 1998, Brainard and Carlin re-examined Seymour and Hewitt's study at a large university that had instituted a Women In Engineering (WIE) program as well as a Society of Women Engineers (SWE) program. The retention of 682 female students pursuing science and engineering programs was followed for six years. It was found that the most common factors which helped females persist in science and engineering programs included an interest in math and science courses, being able to work independently, the positive influence of faculty, career opportunities, and the presence of the WIE program. Interestingly, as students progressed in their majors, more

factors encouraged retention, such as participating in internships and co-ops, declaring their majors and gaining acceptance into an academic department, and experiences in math and science classes after their sophomore year. While several protective factors were found, barriers were also noted by the students. At least 25% of students in each year of school reported low self-confidence (Brainard & Carlin, 1998). Rather than becoming more confident in their abilities, instead it was found that the proportion of women reporting a lack of self-confidence nearly doubled by the end of their senior year. Many students also reported strong feelings of isolation and losing interest, as well as feeling intimated. 41% of third year students and 25% of senior students felt intimated, citing discouragement from low grades, poor teaching, and unapproachable faculty. Brainard and Carlin (1998) measured levels of self-confidence, finding that levels of self-confidence drop over the course of the first year and then slowly rise every subsequent year. However, female student's overall self-confidence was not found to return to its original high level from the first-year. It appears that the creation of the WIE program was successful, helping to maintain a retention rate of 72%. While most students in this sample persisted past the second year, it was found that if students left in their later years, it was more likely due to the educational climate as opposed to interest or difficulty of the course material. The findings of this study indicate that several factors outside of academic ability alone played a role in female student's decisions to persist or transfer out of science or engineering programs.

Literature has found that female students in STEM may chose not to pursue the field for a variety of reasons, and even if the field is pursued, similar reasons may lead to attrition later in the career development path. These factors include demographic background characteristics, service orientation, self-concept, and schooling experiences (Sax et al., 2016). A study by Diekman, Brown, Johnston, and Clark (2010) examined the differences between female retention

in STEM and non-STEM careers. They proposed that women's interest in some careers and disinterest in others may be a result of intersections of people's goals and how these goals may be affected by different careers. Women typically are associated with careers that endorse communal goals, which involves working with or helping others. It was hypothesized that many women perceive STEM as being incompatible with communal goals (i.e., "the lone scientist" stereotype), thus leading them to opt out of STEM careers in favor of careers that afford communion (Diekman et al., 2010). Alongside this hypothesis, Diekman et al. (2010) explained that women's preference to work with others means that they also place greater value on people-oriented or society-oriented careers. Although careers in STEM can provide such opportunities, this is not the initial stereotype, which may lead to lower interest in STEM fields. Results supported the hypotheses, with STEM careers being perceived as inhibiting communal goals and women showing less interest in continuing to pursue these fields, although women with agentic goals did indicate interest in STEM. While interest plays a pivotal role in vocational selection, it is also important to consider other situational factors which may contribute to women's attrition in STEM. Several of these factors can contribute to a "leaky pipeline" in which women in STEM are lost and a high attrition rate forms (Xie & Shauman, 2003). Barone (2011) observed sex differences across eight European nations which mimicked the differences found in Canada and the United States. Barone (2011) argued that there was more than one divide in STEM and humanities fields, stating that in addition to this clear boundary there was also a line which represented care versus technical dimensions. This second distinction indicated that culturally, individuals may separate career choices into those which emphasize psychological feelings and empathy or careers which abide by reasoning (Barone, 2011, p. 164). Thus, even stereotypes about what is required of individuals that work in certain fields also may cause individuals to not

associate women (who are caring and empathic) with STEM fields (which rely more on reasoning).

The "Leaky Pipeline" and STEM Attrition

The path from elementary school to a STEM career for women has often been compared to a pipeline. The metaphor suggests that as the number of girls who study STEM subjects increases in elementary, middle, and secondary school (e.g., more girls in the pipeline), the number of women who become scientists and engineers should also increase (e.g., women come out of the pipeline). When considered as just a pipeline, one would assume that the gender disparities in STEM would disappear over time. However, this has not happened at the expected rate and we continue to see low representations of women in STEM fields. Over time, the pipeline has been called the "leaky pipeline" because women leave the STEM pipeline at various points in their education (Ceci, Ginther, Kahn, & Williams, 2014). Various explanations have been offered for why this process occurs. While some argue that women leave non-traditional occupations because of a lack of confidence (Cech et al., 2011; Kay & Shipman, 2014), others also attribute attrition to a lack of interest (Seymour & Hewitt, 1997) and a "chilly" work environment (Society of Women Engineers, 2007). In actuality, attrition could be due to a number of various factors and could impact women differently, depending on individual differences on other identities they hold. Regardless of cause, the gender disparity has made it a priority to encourage more girls to retain an interest in STEM, in order to prevent leakage down the line (Kulis, Sicotte, & Collins., 2002).

Fouad, Singh, Cappaert, Chang, and Wan (2016) examined the difference between women in STEM who remained in the field versus those who persist despite challenges regarding the environment, a lack of confidence, or lack of interest. This was done because until

2016, no studies had explicitly examined differences between women who left engineering careers and those who remained. Fouad et al. (2016) used Social Cognitive Career Theory to create a comprehensive theoretical lens to examine these differences looking at self-efficacy, outcome expectations, interests, organizational supports, and barriers. Focusing mainly on engineers, Fouad et al. (2016) used a sample of women who had attained undergraduate degrees in STEM. Fouad asked them to identify if they were currently working as engineers or left less than 5 years ago or if they had never entered the field. No differences were found in self-efficacy and outcome expectations between the two groups of women, nor were there differences in vocational interests or workplace barriers experienced. However, results did indicate that there was a difference in the experience of women who stayed versus those that left: workplace specific supports. This included advancement opportunities, a greater understanding from mangers, and a balance of work and family roles. While this study identified that workplace support plays a large role in women's decisions to continue on in STEM careers, other factors related to the environmental context such as work-role stressors and stereotyping against women might also play significant roles on women's choices to stay in STEM.

Recently, two popular narratives have emerged in literature about professional women: "opting out" (Belkin, 2003) and "leaning in" (Sandberg, 2013) (Ceci et al., 2014). Opting out holds that women cannot have both a family and a high powered career. Thus, women are proposed to leave professional careers in order to stay at home and take care of their families. Conversely, leaning in argues that the choices women make can restrain them from leaning further into their work, such as accepting leadership roles or being more assertive about having a satisfactory work-life balance. Both of these narratives are striking for women in STEM because they represent two dichotomies for women in these fields. Those who choose to "lean-in" to their

careers might experience significant challenges in their workplaces. For many women, they might also have to put off starting families. Drago et al. (2006) surveyed faculty in academia and found that many female faculty members were more likely to stay single, to have fewer children, or wait to have children after tenure. This was due to workplace norms which did not support familial commitments.

Similar results were found in a study by Ecklund and Lincoln (2011). They found that among biologists, astronomers, and physicists, about twice as many women as men reported that their career demands caused them to have fewer children than desired. This was also the only factor which was significantly associated with plans to seek careers outside of science. Ecklund and Lincoln (2011) also report than their study likely underreported work and family conflict because individuals with higher amounts of conflict also likely already had opted out of academia. Even in environments which promote family friendly policies, taking time off of work might have detrimental consequences for women, as parental leave may lead to professional isolation or may have negative impacts on research (Mavriplis, Heller, Beil, Dam, Yassinskava, Shaw, & Sorensen, 2010). The impact of work-life balance on choosing to stay in STEM fields is critical to examine if we are to also better understand women's satisfaction with their chosen career paths. Because relationships and communal values are associated with women, women may be under more pressure to balance work and family. If they are not receiving support in STEM environments, this can make it harder to achieve work-life balance, which can ultimately force them to choose work or family and might lower overall levels of satisfaction with their career choices. Alternatively, women maintaining work-life balance might also be under greater pressure to continue this maintenance, which could lead to greater feelings of self-doubt, pressure to be "superwoman", and increased chances of burnout.

Hypotheses

Hypothesis 1: Science self-efficacy will mediate the relationship between stereotype threat and fear of failure.

Hypothesis 1a: Stereotype threat will be a significant negative predictor of science self-efficacy.

Hypothesis 1b: Science self-efficacy will be a significant negative predictor of fear of failure.

Hypothesis 2: Science self-efficacy will mediate the relationship between stereotype threat and fear of success.

Hypothesis 2a: Science self-efficacy will be a significant negative predictor of fear of success.

Hypothesis 3: Science self-efficacy will mediate between the relationship between impostor phenomenon and fear of failure.

Hypothesis 3a: Impostor phenomenon will be a significant negative predictor of science-self-efficacy.

Hypothesis 4: Science self-efficacy will mediate between the relationship between impostor phenomenon and fear of success.

Hypothesis 5: Fear of failure will mediate the relationship between science self-efficacy and academic major satisfaction.

Hypothesis 5a: Fear of failure will be a significant negative predictor of academic major satisfaction.

Hypothesis 6: Fear of success will mediate the relationship between science self-efficacy and academic major satisfaction.

Hypothesis 6a: Fear of success will be a significant negative predictor of academic major satisfaction.

Hypothesis 7: Science self-efficacy will mediate the relationship between impostor phenomenon and academic major satisfaction.

Hypothesis 7a: Science self-efficacy will be a significant positive predictor of academic major satisfaction.

Hypothesis 8: Science self-efficacy will mediate the relationship between stereotype threat and academic major satisfaction.

Hypothesized Model

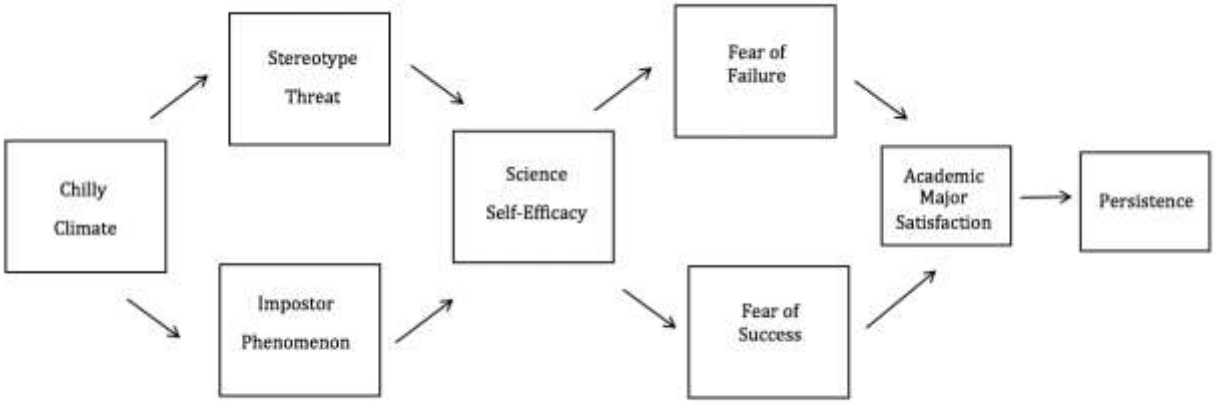

Figure 2. Hypothesized model of the mediated relationship between stereotype threat, impostor phenomenon, and academic major satisfaction.

Alternative Model

Although the variables in this study are hypothesized to follow a specific path, the variables may not operate in that hypothesized order. As experiences of stereotype threat may trigger feelings of inadequacy, which in turn may lower perceptions of one's own self-efficacy. Thus, stereotype threat would begin the path instead of simultaneously act alongside of the

experience of impostor phenomenon. An alternative model was created to test this path, as it pictured in Figure 3.

Figure 3. Alternative model of the mediated relationship between stereotype threat, impostor phenomenon, and academic major satisfaction.

CHAPTER 3. METHOD

In this chapter, I outline the methodology and research design used in this study. I describe the methodology, demographic information about the participants and descriptions of the measures used. Then I describe the research design, power analysis, and procedure. I end with a description of the data analysis plan, including procedures taken to conduct preliminary and primary analyses.

Methodology

The following sections provide descriptions of the various aspects of this study's design. This includes descriptions of the chosen population, sampling procedures, and procedures for data collection. It also includes descriptions of all measures used in this study.

Power Analysis

To estimate the sample size needed to detect significant mediation effects, a Monte Carlo simulation was performed on a sample size of 200 using M*plus* (Muthén & Muthén, 1998-2013) statistical software. The path coefficients used in the power analysis were obtained from the literature. I ran the analysis on 500 randomly generated data sets. To estimate statistical power for the path analysis models, the outcome variable specified in Figure 2 was regressed on the predictor variables and the resulting coefficients were used in the Monte Carlo study as population parameter estimates. I used a coefficient of .24 for the relationship between academic major satisfaction and science self-efficacy (Flores et al., 2014), a coefficient of -.44 for the relationship between fear of failure and science self-efficacy (Jöstl et al., 2012), a coefficient of -.50 for the relationship between perceived fear of success and science self-efficacy (Jöstl et al.,

2012), and a coefficient of -.28 for the relationship between science self-efficacy and stereotype threat (Deemer et al., 2014). For the remaining paths where there was no empirical literature on the relationship between pairs of variables in the study, I used a coefficient of .25, which is a small to medium effect size according to Cohen's (1988) standards, as a substitute. An *N* of 200 produced power ranging from 84-100% to detect significant effects in all paths in the proposed model. The mean RMSEA was .019, the mean SRMR was .030, and the mean χ^2 value was 7.063 (*df* =7). Thus, a sample size of 200 should be sufficient to detect the hypothesized effects.

Participants

The population of interest for this study were female undergraduate students majoring in STEM fields at a large, Midwest university. Although the definition of STEM has been defined in a variety of ways by different organizations, for the interest of this study, an undergraduate student in STEM is defined as an individual pursing a bachelor's degree in a science, technology, engineering, or mathematics major. These STEM majors were selected from a list of majors within these four fields at the university of study (responses may be found in Table 2). A total of 599 participants responded to the survey with 238 cases were removed for not enrolled in a STEM-related major and 13 cases were removed for not completing the survey, resulting in a total of 348 cases. An examination was also completed for statistical assumptions necessary for planned analysis, including univariate and multivariate outliers, nonlinearity, and heteroscedasticity.

The final sample of participants (*N* = 348) included women in the field of engineering (*n* = 189, 54.3%), science (*n* = 98, 28.2%), technology (*n* = 42, 12.1%), and mathematics (*n* = 19, 5.5%). Almost 80% of the participants (n=277) reported that they did not transfer or change majors, while 71 participants (20.4%) reported that they had. Participants ranged in age from 18

to 62 years (M_{age} = 20.16, *SD* = 2.752). Specifically, 96 participants identified as first-year college students (27.6%), 74 identified as sophomores (21.3%), 94 identified as juniors (27%), 80 identified as seniors (23%), and 4 identified as other (1.1%). Over 300 participants (94.8%) identified as domestic students, 16 (4.6%) identified as international students, and 2 (.6%) identified as other (e.g., domestic but raised abroad, resident alien). Participants' overall self-reported GPAs ranged from 1.39 to 4.0 (*M* = 3.37; *SD* = .476; *n* = 348). Reported race/ethnicities included White/European American (*n* = 285, 81.9%), Asian or Asian Americans (*n* = 34, 9.8%), Hispanic or Latina (*n* = 10, 2.9%), Arabic or Middle Eastern (*n* = 1, .3%), Black or African American (*n* = 2, .6%), American Indian or Alaskan native (*n* = 1, .3%), Biracial or Multiracial (*n* = 13, 3.7%) and other (*n* = 1, .3%). Table 1 provides an overview of the demographics of the participants.

After completing the quantitative survey, participants were asked if they would be interested in participating in a qualitative interview about their experiences as women in STEM. Over 160 participants responded to the interest survey, 45 were emailed to ask if they would be interested in participating, and 13 agreed to participate responded and agreed to interviews. The participants demonstrated a relatively homogenous group with respect to demographic classifications. Twelve of the participants were White/European American and Domestic students, while one participant was Asian and an International student. Ages of the interviewees ranged between 19 and 23 years of age, with about half of the interviewees were 21 years of age and identified as juniors in their programs. All of the students were enrolled in STEM majors at the time of interviews and for those who switched majors before the interview, they indicated that they had switched from other STEM fields. The final sample of participants (*N* = 13) included women in the field of engineering (*n* = 7, 53.8%), science (*n* = 2, 15.4%), technology (*n*

= 2, 15.4%), and mathematics (*n* = 2, 15.4%). Because of the recruitment strategy of this study, the similarities among the participants' demographics stem from their choice in major and from their interest in being interviewed about their experiences in a STEM field. For a depiction of the demographic characteristics of the full sample, see Table 2.

Table 1.
Demographic Characteristics of the Sample

Demographic Information	*n*	Frequency
Sex		
Female	342	98.3%
Gender-Queer/Gender Fluid /Gender Non-Conforming	4	1.1%
Other	1	.3%
Missing	1	.3%
Age		
18	45	12.9%
19	96	27.6%
20	85	24.4%
21	68	19.5%
22	44	12.6%
23-62	9	2.6%
Missing	1	.3%
Field and Major		
Engineering	188	54%
Science	98	28.2%
Technology	43	12.4%
Mathematics	19	5.5%
Student Year in School		
First Year Undergraduate	97	21.5%
Sophomore Year Undergraduate	82	18.2%
Junior Year Undergraduate	67	14.9%
Senior Year Undergraduate	74	16.4%
Overall GPA		
0-2	2	.6%
2-3	59	17%
3-4	256	73.6%
4 and above	21	6%
Other/No response	10	2.9%
Ethnicity		
White/European American	285	81.9%

Table 1 continued

Asian/Asian American	34	9.8%
Hispanic or Latina	10	2.9%
Black/African American	2	.6%
Biracial or Multiracial	13	3.7%
Other	3	.9%
National Status		
Domestic Student	330	94.8%
International Student	16	4.6%
Other	2	.6%

Note. $N = 348$; Missing values are also indicated in the table

Table 2.
Demographic Characteristics of the Qualitative Interview Sample

Demographic Information	*n*	Frequency
Sex		
Female	13	100%
Age		
19	3	23.1%
20	2	15.4%
21	6	46.2%
22	1	7.7%
23	1	7.7%
Field and Major		
Engineering	7	53.8%
Aeronautic & Astronautic Engineering	1	7.7%
Chemical Engineering	1	7.7%
Civil Engineering	1	7.7%
Electrical Engineering	1	7.7%
General Engineering	1	7.7%
Materials Engineering	1	7.7%
Mechanical Engineering	1	7.7%
Science	2	15.4%
Atmospheric Science	1	7.7%
Environmental Science	1	7.7%
Technology	2	15.4%
Computer & Information Technology	1	7.7%
Mechanical Engineering Technology	1	7.7%
Mathematics	2	15.4%
Ag Sales & Marketing	1	7.7%
Math & Statistics	1	7.7%

Table 2 continued

Student Year in School		
First Year Undergraduate	1	7.7%
Sophomore Year Undergraduate	4	30.8%
Junior Year Undergraduate	6	46.2%
Senior Year Undergraduate	2	15.4%
Ethnicity		
White/European American	12	92.3%
Asian/Asian American	1	7.7%
National Status		
Domestic Student	12	92.3%
International Student	1	7.7%

Note. $N = 13$

Measures

In this section, I describe all the measures used in the study. I provide a description of each measure including its intended purpose, number of items, structure of subscales, sample items, and psychometric properties (i.e., internal consistency, validity).

Demographic questionnaire. The survey began with a demographic questionnaire to collect basic demographic information from each participant. Questions asked for academic standing, gender identification, age, domestic or international status, race and ethnicity, generational status, if English was the first language, major or field of study, sex breakdown in academic major, overall GPA, participation in learning/living communities, co-ops, research experience, and internship experience, intended career aspirations, and if the participant had ever changed their academic major.

Perceived Chilly Climate for Women Scale (PCC; Pascarella, 1997). Perceived chilly climate for women was measured using the 8-item Perceived Chilly Climate for Women Scale (PCC). These eight items were answered using a five-point Likert-type scale, ranging from 1

(Strongly Agree) to 5 (Strongly Disagree). Example statements included "I have never been singled out in class or treated differently than other students because of my gender" and "I have never observed discriminatory words, behaviors, or gestures toward female students." Pascarella et al. (1997) reported a high internal consistency coefficient with Cronbach's $\alpha = .81$.

Stereotype Vulnerability Scale (SVS; Spencer, 1994). Stereotype threat vulnerability was measured using the 8-item Stereotype Vulnerability Scale (SVS). Eight items are answered using a five-point Likert-type scale, ranging from 1 (*Never*) to 4 (*Almost Always*). The items are conditioned on the statement "How often do you feel that because of your gender…" Example items included "Some people believe that you have less ability" and "If you do poorly on a test, people will assume it is because of your gender." The reported internal consistency coefficients for this scale are high, with Spencer, Steele, and Quinn (1997) reporting Cronbach's $\alpha = .82$, Woodcock et al. (2012) reporting $\alpha = .85$, and Deemer, Lin, & Soto (2016) reported $\alpha = .92$. Woodcock et al. (2012) also found that an effect of stereotype threat on scientific identity, which was impacted by race and ethnicity.

Clance Impostor Phenomenon Scale (Clance, 1985). The Clance Impostor Phenomenon Scale (CIPS) was used to measure the level of impostor feelings. The CIPS is a 20-item, self-report instrument that measures fear of evaluation, feeling less capable than peers, fear that success cannot be repeated, feelings of inadequacy, and self-monitoring behaviors. Participant respond to items on a Likert-type scale, ranging from 1 (*Not True At All)* to 5 (*Very True).* An example of an item would be "I can give the impression that I am more competent than I really am." Ranges of total scores classify individuals as having few (40 points or less), moderate (41-60 points), frequent (61-80 points), or intense (80 points or more) impostor experiences as it relates to their fears of evaluation, not being able to repeat their successes, and

being less capable than others. The reported internal consistency coefficients for this scale are high (e.g., Cronbach's α = .96 in Holmes et al., 1993). Harvey & Katz (1985) reported an internal consistency reliability estimate of .85, based on a sample of 74, and a cross-validation reliability estimate of .74, based on a sample of 72. The CIPS scale was also validated by Chrisman et al. (1995) and Kooligan and Sternberg (1991).

STEM Self-Efficacy Scale (adapted from Fantz, Siller, and DeMiranda, 2011). STEM self-efficacy was measured using Fantz, Siller, and DeMiranda's (2011) engineering self-efficacy scale. Examples of items include "I expect to do well in my STEM classes," "I'm confident I can do an excellent job on the assignments in my STEM classes," and "I'm confident I can understand the most complex material presented by the instructors in my STEM classes." In order to ensure consistency with other measures, this scale was rescaled such that scores ranged from 1 (*strongly disagree*) to 7 (*strongly agree*), while in the original measure items are rated on a 7-point Likert scale ranging from -3 (*strongly disagree*) to +3 (*strongly agree*). Concurrent validity has been validated by Fantz et al. (2011) as they presented a significant positive correlation with current semester GPA and a Cronbach's alpha coefficient of .83, thus supporting the measure's internal consistency.

Fear of Success Scale (Zuckerman & Allison, 1976). This 27-item scale which employs a 7-point Likert-type item format. Written to measure respondent's perceptions of the benefits of success, the presumed costs of success, and the relative value of success in comparison to alternatives. Sample items include: "I expect other people to fully appreciate my potential;" "Often the cost of success is greater than the reward;" "I enjoy telling my friends that I have done something especially well." Zuckerman and Allison (1976) reported internal consistency reliability coefficients for the 27-item scale at .69 for males and .73 for females.

Achievement Motives Scale (Gjesme & Nygard, 1970). This measure contains 15 items to measure hope of success and fear of failure. Individuals were asked to rate their positive or negative affect toward an achievement motivation. “I like situations in which I can find out how capable I am;” “I enjoy situations in which I can make use of my abilities;” “I am afraid of failing in somewhat difficult situations, when a lot depends on me;” “I feel uneasy to do something if I am not sure of succeeding.” Lang and Fries (2006) completed multiple studies using this scale and reported internal consistency reliability coefficients which were higher than .70 in all samples.

Academic Major Satisfaction Scale (Nauta, 2007). The Academic Major Satisfaction Scale (AMSS) was used to measure academic major satisfaction in this study. The AMSS is a 6-item scale that taps students’ contentment with their choice of academic major. This scale is composed of negatively worded items (i.e. ‘‘I am strongly considering changing to another major’’) and positively worded items (i.e. ‘‘Overall, I am happy with the major I’ve chosen’’)**.** Four of these items are reverse scored; therefore, higher scores on these items reflect lower major satisfaction. Participants rate the items on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Confirmatory factor analytic work on AMSS scores yielded evidence of a one-factor structure; they have been shown to be reliable (.94) and differentially predictive of retention in, versus switching, majors (Nauta, 2007). AMSS scores exhibited internal consistency (.90) in previous studies (Deemer, 2015).

Intentions to Persist Scale (Lent, Singley, Sheu, Schmidt, & Schmidt, 2007). Intentions to persist in a STEM major was measured using the Intentions to Persist scale. This scale is a 4-item Likert-type scale, ranging from zero (Strongly Disagree) to 9 (Strongly Agree). Sample items include “I plan to remain enrolled in a STEM major over the next semester” and “I

am fully committed to getting my college degree in a STEM field." Lent et al.'s original study (2003) cited a Cronbach's alpha of .95, however, more recent work by Wilkins-Yel et al. (2018) cited an alpha of .70.

Qualitative Demographic Questionnaire. The post-survey interview volunteer form included a demographic questionnaire requesting basic demographic information from each participant. Questions asked for a contact email, academic standing, gender identification, age, domestic or international status, race and ethnicity, major or field of study, and if the participant had changed or transferred majors.

Procedure

Approval for this study was sought from the Purdue University Institutional Review Board. After approval, information about the study was sent to eligible students through the registrar's office. Enrolled undergraduate female students were invited to participate via a link to the survey in the e-mail. When they opened the webpage, participants were asked to read the informed consent page and electronically provide informed consent. This document contained background information on the student, procedures, and information about confidentiality. They also were reminded of the voluntary nature of the research and a discussion of possible ethical concerns. E-mail addresses of both researchers were provided for contact about any additional questions, comments, or concerns. After informed consent was confirmed, participants were taken to the start of the survey. After completing the survey, participants were taken to a page that thanked them for their participation. Participants were also asked not to discuss the survey with other potential participants. An additional survey followed the quantitative survey, asking participants if they would be interested in participating in a qualitative interview about their

experiences. This second survey featured a shorter demographic form and asked for a contact email.

Research Design

This study used a mixed methods, sequential explanatory approach to understand the relationships between variables. This approach is appropriate in studies where a goal is to further understand lesser known variables. Although theoretical antecedents of variables such as the impostor phenomenon, fear of success, and fear of failure are known from previous research (Clance, 1978), how these variables co-occur with one another and with other variables in the STEM domain has been less examined. A sequential explanatory design is characterized by the collection and analysis of quantitative data, followed by the collection and analysis of qualitative data (Creswell, 2003). This strategy is often useful in assisting to explain and interpret findings of a primarily quantitative study (Creswell, 2003). Because this study initially investigated participant responses quantitatively, the qualitative results will support or explain the findings. While this approach is straightforward and easy to follow, Creswell (2003) notes that a weakness of this design is the length of time involved in data collection, especially if the two phases are given equal priority, as they were in this study.

The quantitative portion of this study utilized a cross-sectional survey approach, using online questionnaires that survey participants at only one point in time. Previous studies have connected certain variables in this study to one another, but no study has examined the relations of all variables in one model. The qualitative interviews were then used to explore participants' responses further. As a result, the qualitative portion of the study was exploratory in nature and sought to provide a more descriptive picture of existing relationships between stereotype threat,

impostor phenomenon, science self-efficacy, fear of failure, fear of success, and academic major satisfaction.

Quantitative analyses. Once data were collected, quantitative preliminary analyses were conducted using Statistical Package for the Social Sciences (SPSS) to identify missing data, examine univariate and multivariate outliers and nonlinearity and heteroscedasticity. Frequencies, means, standard deviations, and ranges for the demographic variables and hypothesized variables were computed. Pearson correlations were also calculated to determine whether the dependent variables were associated with the continuous demographic variables (e.g., age). Following the preliminary analyses, I conducted a path analysis using *Mplus 7.3* (Muthén & Muthén, 1998-2016) statistical software.

All mediated effects were estimated by computing the products of direct path coefficients (Sobel, 1982). The models were fitted using a weighted least square mean- and variance-adjusted (WLSMV) estimator. Indices used to evaluate model fit included the model chi-square test, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Weighted Root Mean Square Residual (WRMR). Values of .90 and higher are deemed acceptable for the TLI and CFI, while values of .08 or less are considered acceptable for the SRMR and RMSEA (Tabachnick & Fidell, 2007). Persistence was measured as a dichotomous variable (see Chapter 4), therefore a weighted root mean square residual (WRMR) was used rather than the SRMR because the SRMR cannot be used with categorical variables. WRMR values of 1.0 or less are considered acceptable, with lower values indicating better model fit (Yu, 2002).

In order to test mediation, bootstrapping, a nonparametric sampling procedure that tests the significance of indirect effects, was used. The hypotheses regarding mediation were (H1) that there would be a mediated effect of ST on FoF via SSE; (H2) there would be a mediated effect of ST on FoS via SSE; (H3) there would be an indirect effect of IP on FoF via SSE; (H4) there would be a mediated effect of IP on FoS via SSE; (H5) there would be a mediated effect of SSE on AMS via FoF; (H6) there would be a mediated effect of SSE on AMS via FoS; (H7) there would be a mediated effect of IP on AMS via SSE; and (H8) there would be a mediated effect of ST on AMS via SSE. Mediation analysis implies a causal chain between at least three variables, whereby the relationship between two variables is accounted for by a third variable (Hayes, 2009). Bootstrapping treats a sample as a pseudo-population, where cases are randomly selected with replacement to generate other data sets (Kline, 2005). When repeated many times (e.g., 1,000), bootstrapping simulates random sampling with replacement and constructs an empirical sampling distribution (Kline, 2005). In this process, nonparametric bootstrapped confidence intervals are calculated in the empirical distribution, allowing for indirect effects to be estimated (Kline, 2005).

As recommended by Hayes (2009) and Preacher and Hayes (2008) for multiple mediation models, the iterative bootstrapping was performed 1,000 times and bias-corrected confidence intervals were used to adjust for over inflation estimates and to yield a parameter estimate for both total and specific indirect effects of all the relationships within the model. Individual indirect effects were calculated through the use of the 95% bias-corrected confidence interval. If the 95% bias-corrected confidence interval for the parameter estimate did not contain zero, then the indirect effect is statistically significant, thereby indicating successful mediation (Preacher & Hayes, 2008).

Qualitative analyses. All interview participants were contacted via email after they indicated their interest in participating in the qualitative portion of the study. After initial contact, participants were scheduled for a thirty-minute appointment time whereby a semi-structured interview was conducted in order to ask about their experiences in their majors. All interviews were recorded, and the audio files were saved on a secure flash drive with pseudonyms to conceal identities. During the interview, participants were asked ten questions, focusing on their academic and career goals, failures and successes, and experiences with stereotypes within their majors (Appendix O).

After all interviews were conducted, interviews were transcribed by the researcher. Then, each interview was read and re-read by the researcher and a committee member, who served as an auditor, in order to look for re-current ideas, identifying patterns and trends in participant's individual answers and shared experiences amongst of the group of thirteen participants. Several trends appeared with high frequency across interviews. These trends were then integrated with the quantitative results to better understand the path of the model.

After analysis and examination of the notes in the interviews, three cases were chosen and identified as significant in their depiction of both general trends in responses as well as individual trends. Notes were then compiled into summaries of the participant's experiences. These summaries were then used to write a vignette of the participant's experiences, highlighting answers in the interview that stood out as particularly informative or that clearly addressed the question asked. Once the significant cases were identified, their quantitative results were also re-examined to see, if their responses on the quantitative measures mirrored their responses in the interviews.

CHAPTER 4. RESULTS

In this chapter, the results of the study are presented, including the preliminary analyses and the analyses of the hypotheses.

Data Screening

Data were first visually screened for missing data and inconsistencies in scale scoring. Participants who missed more than 5% of the total survey were excluded from the study, resulting in the removal of 238 cases.

Normality of the variables was assessed by histogram inspection and skewness and kurtosis coefficients. Visual inspection and the skewness and kurtosis values (i.e., under the absolute value of two) indicated the data were normally distributed (Tabachnik & Fidell, 2013). Persistence demonstrated a negative skew (skew = -23.85), and thus the variable was recoded in SPSS as a dichotomous binary variable, with 0 indicating a score of 8 or below and 1 indicating a score of 9 on the item responses. Thus, when running the path in *Mplus*, a weighted least square estimated model was used, as persistence was a categorical variable and all other variables were continuous.

Following examination of normality, nonlinearity and heteroscedasticity were examined visually by generating bivariate scatter plots for all pairs of variables in the model and fitting regression lines to the data for all the relationships in the model. Visual inspection and curve estimation determined that the relationships are sufficiently linear to be tested using a structural equation model algorithm such as in *Mplus*.

Next, multicollinearity was assessed by running a regression analysis using persistence as the dependent variable and all other variables as the independent variable. If the tolerance

variables were less than .10, this would indicate that multiple correlation with other variables is high, suggesting multicollinearity. The variance inflation factor (VIF) is the inverse of the tolerance values, and scores over 10 would be a concern. The tolerance values were above .10, ranging between.637 and .794, for all variables VIF values were below two for all variables, ranging between 1.259 and 1.571, indicating no serious multicollinearity and no violation of the multicollinearity assumption (Cohen, Cohen, West, & Aiken, 2003).

Preliminary Analyses

Prior to performing the primary analyses, preliminary analyses were conducted to determine basic descriptive information of the data. This section offers descriptions of the variables, the internal reliability of the measures, and the relationships between the variables. First, descriptive statistics were computed including means, standard deviations, and the internal consistency coefficient of all the scale scores (see Table 3). Cronbach's alphas for subscales ranged from .78 to .94 for all the scales (i.e., stereotype threat, impostor phenomenon, science self-efficacy, fear of failure, fear of success, academic major satisfaction, and persistence).

Table 3
Descriptive Statistics and Reliability Coefficient of Scale Scores

Measure	Scale Range	*M*	*SD*	α
Stereotype Threat	8-40	17.82	6.68	.886
Impostor Phenomenon	20-100	66.60	15.56	.916
Science Self-Efficacy	9-63	46.01	10.49	.946
Fear of Success	27-189	106.56	17.25	.799
Fear of Failure	5-20	15.21	3.09	.788
Academic Major Satisfaction	6-30	24.96	5.17	.906
Climate	8-40	18.07	7.19	.873
Persistence	0-36	34.40	3.74	--

Note. $N = 348$

Zero-order correlation coefficients were also computed for all the study variables. Most of the relationships among the primary variables were in the expected direction with many being

statistically significantly, ranging from -.274 to .511. Correlations among the variables are depicted in Table 4.

Table 4
Bivariate Correlations Between Variables

Variable	1	2	3	4	5	6	7	8
1. Stereotype Threat	--							
2. Impostor Phenomenon	.287**	--						
3. Science Self-Efficacy	-.168**	-.374**	--					
4. Fear of Success	.192**	.392**	-.195**	--				
5. Fear of Failure	.127*	.467**	-.236**	.351**	--			
6. Persistence	-.063	-.034	.209**	-.112*	-.081	--		
7. Academic Major Satisfaction	-.241**	-.274**	.415**	-.198**	-.227**	.439**	--	
8. Climate	.511**	.205**	-.184**	.157**	.038	-.010	-.192**	--

Note. $N = 348$. ** = Correlation is significant at the .01 level (2-tailed). * = Correlation is significant at the .05 level (2-tailed).

Analysis of Hypotheses

A path analysis was performed to examine the hypotheses. There were several mediators and persistence acted as the main outcome variable. As indicated in Chapter 3, there were five hypotheses: (H1) Science self-efficacy will mediate the relationship between stereotype threat and fear of failure; (H1a) Stereotype threat will be a significant negative predictor of science self-efficacy; (H1b) Science self-efficacy will be a significant negative predictor of fear of failure; (H2) Science self-efficacy will mediate between the relationship between stereotype threat and fear of success; (H2a) Science self-efficacy will be a significant negative predictor of fear of success; (H3) Science self-efficacy will mediate between the relationship between impostor phenomenon and fear of failure; (H3a) Impostor phenomenon will be a significant negative predictor of science-self-efficacy; (H4) Science self-efficacy will mediate between the relationship between impostor phenomenon and fear of success; (H5) Fear of failure will mediate

the relationship between science self-efficacy and academic major satisfaction; (H5a) Fear of failure will be a significant negative predictor of academic major satisfaction; (H6) Fear of success will mediate the relationship between science self-efficacy and academic major satisfaction; (H6a) Fear of success will be a significant negative predictor of academic major satisfaction; (H7) Science self-efficacy will mediate the relationship between impostor phenomenon and academic major satisfaction; (H7a) Science self-efficacy will be a significant positive predictor of academic major satisfaction; and (H8) Science self-efficacy will mediate the relationship between stereotype threat and academic major satisfaction.

Path Analysis of the Hypothesized Model

In the hypothesized model, there are several mediators, which were hypothesized to impact the outcome variable, persistence in a STEM major. Results from this model indicated poor model fit, χ^2 (18, N = 348) = 142.150, p < .001; CFI = .723; WRMR = 1.591; TLI = .569, and RMSEA = .141. As the values for TLI and CFI were less than .90, this was not an acceptable fit. In addition, because the RMSEA was more than .08, this was also not an acceptable fit. The WRMR was greater than 1.0, indicating lack of model fit. 28.3% of the variance in persistence was explained by predictors in the model and though the chi-square statistic (χ2) was significant, this statistic might not be the most reliable indicator as it is sensitive to sample sizes (Byrne, 2010).

Table 5
Direct effects of the hypothesized path analysis

Path	*β*	*SE*	*p*
To Persistence from:			
Academic Major Satisfaction	.532	.057	.000
To Academic Major Satisfaction from:			
Science Self-Efficacy	.509	.092	.000
Fear of Failure	-.006	.067	.931
Fear of Success	.016	.071	.817

Table 5 continued

To Fear of Failure from:			
Science Self-Efficacy	-.451	.064	.000
To Fear of Success from:			
Science Self-Efficacy	-.415	.070	.000
To Science Self-Efficacy from:			
Stereotype Threat	-.234	.063	.000
Impostor Phenomenon	-.543	.058	.000
To Stereotype Threat from:			
Climate	.513	.049	.000
To Impostor Phenomenon from:			
Climate	.213	.061	.000

There were several significant direct effects demonstrated in the model. Chilly climate was a significant positive predictor of stereotype threat (β = .513, p = .000) and impostor phenomenon (β = .213, p = .000). Stereotype threat was a significant negative predictor of science self-efficacy (β = -.234, p = .000), as was impostor phenomenon (β = -.543, p = .000). Science self-efficacy was a significant negative predictor of fear of failure (β = -.451, p = .000) and fear of success (β = -.42, p = .000), and a positive predictor of academic major satisfaction (β = .509, p = .000). Finally, academic major satisfaction (β = .532, p = .000) was a significant positive predictor of persistence. These direct effects are depicted in Table 5 and Figure 3.

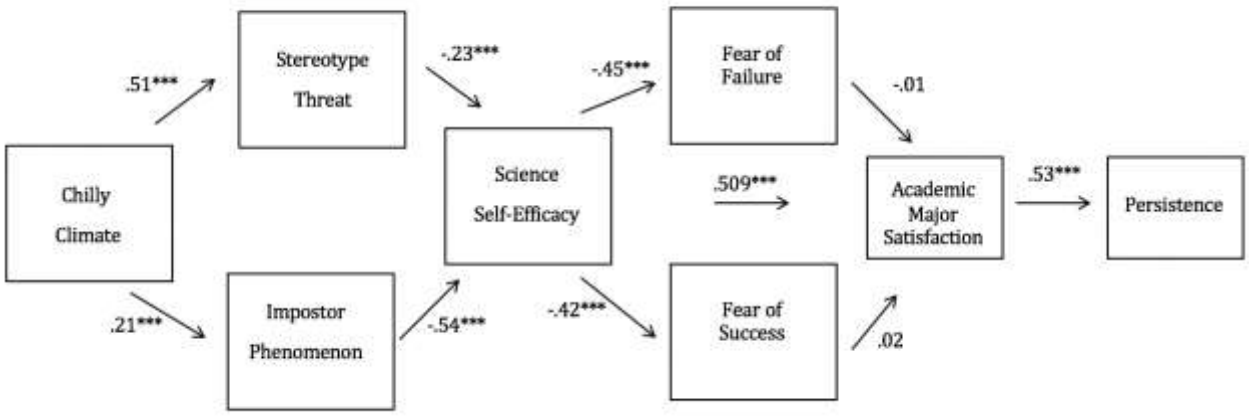

Figure 4. Standardized direct effects of the hypothesized model.
*p < .05., ** p< .01, *** p < .001.

To test for indirect effects, bootstrapping was performed 1,000 times and results revealed various significant findings. Results were considered significant if the parameter estimate did not contain zero. Significant indirect effects were found for all indirect effects except for two: from science self-efficacy to academic major satisfaction via fear of failure (*estimate* = .003, 95% CI [-.068, .056]) and from science self-efficacy to academic major satisfaction via fear of success (*estimate = -.007*, 95% CI [-.072, .049]). These two indirect effects were not significant because the confidence interval contained zero, thus hypotheses 5 and 6 were not supported. For all other indirect effects, the results were significant, and supported hypotheses 1, 2, 3, 4, 7, and 8. These results are presented in Table 6.

Table 6
Indirect effects of the hypothesized path analysis

Indirect Effect	*Estimate*	*Lower 2.5%*	*Upper 2.5%*
Science Self-Efficacy→Fear of Failure→Academic Major Satisfaction	.003	-.068	.056
Science Self-Efficacy→Fear of Success→Academic Major Satisfaction	-.007	-.072	.049
Stereotype Threat → Science Self-Efficacy→ Academic Major Satisfaction	-.119*	-.223	-.042
Impostor Phenomenon → Science Self-Efficacy→ Academic Major Satisfaction	-.276*	-.400	-.170
Stereotype Threat→ Science Self-Efficacy→ Fear of Failure	.105*	.043	.182
Impostor Phenomenon→ Science Self-Efficacy→ Fear of Failure	.245*	.142	.348
Impostor Phenomenon→ Science Self-Efficacy→ Fear of Success	.225*	.124	.340
Stereotype Threat→ Science Self-Efficacy→ Fear of Success	.097*	.040	.171
Chilly Climate→Stereotype Threat→Science Self-Efficacy	-.120*	-.191	-.052
Chilly Climate→Impostor Phenomenon→Science Self-Efficacy	-.115*	-.194	-.050

Note. * 95% bias-corrected confidence interval for the parameter estimate does not contain zero.

Path Analysis of the Alternate Model

In the hypothesized model, experiences of stereotype threat and impostorism were measured concurrently; however, previous research has indicated that activation of a stereotype may trigger concerns of evaluation (Steele, 1997) and self-doubt about adequacy (Dasgupta, 2011). Thus, the perception of experiencing stereotypes may trigger feelings of impostorism, which in turn may impact an individual's self-efficacy. In the alternative model, impostor phenomenon serves a mediator between stereotype threat and science self-efficacy. Results from this model indicated better model fit than the hypothesized model, χ^2 (20, N = 348) = 79.007, p = .000; CFI = .868; WRMR = 1.227; TLI = .816, and RMSEA = .092.

Table 7
Direct effects of the alternative model

Path	*β*	*SE*	*p*
To Persistence from:			
Academic Major Satisfaction	.539	.054	.000
To Academic Major Satisfaction from:			
Science Self-Efficacy	.502	.061	.000
To Fear of Failure from:			
Impostor Phenomenon	.611	.061	.000
To Fear of Success from:			
Impostor Phenomenon	.477	.055	.000
To Science Self-Efficacy from:			
Fear of Failure	-.328	.080	.000
Fear of Success	-.181	.074	.014
To Impostor Phenomenon from:			
Stereotype Threat	.336	.063	.000
To Stereotype Threat from:			
Climate	.532	.048	.000

Results revealed that all direct effects in the alternate model were significant: from climate to stereotype threat (β = .532, p = .000), from stereotype threat to impostor phenomenon (β = .336, p = .000), from impostor phenomenon to fear of failure (β = .611, p = .000), from impostor phenomenon to fear of success (β = .477, p = .000), from fear of failure to science self-

efficacy (β = -.328, p = .000), from fear of success to science self-efficacy (β = -.181, p = .000), from science self-efficacy to academic major satisfaction (β = .502, p = .000), and from academic major satisfaction to persistence (β = .539, p = .000). These direct effects are depicted in Table 7 and Figure 5.

Figure 5. Standardized direct effects of the alternative model
*p < .05., ** p< .01, *** p < .001.

To test for added indirect effects, bootstrapping was performed 1,000 times and results revealed significant indirect effects for all indirect effects. Although all indirect effects were significant, there were no hypotheses made which they supported.

Table 8
Indirect effects of the alternative model

Indirect Effect	*Estimate*	*Lower 2.5%*	*Upper 2.5%*
Science Self-Efficacy → Academic Major Satisfaction → Persistence	.271*	.178	.366
Fear of Success→ Science Self-Efficacy → Academic Major Satisfaction	-.091*	-.182	-.024
Fear of Failure → Science Self-Efficacy→ Academic Major Satisfaction	-.165*	-.280	-.081
Impostor Phenomenon → Fear of Failure → Science Self-Efficacy	-.200*	-.348	-.088
Impostor Phenomenon → Fear of Success → Science Self-Efficacy	-.087*	-.185	-.020
Stereotype Threat → Impostor Phenomenon → Fear of Failure	.205*	.118	.310
Stereotype Threat → Impostor Phenomenon → Fear of Success	.160*	.092	.243

Table 8 continued

Chilly Climate→ Stereotype Threat → Impostor Phenomenon	.178*	.102	.259

Note. * 95% bias-corrected confidence interval for the parameter estimate does not contain zero.

Qualitative Results

Based on the analysis of interviews, a series of three cases were identified as significant. These cases were selected based on recurring trends as well as unique characteristics in the participants' responses. Using vignettes from semi-structured interviews, I profile the participant's experiences of stereotype threat and fears of failure and success reflected on their academic and work experiences.

Vignettes of Participants' Experiences

The term "vignette" refers to a descriptive account that portrays a sequence of events that is representative of an individual in a narrative format (Miles & Huberman, 1994). The vignettes are arranged in alphabetical order of the participant's pseudonyms. Compelling responses from three of the ten interviews were chosen. These participants experienced many of the same experiences in their STEM fields; however, their experiences, as well as their own individual backgrounds, impacted how they answered and what stories they shared with me. The vignettes include rich, descriptive narrative accompanied by discrete quotes taken from each participant's interview. The narrative represents a blend of description and discussion with emphasis on how different theories informing this study may explain each participant's lived experiences.

Vignettes

Anna

Persistence despite Encountering Gender Bias

"Internships for women are rough. Especially your first one because it's like a culture shock." A junior in materials engineering, Anna offered several reflections on her experience as one of a handful of women at an engineering company. Before attending her internship, Anna was fully immersed in her major. She lived in an engineering learning community, attended classes specifically oriented toward women engineers, and reported being surrounded by women engineering majors on a daily basis.

> Everybody always says that engineering is male-dominated but I didn't taste it in college. Yeah, there are more men, but I didn't realize that you lose so many female engineers when you go into industry and there are so many different companies.

After entering industry, Anna became immediately aware of the struggles women in her field face. For her internship, Anna was placed at a small company in Indiana, where she was one of few women. For Anna, that discrepancy was shocking. "You spend all this time in programs where you are surrounded by women but then enter industry and there are no women supporting you". Anna started to encounter different gender-related challenges, including one based on her appearance. Here Anna describes:

> You get those crappy situations when you're a female engineer and you're wearing a skirt in the workplace and get a dirty look from your male coworker. Because you're wearing a skirt and you're an engineer and engineers don't wear skirts. He asks you if you know how to use a drill bit cause you're wearing a skirt. You have those kind gross situations where you're like 'Okay, I'm a woman engineer. I know it comes with issues."

Unfortunately, the support Anna was hoping to gain from other females in the workplace was not evident. Assigned a female supervisor, Anna hoped to find a mentor, or at least a

confidant, aware of her experiences. This supervisory relationship, although strained, was never a point of contention until it was time for feedback and Anna realized she was getting more push-back from her supervisor than her male peer. After one feedback session, Anna confided in her male peer, who told her that the supervisor they shared did not think Anna was competent. Anna stated:

> That shook my ego so hard. I had spent all this time feeling like I was a perfectly competent engineer and was doing okay. My other co-workers seemed fine with me. But then suddenly I had this push-back from my boss and it shook the ground I was standing on.

After enduring criticism from male co-workers and then realizing how much overall support she was lacking, Anna began to understand that she was more alone than she initially thought. Her initial shock also led her to question whether or not she belonged in engineering. A motivated student, Anna has been working toward engineering since she was in high school and expressed plans on attending graduate school for engineering education. Her experience working in industry seemed to have a direct impact on these future plans. During her interview, Anna expressed the following thoughts:

> Going into industry you kind of say "Maybe I need to re-evaluate what I thought I wanted to do with the rest of my life. I have definitely done that to myself. Maybe my goals are wrong and I won't thrive in this environment."

Anna shared that she would be looking into other types of positions and had gained practical knowledge from the experience. "It was a yucky mess, but I did walk away a better engineer and was a lot more educated on what industry can look like." Although her experience was not what she expected, Anna shared that she expects to graduate with a degree in materials engineering and then teach or hold a position in a STEM diversity program at a university.

Despite continued plans to pursue her major, aversive experiences appear to play a part in which path Anna decides to follow. While she has persisted in her field thus far, Anna may still be negatively impacted by the bias and hardships she has experienced. More specifically, Anna appeared to be impacted by a lack of social support in the midst of a chilly climate. Beasley and Fischer (2012) found that students' decisions to stay or leave STEM fields was impacted by their experience of stereotypes. Performance anxiety, a result of exposure to stereotype threat, could then lead to a higher rate of attrition for those holding marginalized identities in their field (Beasley and Fischer, 2012, p. 442). For those who do not leave their field, they may continue to face stereotypes or gender biases, both within their major and once in the field, which may then impact choices later on in their career decision making process.

Grit and Pride in the Female Identity

Before her internship, Anna faced the "weed-out" culture of her engineering program. One class in particular that tends to be difficult for students is calculus, a requirement to advance within the major. A high achieving student in high school, Anna was not pleased with failing the course her first semester of college. "I called my mother because I was so disappointed in myself. She asked what I was going to do. When I said "retake it?" she said "Yeah, you are." This was when Anna reflected on values instilled in her that allowed her to fight against an internalized fear of failure. "I come from a very classic Midwestern family where you can be sad about it for a day, but if you're not going to fix your problem, you can't be sad about it anymore." Anna characterized her persistence and determination as being rooted in her family values. She stated the following:

> I never really appreciated my Midwestern values until I came to college. My parents taught me grit and that is one of the best things about me. I'm not going to give up. Engineering can be difficult, but you have to have the grit to stick with it.

According to Anna, her grit has been instrumental in addressing gender stereotypes and the pressure to assimilate into male dominated spaces. Describing a female peer who "assimilated" into the male culture by acting like "one of the guys", Anna shared how she can see the protective benefits of that strategy, as it allows one to easily navigate the field. "My boss was scared of her. She got catty with her and said "No, you can't treat me this way". That's how you survive the situation, otherwise a boss will just run you over." However, Anna recognized that this dampened the experience of her peer's gender expression. "I've seen her stand up, but because of that method, she's not standing up to her as a woman. She's standing up as someone who has assimilated to male traits." While powerful, Anna has realized this is not what she wants for herself.

> I don't want to choose. I want to be a woman in engineering who isn't catty and doesn't fight and doesn't create tension with other women, but I don't want to be the dude. I'm feminine and I want to be a woman. And I want to bring my female experiences to my workplace. My opinion matters because I'm different in this situation.

For Anna, being a woman is an integral part of her engineering identity and vice versa. She does not delineate between the two constructs and wants to retain her identity as a female engineer without compromising or placating to the male cultural norms embedded in engineering. However, when trying to retain this complete identity, she, as well as other women in her field, may be faced with challenges as they work to find their fit in the workplace.

The Importance of Support

The support of peers proved to be instrumental for Anna as she addressed and navigated through negative stereotypes during her internship. Through conversations with others, she was offered affirmation in that what she was experiencing was not unusual or unexpected.

> I came back from my first session and the program told me I wasn't crazy. Having all of those other stories they shared were exactly what I needed in the moment. My classes were so supportive and helped teach me how to manage all these things that were happening.

Courses within the Women in Engineering Program also proved to be a safe space Anna needed as she processed the hostility and feelings of impostorism that stereotypes could elicit. The classes identified barriers she could face and then identified tools and resources she could use in order to identify issues, confirm they were issues, and then address and confront them. Anna's classes provided language for what she was experiencing in industry:

> We learned the term impostor syndrome in class and I understood that when my manager told me that I was incompetent and it shook my ego... it should check your ego when somebody says that. And I went 'No. I'm perfectly fine at what I do. Just because she treats my male coworker like he walks on water does not mean he's significantly better than me.' And so like, having that class told me that it was okay...it's not okay that these things are happening, but know to deal with them.

Anna spoke highly of her peers, sharing how normalizing it was to discuss barriers and challenges, but also shared how grounding of an experience it can be to work and spend time alongside others who hold similar values.

> I love the program because I work with girls who are girls. They don't assimilate because our program reminds you that you don't have to. I choose to stand with them because it's safer and because it's something I want to encourage.

One may question why students may persist in fields where they experience barriers, such as stereotypes or gender biases, which can have an influential impact on their self-concept. Like

Anna, most female students who enter STEM fields likely do so because of their interest or passion for the field. The sense of solidarity that emerges from this shared experience, especially when exposed to programs like Women in Engineering, seem to be highly motivating for women to keep pursuing their field of choice, especially when they know they have others to whom they can turn to for support.

Reflecting on the differences between school and industry, Anna began to name why support becomes such an important factor of workplace satisfaction. She shared that she understood why certain barriers, such as stereotypes and hostile environments, were situationally present. Although distressing, Anna was optimistic that work environments will start to change in the coming years, as women continue to enter the field and younger male peers bring more progressive mindsets.

> My coworkers who got hired that are recent graduates were so much easier and better to work with than my coworkers who graduated 20 years ago. It is progressing, especially places like [our school] and other Big 10 colleges that are putting emphasis on getting women in engineering and getting diversity within engineering.

Anna shared a wish for her male peers to be more accepting of diversity in order to provide support women need, especially if they are the minority in a given workplace.

> I hope that when I mature and my peers are what's in the workforce, then it'll be a lot better for me and how I feel at the time. I'm hoping that at some point my biases will become dated as there are 20-year old coworkers coming in, in 10-20 years...that my opinions will be dated and that they will have more progressive opinions. And I hope that this is continual improvement for everybody.

Sophia

Being a Woman in the "Code Bro" Culture

"People don't expect me to say I'm an engineer, which is weird. And that bothers me." As a sophomore, Sophia is working on finding her footing within the male dominated major of electrical engineering. Heavily involved in STEM related clubs in high school, Sophia has had to adjust to having fewer female classmates in college. "This semester I feel like I've experienced new emotions just because this is so weird to me." This change has been particularly noticeable in certain classes that have had an impact on Sophia's motivation.

> I've never experienced this few girls anywhere in my life before. When I had my lab practical, it was just me and one other girl. There are two girls in my forty-person lab section. I was just standing outside of my lab in this big hallway of guys. I didn't feel like I was a part of anything.

Sophia described her major as being typical of the "code bro" culture. "We're very much in that Code Bro culture. I always think of *The Social Network*, where they're all just coding and drinking." Robinson and McIlwee (1991) defined the "culture of engineering" as a socially defined standard of behavioral and interaction among engineers, which strongly favors the male gender role (p. 406). Because of this, an engineer is perceived as a man who conveys the image of hands-on competence and has a desire to discuss and work on these activities at length (Robinson & McIlwee, 1991, p. 406). The stereotype that "code bros" are constantly working in order to complete more work has led to some misaligned values for Sophia.

> I think electrical engineering's culture is pretty bad because of the culture being toxic, like "Let's pull this all-nighter to finish this lab". I feel like the work life balance is off. Professors should not expect this much from us. I want to have a life.

When asked what she has experienced or thought to herself about being an engineering major, Sophia noted being aware of gender differences and wondering about her fit. "Some

internal part of me is like “Ugh, why are there no girls in here? Should I not be in this major either?” Sophia also shared how constantly facing the stereotype of coding culture has led to a decrease in her motivation.

> I feel like they are very demotivating sometimes. Especially with putting in so much work and sometimes I feel like I know I can do it but I don't want that to be expected of me. So sometimes that's demotivating in general. Your peers are willing to pull all-nighters but you aren't. Am I committed to my major? I am, but I don't want to put my health at risk.

Trying to balance her course work and other aspects of her life were likely already difficult for Sophia, as it is most students. However, when faced with the reality that she would need to retake a difficult course, this motivation might have impacted her self-efficacy even more. It is often common for students to retake classes, especially large, challenging, general education courses which are required to pass if one is to take more major specific courses later on. Retaking a lab course and being one of two women there proved to be a combination of barriers Sophia faced.

> This was a lab I had with mostly guys. I feel like that impacts my motivation too because I feel like my TAs all thought I was dumb. I felt like they talked down to me a bit. My least favorite thing is when you’re sitting, and a TA will take your mouse from you. I just cringe. Like they don’t even trust me to press the right mouse button.

Sophia reported finding herself working harder to do well and to not reinforce negative stereotypes about women in science fields. “It’s really unmotivating when you have a rough lab day and think “They’re going to think all girls are terrible at this” because there are only two girls in here.”

This pressure to do well, paired with her gender identity has led Sophia to be mindful of gender expression as she navigates through the field. Her comments reflect a sense of dissonance

as she maintains her identity as a female but also wants to be accepted by her peers. Her fears indicate that assimilating too much to the "Code Bro" culture could lead to her losing her sense of self.

> I feel the impact of fewer women on culture here. I always worry about dressing more masculine subconsciously for my job, but I want to maintain who I am. Sometimes I worry about dressing more masculine at work and I want to make it a point that I am still a woman and I am doing my best. I never want to feel pressured to dress a certain way to get people to respect me.

Facing and Reframing Failure

Although retaking classes is fairly typical in a college setting, Sophia's needing to do seemed to have an impact on self-efficacy. "I had to retake a class and I really felt like it reflected on my intelligence. That one? It really hurt." Used to achieving in high school, Sophia did not expect to fail. That failure likely shook her self-efficacy and led to fears about failing again. "I had the worst winter break because I was so upset with myself and I really felt like I had let everyone down." Sophia's reflections at that time were internalized and self-blaming, comparing herself to her brother, who also majored in engineering but did not pursue the field. Thinking back on this time, Sophia shared how she noticed herself coping differently than her brother did.

> It's interesting because my brother went through electrical and computer engineering and he failed so many classes and had to switch out. I feel like every time he took a class, he would always blame the professors and everything but himself. But I blame myself before I blame professors or the way the class is structured and stuff like that.

Although she was retaking the class again and felt better the second time around, Sophia seemed to have internalized an expectation that she needed to succeed in the class without asking for external help. This personal responsibility to do well on her own may stem from an

internalized pressure to prove herself as competent in a competitive culture where she holds a minority identity.

> I definitely felt like I was almost too scared to get help sometimes. I've gotten better, but just going to office hours to ask for help is tough because I want to be self-sufficient, even though I know that's not practical all the time.

Although difficult, asking for assistance proved to be a way in which Sophia was able to take responsibility for her own success and use resources that would provide her support moving forward. Having failed the class one, Sophia was intent on doing well the second time. She shared her use of resources, and persistence in making sure she ran through the material so that she understood it.

> I nailed my lab practical and was very happy. I struggled a lot in that class so I had to trouble shoot a lot of things myself to do well. When I got to the lab practical, I knew what the issues were and could fix them on the fly. I learned from my mistakes.

As she progresses within her major, Sophia anticipates facing more systemic and social barriers, but has realized the importance of reframing how she views failure and success for herself.

> Usually I'm not this self-reflective, but I need to be so much nicer to myself this semester if I'm going to stick through it. I was just so miserable last semester that there was no way I could keep this up.

In obtaining success and continuing to support herself as a female engineer, Sophia is combating stereotypes and facing her fears head on. One of the simplest ways to do so appears to be the way she has changed her internal dialogue.

> I feel like it takes a lot for me to feel like I'm doing okay but little things like job experience and support help. I'm also rewarding myself for doing well. I've been trying to be better at taking a step back to be like "You did a good job" instead of

> punishing myself for not doing well. That's a really toxic mindset. If you place all of your self-worth in your grades, you're really going to hurt yourself. I did that a lot last year and just had a bad semester, but I've been self-reflective this year and really working on improving that part.

Finding Support and Representation

The male dominated atmosphere of engineering has been found to negatively impact women's persistence. Although women in engineering have been found to be bright and competent, many leave the field, dissatisfied with their experiences in industry (Robinson & McIlwee, 1991, p. 412). In their study, McIlwee (1991) found that a sample of women reported feeling dissatisfied when they felt "pegged" by male peers as incompetent, leading to greater feelings of insecurity and less connection to male co-workers. In situations where they are the minority, women may be more likely to feel pegged more often than not.

For Sophia, finding social support proved to be needed, especially after a day in which she felt singled out in class. She shared how she finds this support through a group of female engineering students whom she spends most of her time with. Through talking with them, she has found comfort in their shared experiences. "I have peers who are in my degree too, but older, so they remind me that it was hard for them too and that everyone fails a class. I'm not abnormal."

Being surrounded by like-others seems to have added to Sophia's confidence in her major, increasing her self-confidence and sense of competency. A study by Maltese and Cooper (2017) found that women tend to rely more heavily on support from others, particularly mentors, as they persist in STEM fields, whereas the most influential factor of male persistence is self-driven interest. Interestingly, the support from peers within a female's major field was found to be strongly associated with female's completion of a STEM degree, as well as the grades they received in their first STEM classes (Maltese & Cooper, 2017). Seeing female representation

within her department and work experiences also seems to have had such an impact on Sophia. "My new professor is female, which is very cool. Even though the class is all male, having a female teacher is like 'Okay, this is reassuring.' Another reassurance was her chance to spend time working with female peers and a female mentor the previous summer.

> It was really fun and hands-on. There were two interns and we were equals. I had a female mentor and she was my favorite person. She was a tiny powerhouse and it was just nice to see her and be inspired.

Emma

Measuring Up to "The Guys"

"I think I might struggle to get far as somebody who's mediocre. I think I'd get overlooked, honestly." Since her first year of college, Emma has been working hard to get ahead as a Computer Information Technology (i.e., CIT) major. In addition to throwing herself into course work, she has been working as a university IT technician in an effort to secure a position as a Cyber Security project manager for FaceBook. Emma's intrinsic motivation has played an important role in her success as a CIT major.

When asked why she has worked so hard, Emma shared "I don't know…some of it's being a girl and some of it's because the industry is really competitive." Although seemingly simple, this statement has been supported by the literature. Lane, Goh, and Driver-Linn (2012) found that perceptions of individual women are filtered through stereotypes about their gender. When compared to men, women are stereotyped as less intelligent and less competent in mathematics and science. As the minority group in the setting, they may be seen as outsiders or extra competition. Describing her experience as a CIT major, Emma highlighted stereotypes of female CIT majors that she has been working hard to avoid.

> There's a stereotype that girls aren't necessarily competent, that's the word I'd use. Not that they're stupid. Just that they don't apply themselves or they sort of skate by. They don't tend to be quite as technical. We tend to choose more project management or IT tracks instead of the super technical ones.

Often when there are one or few women within a group, this may lead to experiences of being seen as the "token" of the group (Kanter, 1977). The solo woman might see her work as being subjected to much more scrutiny than her male peers and at that point her work may be regarded through a stereotyped and gendered lens (Ridgeway, 2001). Emma noted frustration with this double standard. "You're held to a higher standard but then at the same time, everyone thinks you're the lower standard."

Emma described how quickly gender norms inform assignments in group projects, pigeonholing women to only fill certain parts.

> In certain types of projects, women tend to get cut out of the group. I was in a coding project where there is only so much you can do. Everyone else (i.e., male peers) took it over. I don't know if was that I'm more of an infrastructure person than a coding person, but I definitely was not included.

Emma's experience closely matches Mannix and Neale's (2005) description of "out-group" members, where single female members on male technical teams may be the subject of more stereotyping than male members may be. Emma's also heard of this happening to other women within her major. "I've heard stories from my friends where during a group project one guy just physically pushed her away from the computer."

While Emma realized these events were occurring, she was also questioning what it would mean if she were not to meet her goals because of experiencing stereotypes or navigating through certain relationships with male peers.

> I think it would tell me that I'm not the person I wanted to be. That I'm not competent, smart, or motivated. Something like that. I think that I would probably look like a failure in everyone else's eyes too. That would bother me if it happened.

Having put in tremendous amounts of effort thus far, Emma seems to have developed a strong self-efficacy that has encouraged her to pursue her goals and persist despite the challenges she has faced. Social comparison to others in her field, especially when the male majority peer is chosen over the female minority, may be an influential factor to Emma's drive to succeed in a major underrepresented by women.

Gender Expression Inside and Outside of a STEM Major

Turkle (1995) described the masculine traits (i.e., masculine, White, and heterosexual, working extensively on hard programming) which are most often associated as the occupational culture within IT. Often these expectations are what conflict with the work-life balance women want to maintain. Emma spoke to the extra work and time required of her to maintain her value of social connection.

> I have to especially reach out to friends that I made elsewhere, which is hard to do. I don't really get to socialize. I often feel kind of cut-out of female life. It's hard to find time to spend with female friends to talk about and do female things.

Settles (2004) found that women who identify more with a woman-scientist identity in which they struggle to maintain both identities are also likely to report poorer academic science performance, lower self-esteem and life satisfaction, and more depression. As she has been focused on academics, which also takes up much of her time, Emma spoke to this experience.

> I think it's especially a challenge for me because most of my friends are not in my major. There aren't a lot of girls in my major. If I'm [spending time with girlfriends] it's something that I have to maintain completely separately.

Such challenges can have long-term impacts on women, such as long-lasting depression (Settles, Jellison, & Pratt-Hyatt, 2009). This is particularly detrimental for women in STEM fields, as they are more often surrounded by the male majority. Emma elaborated further, sharing the impact of holding a minority identity:

> I feel like I often get left out. I'm a very social person, a normal girl. I've always had a ton of girlfriends and normal relationships. But when you're one of right people in a major of over 100 dudes? You don't necessarily find your girlfriends among your classmates, so it's isolating.

Emma shared how while there aren't many females in her major, she still must integrate herself into the culture of her major in order to continue on. This is not without its own challenges, in which her sense of self is challenged.

> Eventually you just get treated like you're another one of the guys. Lots of my friends are guys. If I'm in the room and they're talking about guy stuff? That used to bother me, but now…I don't know. I'm just so used to it at this point and they're used to me being there.

Although integrated into the culture of her major, Emma's experiences demonstrate the struggle of holding a minority identity and trying to prove one's worth in a field that seems set her up for failure. Emma's experiences demonstrate a fear of failing and confirming stereotypes, which drives her success and motivation to keep moving forward toward her goals. Because of this work ethic, she is forced to sideline her relationships with female peers, which may increase her feelings of isolation.

Trends across Cases

Based on prior research, women's lack of representation in STEM is not linked to a failure to achieve but rather to a lack of persistence (Lee, Alston, and Kahn, 2015). Women have been shown to perform equally well as men in academic settings (Benbow & Stanley, 1982;

Feingold, 1992). The purpose of these vignettes was to explore women's experiences in STEM fields and possibly uncover and understand what factors may be contributing to differences in persistence. Results from the interviews revealed four recurring trends across the three cases. What follows is a cross case analysis of the responses provided by Emma, Sophia, and Anna. The first trend emphasizes persistence within their chosen fields. The second trend explains belongingness and fit. The third trend indicates the importance of social support.

Persisting despite the presence and threat of stereotypes

Although a majority of the women interviewed in this study indicated that they had experienced stressors such as exposure to stereotypes, gender bias, and sexism, most of the women chose to stay in their STEM fields. Across vignettes, Anna, Sophia, and Emma decided to stay in their majors despite feeling like the minority amid exposure to harmful stereotypes and biases. Although recognition of stereotypes has been shown to have a detrimental impact on those in marginalized groups, the women in this study persisted despite awareness and meaning of the stereotypes. Thus, the awareness of stereotypes did not directly translate or have direct impacts on how each of these women approached barriers within their majors. For example, despite negative experiences in her male-dominated lab, Sophia persisted and was successful in her lab practical. Emma obtained an internship she wanted, and Anna completed her internship. One common variable across these vignettes is how each woman perceived her challenges and interpreted feedback given to her. Sherman et al. (2013) spoke to the importance of self-affirmation, which increases self-worth and allows individuals to focus on their personal qualities, which can successfully reduce the negative impact of identity threat. Simpson and Maltese (2016) found that despite past and present failures, most participants in their study on STEM students continued within their pursuit of STEM. Past experiences may have led each of

these women to developing some aspect of "grit", which Anna named in her interview. Duckworth et al. (2007) define grit as a trait which entails working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress" (p. 1087-1088). Possession of grit in any amount may be what has been encouraged women in this study to pursue their chosen fields, without having a large impact on their science self-efficacy and overall sense of competence.

Responding to biases and stereotypes

Another trend in the interview data pertained to the women's perception of their male counterparts both in classroom settings and in the workforce. While Sophia compared her experiences in STEM to those of her brother, Emma spoke about feeling like peers chose her partner over her when they had questions and Anna spoke to a male peer receiving preferential treatment. For example, when faced with adversity, Anna chose to call upon her grit and social resources. Sophia confided in her peers but then chose to refocus her attention on herself. Emma noted frustration but did not appear to let it impact her goal-retention or sense of self. Lee, Alston, and Kahn (2015) explored how achievement motivation impacts women in STEM's choices to persist in academic settings, finding that it can significantly mediate the relationship between identity threat and performance. They framed this mediation as being impacted by how students choose to approach performance situations, which could also be translated into how female students perceive biases and stereotypes as they occur. Lee, Alston, and Kahn (2015) cite work by Darnon et al. (2009) stating that typically identity threat triggers individuals to act in avoidance of goals. However, identity threat may also encourage students to approach their goals, which then may motivate them to perform or even out-perform their peers, leading to

higher performance outcomes. This was evidenced in Emma's account of striving to do better than her partner and Anna's determination despite negative feedback from her boss.

The consequences of fitting in

Feeling like one "fits" in their environment was a trend that emerged from the qualitative analysis. While Anna spoke about the biases she faced at her internship, Sophia highlighted feeling outside of the "code bro" culture, and Emma was focused on being mistreated at her part-time job. Walton and Cohen (2007) used the term belonging uncertainty to describe how individuals in stigmatized groups are more uncertain of the quality of their social bonds and are thus more sensitive to issues of social belonging (p. 82). In situations where women are the minority, like Sophie in her lab and Anna at her internship, they are more likely to be exposed to negative stereotypes and experience threat associated with holding those identities. While this may have an impact on their academic performance, experiencing stereotype threat could also be considered as having an impact on women's sense of belongingness in their fields. Because the stereotype highlights the awareness of being the "other" in these settings, women may also be more sensitive in trying to form relationships with male peers to gain acceptance (Walton et al., 2015). Gender disparities can also be viewed as a sign that women do not belong or cannot succeed in these fields (Walton and Cohen, 2007). This can be difficult when acceptance also comes with the price of shedding their female identities or assimilating into the male-dominated culture which, through these interviews, we found women are reluctant to do because it isolates them from a major component of their overall identity. While some do assimilate, such as Lauren disconnecting from her female friendships and feeling out of touch with her female identity, others like Anna fight to highlight that identity in male dominated settings, which may cause them grief and backlash. Both choices can be difficult to maintain and leave women feeling as if

something is missing or with increased frustrations toward their environment and co-workers. This lack of balance impacts many women in STEM fields, who are forced to make choices about their priorities and how they may reach their goals while also maintaining their sense of self.

Connecting belongingness and social support

A final and crucial trend across interviews was the link between belongingness and the importance of social support, particularly in female representation in STEM fields and finding comradery within majors. While Anna and Emma spoke highly of support they have found on campus and their continued maintenance of such relationships, Emma noted how maintaining such friendships can be a struggle when one is fully engrossed in their major. This highlights the struggle of work-life balance mentioned in the previous trend. While in settings where they are the minority creates a sense of belonging uncertainty, interviews also revealed the importance of social support networks. When surrounded by other females in STEM or by those viewed as social support (i.e., family, friends, Women in Engineering program), women seemed to gather an energy that also allowed them to continue on in their pursuit of a STEM degree.

There is much literature that speaks to the value of female role models in STEM fields. Studies suggest that it increases not only overall diversity in the field but also provides women with the ability to relate to a similar-someone (references). When females see individuals who are counter-stereotypic or are examples of high-achieving role models, the negative implications of identity threat have been found to be mitigated (Plant, Baylor, Doerr, & Rosenberg-Kima, 2009; Stout, Dasgupta, Hunsinger, & McManis, 2011). Stout et al. (2011) found that when female engineering students were exposed to a female role model, compared to male students

presented with male role models, they were more likely to have a higher intention to pursue their engineering degrees, having a positive impact on retaining female students.

Seeing other female peers succeed and persist has a similar impact on female students in STEM. While they may be separated by year in school, classes they are in for the semester, or by internship experiences, female students find ways to check-in with one another. This can help normalize their experiences and reaffirm that sense of belongingness. For example, although Anna felt unsupported by her female role model at her internship site, she spoke highly of supportive friends whom she would visit with on weekends and who encouraged her to persist throughout the work week. Additionally, Anna spoke highly of the women in her engineering classes and peers who reaffirmed that her experiences were not unusual and provided her with information about what she was experiencing. Sophia, who also cited feelings of isolation in classes, referred to the female group of friends she confides in. Conversely, Emma spoke to the lonely impact of not having such a social network present in her school life. Having such social support likely increases women's self-worth by affirming values related to the self, such as personal qualities and relationships, which is known as value affirmation (Sherman et al., 2013). This affirmation can then be used to protect against the impact of identity threat because it affirms personal values which are different from the negatively stereotyped identity (i.e., being a woman in STEM). Cohen and Garcia (2008) found that when surrounded by peers who frame social adversity as universal and temporary, individuals experience less anxiety and negative affect tied to belonging uncertainty. Thus, it is unsurprising why so many females across interviews spoke to the importance of not only being surrounded by female peers but also seeing more diversity in STEM fields.

CHAPTER 5. DISCUSSION

This study used stereotype threat and impostor phenomenon theories as frameworks to examine the impact of stereotype threat and feelings of impostorism on women undergraduate STEM students' academic satisfaction and persistence within STEM fields. This chapter provides a summarization of the findings and discussion of the implications of the results. First, the results of the preliminary findings and primary hypotheses are interpreted. This is followed by a discussion of the limitations of the study, recommendations for future research, and implications for counseling practice and social advocacy.

Preliminary Analyses

Preliminary analyses were completed in order to define variables, find the internal reliability of the measures, and better understand the relationships between variables. Descriptive statistics demonstrated that the mean scores on impostor phenomenon, science self-efficacy, fear of failure, academic major satisfaction, and persistence fell at about the scale midpoints. The mean scores on stereotype threat, fear of success, and climate fell below the midpoints.

Quantitative results revealed that participants in this study endorsed experiencing lower levels of stereotype threat than would be expected, as the mean fell around one standard deviation lower than the midpoint. This was also prevalent in the qualitative interviews, as participants were able to acknowledge which stereotypes exist in their major fields; however, they did not personalize these stereotypes to themselves. In several of the interviews, women quickly named the common stereotypes about what individuals in their majors are like, and several also mentioned stereotypes about women in their majors. Although these stereotypes were named, when asked if they felt they experienced or exemplified these stereotypes, women

in this study denied or stated they did not believe they had been subject to those stereotypes, which would explain the lower quantitative mean in the descriptive data.

Conversely, the mean for impostor phenomenon symptoms was approximately half of a standard deviation above the midpoint, suggesting that the women in this study were more likely to endorse experiencing impostorism than feeling stereotyped. Although they were not prompted to speak to their experiences as women in the field through questions asked in the qualitative interview, several participants chose to frame their experiences in their majors this way. In the vignettes provided in Chapter 4, Anna, Emma, and Sophia spoke to different experiences whereby they questioned what it meant for them to be a woman in their chosen majors and what it may mean for their future careers and work-life balance.

One reason why these patterns emerged may be tied to experience of the educational climate in their respective majors. Correlations demonstrated that as the experience of chilly climates is endorsed, female participants are more likely to be aware of negative stereotypes and experience impostor symptoms at significant levels. Although scores on both stereotype threat and impostor phenomenon were endorsed, scores on stereotype threat were relatively low. This suggests that women in this study may have been more aware of stereotypes in their fields, leading to the use of protective strategies, such as disidentification with common stereotypes. However, as impostor phenomenon is less discussed in the common vernacular, these tendencies may be harder to notice and control. Within impostorism, participants were more likely to endorse fears of failure than success, as the fear of failure mean was above the midpoint and fear of success mean was just below the midpoint. Although both types of fears were positively correlated with impostor phenomenon at a significant level, participants may have been more cognizant of fears of failure than fears of success. Interestingly, there was a stronger correlation

found between fear of failure and impostor phenomenon, whereas the correlation between fear of success and stereotype threat was stronger. This may indicate that as one's impostor fears increase; they are more likely to be aware of not wanting to fail and confirm that they are an impostor. In the qualitative interviews, this was observed as participants questioned their competency and fit within their majors (i.e., "Is this what I'm supposed to be doing?"). Relatedly, when a woman achieves success in her field, she may experience more fears of success which may make her more aware or mindful of negative stereotypes about what it means to be a successful woman in her field (e.g., "bossy", "cold"), thus increasing the fear of confirming stereotypes (reference). Additionally, the stronger one's experience of stereotype threat, the more they fear success, which could further isolate them from their peers, creating a more significant lack of belongingness within one's field (reference).

Science self-efficacy appeared to play an integral role in the predicted relationships amongst the variables. The mean score for science self-efficacy was higher than the midpoint, indicating that participants held a high amount of science self-efficacy. As self-efficacy is linked to confidence and feelings of competency (Cech et al., 2011; Cheryan et al., 2009), this could serve as a protective factor when considering academic major satisfaction and persistence within STEM fields despite experiences of stereotypes and impostorism. Although correlations demonstrated that experiencing a chilly climate, stereotype threat, impostor phenomenon, fear of success, and fear of failure were associated with lower science self-efficacy, other external variables that were not measured but were mentioned in the qualitative interviews, such as grades, social support, and "grit," may increase self-efficacy. If self-efficacy is maintained, women are then significantly more likely to experience academic major satisfaction and persist within their fields. This demonstrates that although several variables may have negative impacts

on how women experience their majors, other key variables may exist that continue to support women as they navigate through their majors.

Primary Hypotheses

The hypotheses in this study were focused on the direct and mediated relationships across variables. Indirect effects demonstrated that six of the eight hypotheses were supported at significant levels, however due to poor model fit, these results may not be accurately interpreted. Stereotype threat and impostor phenomenon were used to better understand the external factors which may impact the internal experiences of women in STEM majors. Hypothesis 1 predicted that stereotype threat would have a mediated effect on fear of failure via science self-efficacy. Inspection of direct path coefficients indicated that stereotype threat was a negative predictor of science self-efficacy, supporting hypothesis 1a, and that science self-efficacy was a significant negative predictor of fear of failure, supporting hypothesis 1b. This indicates that stereotype threat leads to a decrease in science self-efficacy, which, in turn, leads to a decrease in fear of failure. This then produces a positive indirect effect, with stereotype threat leading to an increased fear of failure by decreasing science self-efficacy first. Thus, science self-efficacy serves as a mechanism through which fear of failure experiences a positive effect, supporting hypothesis 1.

Similarly, hypothesis 2 predicted that science self-efficacy would mediate the relationship between stereotype threat and fear of success, with science self-efficacy being a significant negative predictor of fear of success. The positive indirect effect here demonstrates that stereotype threat was associated with a decrease in science self-efficacy, which in turn was associated with a decrease in fear of success. Thus, science self-efficacy was the mechanism responsible for the positive indirect relationship between stereotype threat and fear of success,

supporting hypothesis 2 as well. This was also represented in the qualitative findings. Participants described fears about their choice in major, wondering if they "picked the wrong major" or if they were in the wrong career path. Notably, experiences with past fear seemed to encourage women to reflect on failures as something they could prevent and have control over. Several participants shared how after a failure, they critiqued themselves in order to excel the next time or to "reflect on [my] intelligence." In an interview with Keri, a sophomore in mathematics who scored moderately on the stereotype threat measure, she explained that experiences in her field cause her to want to succeed on her own, in order to not been seen "as a user" of male peers. She shared that this then raises the need to work harder in order to not fail and confirm that women need men's help to succeed. These results demonstrate that science self-efficacy is an important mechanism needed to reduce the negative effects of stereotype threat. When women experience higher levels of science self-efficacy, this should result in women holding fewer doubts about their ability to succeed in STEM and a lower fear of success, developing greater perceptions about their agency and control over their career development.

Hypothesis 3 predicted that science self-efficacy would mediate the relationship between impostor phenomenon and fear of failure, hypothesis 4 predicted that science self-efficacy would mediate the relationship between impostor phenomenon and fear of success. Positive indirect effects were found for each of these paths, supporting both hypotheses. In the model, impostor phenomenon showed a significant negative association with science self-efficacy, thus as women increasingly feel like impostors in STEM they tend to experience lower perceptions of science self-efficacy. Decreases in science self-efficacy are in turn associated with decreases in fear of failure and fear of success. Science self-efficacy thus appears to transmit the positive influence of impostor phenomenon on fear of failure as well as fear of success.

Hypothesis 5 predicted that fear of failure would mediate the relationship between science self-efficacy and academic major satisfaction, while hypothesis 6 predicted that fear of success would mediate the relationship between science self-efficacy and academic major satisfaction. Results indicated a positive direct relationship between science self-efficacy and academic major satisfaction, however, the introduction of fear of failure of failure as a mediator did not seem to impact this relationship significantly as the indirect effect was not significant. While science self-efficacy has a significant negative impact on fear of failure, fear of failure does not have a significant impact on academic major satisfaction. Fear of failure does not significantly mediate the relationship between science self-efficacy and academic major satisfaction, therefore, hypothesis 5 was not supported. This lack of significance may be linked to how fear of failure is experienced by the individual. Fear of failure may be internalized as an energizing form of motivation, resulting possibly in greater effort and improved performance. However, the negative emotional characteristics of fear of failure, such as worry or anxiety, likely has a detrimental impact on positive affective outcomes such as satisfaction. Thus, although increased academic performance might be associated with greater academic satisfaction, any effects of performance might be negated by reduced feelings of well-being. Additionally, fear of success does not mediate this relationship, as is demonstrated by the non-significant negative indirect effect, thus hypothesis 6 was not supported. A similar relationship may be occurring here, where motivating properties of the fear of success are counteracted by the negative affective properties, such as fear creating distance between one's self and peers. Data from the qualitative interviews offered valuable information for why this may be the case. In her interview, Anna spoke about the Midwestern "grit" her parents instilled in her. This grit may be what is helping students maintain higher levels of self-efficacy and may be protecting them from

experiencing fears related to failing or succeeding. Likewise, Angi, a first-year student in mechanical engineering explained that although stressors in her major frustrate her, they also "instill a mindset where I feel like I have to do better." Although female students are motivated to remain in their majors because of self-efficacy which reduces fears of failure and success, the affective and behavioral correlates of fear of success and fear of failure may have mixed effects on academic major satisfaction, canceling one another out. Students may then feel that they are equipped to work harder to reach their goals, but this may not necessarily imply a satisfaction with their major.

Hypotheses 7 predicted that science self-efficacy would mediate the relationship between impostor phenomenon and academic major satisfaction. Hypothesis 8 predicted that science self-efficacy would mediate the relationship between stereotype threat and academic major satisfaction. While the paths from stereotype threat and impostor phenomenon to science self-efficacy were both negative, science self-efficacy had a positive direct influence on academic major satisfaction. Thus, both stereotype threat and impostor phenomenon led to an indirect decrease in academic major satisfaction because women's science self-efficacy was decreased first. Ashley, a sophomore in mathematics highlighted this frustration when she shared how not doing well in her courses creates a conflict between "what you really want and what's really hard to do."

The alternative model rearranged several variables to consider other pathways that may influence academic satisfaction and persistence. Although the alternative model fit the data better than the hypothesized and several significant direct and indirect effects were demonstrated, the model still did not fit the data well according to the fit index values. Chilly climate had a positive and significant association with stereotype threat, meaning that as experiences of chilly climates

increased, so did stereotype threat. Impostor phenomenon served also as a significant positive mediator between stereotype threat and fears of failure and success. Although impostor phenomenon had significant positive direct effects on fear of failure and fear of success, these two variables had significant negative direct relationships with science self-efficacy, meaning that they served as significant negative mediators in the relationship between impostor phenomenon and science self-efficacy. This means that as impostor phenomenon is experienced, science self-efficacy will decrease. Although science self-efficacy had a positive direct relationship with academic major satisfaction, the negative mediators of fears of failure and success means that science self-efficacy leads to decreased academic major satisfaction by first reducing these fears. Lastly, a positive indirect effect of academic major satisfaction on the relationship between science self-efficacy and persistence was found.

In both the hypothesized and alternative models, the outcome variable was female participant's persistence in their chosen STEM majors. In the hypothesized model, 28.3% of variance in persistence was explained by predictors in the model, whereas in the alternative model, the predictors explained 29% of the variance in persistence. Taken into consideration, the other remaining variance may be attributable to factors not considered in this study. Although academic major satisfaction may play a role in student's persistence, additional variables must also be considered. Several participants described factors that encouraged or motivated them to pursue their given majors. Anna introduced the concept of "grit," while other interviews suggested that, although participants did not label their experiences as grit, they may have experienced similar feelings or motivating factors throughout their educations. Originally introduced by Duckworth, Peterson, Matthews, and Kelly (2007), grit is defined as trait-level "perseverance and passion for long-term goals" (p. 1087). Their study found that individuals

who held more grit demonstrated better outcomes in a variety of settings than those with lower levels of grit. Duckworth et. al also developed a scale that consisted of two subscales: consistency of interests and perseverance of effort. This scale intended to measure the extent to which individuals stay interested in the same goal over periods of time, as well as the extent to which individuals maintained high levels of effort toward the same goal over time. Although little is known about how grit relates to self-efficacy, goal orientation, and academic outcomes, grit may have played a large role in academic persistence than originally anticipated.

While Anna was the only participant to label her motivation as "grit", several participants in this study shared experiences highlighting how they intended to pursue long-term goals, which is suggestive of some of their own grit. For example, Jess, a sophomore in Civil Engineering who endorsed higher fears of failures on the quantitative measure, described how despite experience internal fears of failure about potentially failing the class again, she still experienced a need and want to succeed despite identified barriers of perceived class difficulty and procrastination. This need to succeed and prove something to herself played a critical role in her perseverance. An additional factor to consider in grit and motivation is the way women in this study conceptualized failure, as it likely played a role in how they developed their "grit" or motivation to persist. Many women in this study noted how failure would have to be large to dissuade them from their goals, creating a higher standard for failure. This standard may have either been a contributing factor to their forming grit or may also be a result of experiencing grit. One participant shared that she would need to experience a 100% chance of failure in order to be dissuaded from pursuing her goals, sharing "if you have a goal and it's something that you're seriously wanting to do, then there shouldn't be anything that stands in your way for any reason at all." The amount of grit experienced may also change across time as women progress through

their majors. For example, a junior in Natural Resource and Environmental Sciences reported how her internal reactions to failure changed from "I'm a failure as a person" to "I failed a class" to "I just didn't handle something correctly and made a mistake." This thought progression may suggest a link between internal motivators (e.g., fear of failure, motivation) and grit development, which may then have an impact on persistence.

Although no hypotheses were formed about the impact of chilly climate on stereotype threat and impostor phenomenon, significant negative direct effects were also found. Chilly climate had positive direct effects on both stereotype threat and impostor phenomenon, meaning that perceptions of chilly climate led to more experiences of stereotypes and feelings of impostorism. As previously stated, both stereotype threat and impostor phenomenon both had negative direct effects on science self-efficacy. Thus, both stereotype threat and impostor phenomenon served as mediators in the relationship between chilly climate and science self-efficacy, meaning that women experienced lower science self-efficacy when chilly climate was experienced.

Limitations

Limitations must be considered for this study. Data in this study may be limited as it was collected from one large, public, Midwestern research university. This university has a focus on STEM programming and is known for its engineering programs. This university's student body is limited in ethnic and racial diversity; however, about 22% of the student body consists of international students. Because of these characteristics and its geographic location in the United States, results from this study may not be generalizable to other regions, environments, or smaller, liberal arts universities or colleges. In this study, a majority of participants identified as White and domestic students, which may not speak to the experience of students who hold

minority identities and/or are from outside of the United States. This is important to note, as the experience of variables such as stereotype threat or impostor phenomenon may differ greatly.

Another limitation is the impact of sampling only undergraduate women in STEM majors. A sample of female graduate students may have impacted results in that graduate students' experiences may differ from those of undergraduates, as they are further along in their studies and have more experiences both in academic settings and in work experiences, such as internships or cooperative education programs. This differentiation of experience in major or program is important in that year in school appeared to have an impact on how participants in this study answered questions in both the quantitative and qualitative portions, with more senior students reported experiences of stereotype threat or endorsing fears of failure. First- and second-year students who declared their majors early reported taking several "first year engineering" courses as well as general education courses. Although more junior students may have been exposed to STEM courses in their majors, many of their courses at the time of interviews may have been general education courses, not specific to their major. Thus, these students may have had less exposure or familiarity with major variables in this study. The trends we expected to see in the results might be more prevalent in older students, graduate students, or those working in academia and industry.

Qualitative results demonstrated that experiences in one's major and with other peers' matter in that these experiences impacts one's perception of their belongingness and fit in their chosen field. While several of the participants interviewed were juniors and seniors who could speak to their varied experiences, a good portion of the study participants were first year students. This first-year cohort might not have been individuals who experienced or were aware of the variables of interest, leading to different qualitative results than might have been produced

with a more mature group of participants. Additionally, they could also be more aware of variables such as stereotype threat or self-efficacy, but due to limited experiences, not endorse variables as much as would have been expected. Another limitation here is that as the interviews were voluntary. The interviewees may not have been individuals who were experiencing variables as much as those individuals who did not participate in interviews. Although there were participants with high scores on impostorism and stereotype vulnerability, when emailed, they did not respond, which may demonstrate a reluctance to speak about their experiences. This also may have been impacted by the time of year interviews were conducted, in mid-April around the end of the Spring 2018 semester.

This study specifically focused on women in STEM fields; however, results may have been impacted by the specific fields. Had we included majors outside of the "pure" sciences (e.g., chemistry, physics), we may have gotten different responses. Additionally, if we had split up the four main tenants of STEM into science, technology, engineering, and mathematics, we may have seen a comparison in scores across results. If specific disciplines had been considered instead of the general theme of STEM, there may have been a great variation of women's experiences across disciplines. By doing this, we may have been able to observe differences with experience of stereotype threat, impostor phenomenon, persistence, etc. For example, because more women are found in science than in engineering majors, these differences in how women experience the variables of interest could result in a variation of the experiences reported in this study. This could then impact the focus of what considerations need to be taken for women in specific fields, as they might encounter different types of difficulties or have different needs.

It is important to note that this study relied on self-report and volunteers, in both the quantitative and qualitative measures, thus participants were not screened. This can result in

biased responses and self-selection. Self-selection likely also played a role in the qualitative interviews. It is possible that some participants who participated in this study differed from other participants. For example, students had differing backgrounds, experiences, and exposure to STEM, which may have impacted how they answered items. Additionally, the participant population in this study was primarily European-American, which may make it difficult to understand the impact that these constructs have on individual multiple factors in these analyses. As each of the participants in the study held identities outside of "women in STEM", because of our fairly homogenous sample, it is hard to see the impact that other significant identities in their lives might have had on their major satisfaction and persistence. Another threat to external validity addresses reactivity of participants, who may have answer differently if they knew they were taking part of a study and choose to answer differently or in ways which were inconsistent with their experiences.

The validity of the impostor phenomenon, fear of failure, and fear of success as constructs may also have affected results. Various contradictions in the literature about these constructs may impact their validity. For example, the occurrence of impostor phenomenon has been debated in previous literature, sparking a debate over whether impostor feelings occur in new situations and resolve over time (Bischoff & Barton, 2002) or if these feelings remain consistent across one's career (Fried-Buchalter, 1992; Topping & Kimmel, 1985). Individual differences in how impostor feelings arise may account for variability, in that individual differences in education, family background, and academic habits may have differed. Similarly, because fear of success as a construct has not gathered much attention in recent years, this presentation of fear of failure might have create inconsistencies between measurement and presentation in this sample. If a newer scale had been used to measure fear of success, this may

have contributed differently to overall findings. Similarly, although stereotype threat has internal consistency, its construct validity is still being determined, which may impact how accurate it is in capturing the experience of stereotype threat. While the questions on the scale consider participant's perceptions of stereotypes, it may not be an accurate measure of how stereotypes are experienced. This could be seen in this study, as participants were able to note an awareness of stereotypes but shared that they did not experience them. Thus, students may be aware of stereotypes and their impact, but may not endorse them, either from a lack of internalization or from internalized sexism, given their experience and expectations for what it means to be a woman in a STEM field.

Implications for Research and Practice

The analysis of this mixed-methods study helps to clarify and establish several implications for future research and clinical practice as we continue to study and better understand the impact of internal and external factors on female career-decision making in STEM fields. One consideration for future studies includes the establishment of new and updated scales to measure some of the lesser known variables in this study, such as the fear of failure and fear of success. While these variables are measured as part of the impostor phenomenon scale, when measured separately, the scales are harder to obtain evidence for. For those interested in better isolating these variables to better understand the mechanics and function of these fears, new, more current scales may need to be created and validated, which could be more indicative of their presence. Because there are few scales that quantitatively measure fear of success and fear of failure successfully, a qualitative approach may serve a better fit to gather data on the experience of these fears. Interviews and open-ended questions may allow participants to elaborate on their concerns and further explain their experiences.

Qualitative interviews with participants demonstrated the appearance of several variables that the proposed model for this study did not include. Several participants highlighted how important they had found social support from female peers, whether it be through the Women in Engineering program, classes, or through living communities specifically geared toward facilitating female interaction. Two variables that may facilitate a better understanding of female persistence and identification in STEM may be belongingness and embeddedness. When female students experience isolation or a sense of marginalization, feeling like a "token" may cause them to engage in a process known as belongingness uncertainty. This concept, defined by Walton and Cohen (2007), describes how when stigmatized groups are uncertain about the quality of their social bonds, they may be more sensitive to issues of social belonging (p. 87-88). Such uncertainty may then cause women to remain hyper vigilant to their perceived lack of belonging and create a heightened sense of awareness about being other. Thus, it is understandable that when female students gain more exposure to their peers or female role models in the form of professors or mentors, they are more likely to feel embedded in their programs. Previous research has found that when women experienced a greater sense of belonging in their STEM majors, they also expressed higher STEM academic motivation and confidence and were more likely to intend to persist (Walton, Logel, Peach, Spencer, & Zanna, 2014; Lewis et al., 2017). This is important to consider because when women do experience a lack of belonging, this social perception may activate a specific kind of fear linked to social deviance, upsetting social norms, or causing women to question their gender role orientation (Ethier & Deux, 1990, p. 77). Continued internal experiences like this may then likely increase one's likelihood of questioning if they should remain in their field. However, if counteracted with greater exposure to women, this may be a more effective way to reduce the impact of

stereotype threat or impostor beliefs, as women will then interact regularly with those share similar identities and can support them as they experience barriers within a male dominated environment. A study by Tao and Gloria (2018) found that when female doctoral participants were exposed to other female graduate students, they were less likely to feel like a "lonely only" in their fields, which perhaps also directly has an impact on persistence. Additionally, Dennehy et al. (2017) demonstrated that mentorship from female mentors, and not grades, impacted female students' sense of belonging and self-efficacy beliefs in STEM. This exposure to other women in STEM may play a large role in female's self-efficacy and identification in STEM fields (Stout et al., 2011). Once "embedded" in their fields, variables such as prestige and grit may be more likely to form (Morganson et al., 2014). As women progress in their fields, the more connected they feel, they more likely they will then be to be proud of their accomplishments and the more likely they will be to want to persist, particularly if they are aware of which barriers they have bypassed. This achievement is then viewed as a way to "flip the script" and create positive marginality. Positive marginality refers to the idea that minority group members may reflect on and redefine their non-dominant experiences in a way in which they can view that marginalized identity as a source of advantage (Unger, 1998). This may be a way in which individuals then understand that they barriers they face are the result of structural or cultural processes and not tied to one's own personal inadequacies (Mayo, 1982). The wealth of knowledge tied to these concepts of belonginess, embeddedness, and positive marginalization may offer a new perspective in the consideration of how and why women continue to persist in STEM fields despite environmental barriers.

A significant focus of this study was science self-efficacy, as self-efficacy can greatly impact one's perceptions of their competencies and may be indicative of future intentions to

persist within a field. In this study, science self-efficacy was a negative mediator in various interactions between variables. While science self-efficacy was chosen for this study, future studies may consider other mediators, such as student's expectancies and achievement goals in relation to STEM. Several participants in this study spoke of "grit" and other motivating factors (e.g., family, grades, personal expectations) which encouraged them to continue to pursue their majors, despite negative experiences. A better understanding of what these variables are may add to the knowledge base we have formed about the impact of one's sense of competency and ability to pursue one's goals. Relatedly, there may be additional anxieties or fears unrelated to fears of success and failure that were not considered in this study. A sense of confidence about their capabilities has been linked to women's interest in STEM fields, such as math and science (Lent et al., 2005) and commitment in STEM (Enman & Lupart, 2000), thus it is likely that there are other factors which we did not explore here which may facilitate an understanding of what underscores female's perceptions of their own abilities and which may impact their career development and decision-making.

A final consideration for future work involves further exploration of the ways in which multiple identities (e.g., racial, age, year in school) may impact the experience of impostorism and stereotype threat. The interaction of the multiple identities held, such as race and gender, may certainly impact how women make career decisions in STEM fields. For example, Asian American women might feel less stereotypically threatened because of the positive stereotypes associated with being Asian in a STEM field, however African American women might feel more stereotypically threatened due to negative associations of being both African American and a woman. Year in school might also impact how stereotypes and impostorism are experienced, as first-year students, with less exposure to the field, may feel experience different stressors than

more senior students. Other important variables to consider would include first-generational status, cultural values (i.e., agentic vs. communal), and year in college. While some cultural factors may be interpreted as barriers, the strength of one's cultural background may also serve as a protective factor against perceived academic threats (Ethier & Deux, 1990, p. 62). Just as it is important to consider significant intersecting identities, women's stage in the "pipeline" of STEM may contribute to our understandings of barriers for women in STEM. While this study focused on undergraduate women, with a majority if participants identifying as first years, research done with graduate students and women in the workforce may reveal different how feelings of impostorism change across the career span. As such, a longitudinal study, tracking students from their undergraduate years to graduate studies might also be considered, in order to gather data across several years and consider how these variables may present differently. Continued research across different identity groupings to better understand how intersectionality impacts women's experiences may significantly impact how women's educational and career outcomes are understood.

This study also contributes further to our understanding of interventions and programming that individuals working with female students in scaffolding programs, learning communities, internship sites, advising centers, counseling centers, and Women in Engineering programs might find helpful. In our sample, several students noted their involvement in female support programs on campus, as well as additional support they found from female peers and female professors. As peer support is immensely valuable, reducing a sense of isolation and forming a sense of community, creating such opportunities for female students continues to be important to integrate on college campuses. Female role models are historically lacking in academia. However, for those who did experience a class or mentorship with a female professor,

this demonstrated a huge difference for students, even causing some to say they want to persist in their major so that they can support female students in the future as professionals. In environments where such communities are lacking, professionals working with women who present with impostor tendencies or experiences of stereotype threat should continue to validate these students' experiences while also connecting them with available resources. Although resources or relationships may be difficult to establish in some settings, the effort does have a beneficial impact on students and may have a greater impact on persistence than is currently known. Such programming is also valued when women in STEM enter industry or the workforce, valuing workplace support and demonstrating more overall satisfaction (Foaud, 2017). For those students who do continue to struggle, an emphasis on values exploration may be critical to review with students as they explore what motivated them to enter their chosen fields and what may encourage them to continue in male dominated feelings. For many women, it may be difficult to compromise historically communal values in agentic and individualistic STEM environments (Diekman, Clark, Johnston, Brown, & Steinberg, 2011). However, if reviewed and encouraged, the facilitation of values discussions may encourage women to consider what resources they can seek or how workplaces have change in order to assist them in establishing or finding workplaces that hold values congruent to their values, impacting persistence in a different way. Regardless of the support offered to women in STEM, it is apparent that professionals working with these students in any context must be aware of the various barriers they are facing while also validating and normalizing their experiences.

Counseling psychologists may play an integral role in supporting female students in STEM as they navigate environmental and social challenges that appear to be prevalent in these fields of study. As counseling psychology values understanding person-environment fit, working

with female clients in therapeutic settings or alongside STEM faculty and staff to better understand and be aware of how environmental factors, such as a "chilly climate" or the perception of stereotypes may be a necessary step. Increasing the awareness of how female students may perceive their environments and their peers and addressing these concerns earlier on in the process of study may offer female students support outside of specifically designed programs, such as Women in Engineering programs. Additionally, this increased awareness may then speak to ways in which a greater focus on female career development in STEM can be impacted by variables like stereotype threat or fears of failure or success, as the social implications of these factors may lead to higher attrition rates of female students. Using a preventative and educative developmental perspective, by encouraging or facilitating those in STEM fields to directly address and establish ways in which female students may be supported by their academic programs and peers, this may lessen the internal experiences of some of these variables, particularly the impostor phenomenon or stereotype threat.

Conclusion

To contribute to the efforts of increasing women's representation in STEM, the present study examines how variables like the impostor phenomenon and stereotype threat have an impact on undergraduate women's science self-efficacy and academic major satisfactions. In combination, these factors may interact and influence STEM student's career decision-making processes. Quantitative results from this study demonstrated several indirect positive effects of variables on one another, suggesting that there are multiple variables relationships which may form when students experience more than one environmental stressor at a time. Supplementary qualitative results underscored the impact of stereotype threat and impostorism, as well as the importance of connectedness and support in the pursuit of persistence in STEM fields. Future

studies may be designed to improve on the limitations of this current study and explore how factors like belonginess, embeddedness, motivation, and increased social support may impact women's motivation and persistence within their STEM fields, perhaps interacting with the impostor phenomenon and stereotype threat in a way not yet predicted.

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APPENDIX A. PURDUE UNIVERSITY IRB APPROVAL

PURDUE
UNIVERSITY

OFFICE OF THE REGISTRAR

To: IRB Administrator/Chair

From: Jerry Ross, University Registrar

Date: 2/14/18

Subject: Data Agreement Approval for Research Study

Project Title: The Role of Stereotype Threat and Imposter Phenomenon in Predicting Ur

IRB Number: 1802020223

This memo is in regards to the access of restricted student data requested by Eric Deemer , principal investigator for research purposes. The Office of the Registrar reviewed the IRB Proposal and the Data Agreement to ensure proper use of the student data including storage and destruction. The investigators will pull all student data and agree to withhold small subsets of student populations if they determine that students can be identified by race, gender, age or other demographic characteristics.

The following data elements will be pulled from COGNOS:

Purdue undergraduate students' email addresses

610 PURDUE MALL • WEST LAFAYETTE, IN 47907-2040
(765) 494-8581 • FAX: (765) 494-0570

PURDUE
UNIVERSITY

OFFICE OF THE REGISTRAR

The co-investigators will extract student data through the University approved reporting tool (COGNOS) as outlined in the data agreement. All data must be destroyed, as defined in the data agreement, by December 31, 2018 . Individual student data will not be shared and only summary (non-identifiable) data will be published.

I approve of and co-investigators accessing the student data as outlined in the data agreement.

C: , Principal Investigator
Kathy Wierzchowski , Co-Investigator

610 PURDUE MALL • WEST LAFAYETTE, IN 47907-2040
(765) 494-8581 • FAX: (765) 494-0570

APPENDIX B. RECRUITMENT EMAIL

Dear Purdue Student,

My name is Kathy Wierzchowski, and I am a doctoral student in Counseling Psychology at Purdue University. I am currently conducting a study (under the supervision of my advisor, Dr. Eric Deemer) to better understand how women's choice to major in a STEM field may be related to their thoughts and emotions about themselves.
If you are a female 18 years of age or older and are enrolled as an undergraduate student at Purdue University, I would greatly appreciate your thoughts and perspectives.

The survey consists of demographic information and 9 measures. It will take about 10-15 minutes to complete the study. The survey is anonymous, and your participation is completely voluntary. You may, of course, withdraw from it at any time. Additionally, you may skip any survey items that you want.

If you are interested, please complete the on-line survey by following the web link below.
https://purdue.qualtrics.com/***

Thank you very much for helping me with this research.

Please feel free to forward this e-mail invitation to your friends who are eligible to participate in this study.

Kathy Wierzchowski, kwierzch@purdue.edu
Eric Deemer, edeemer@purdue.edu

APPENDIX C. PARTICIPANT INFORMATION SHEET

RESEARCH PARTICIPANT INFOMRATION SHEET

What is the purpose of this study?
The purpose of this study is to better understand how women's choice of academic major may be related to their thoughts and emotions about themselves. Your participation is not required, but it would be greatly appreciated as it can contribute to research on academic development.

What will I do if I choose to be in this study?
If you agree to participate in this study, please check the "I am ready to participate" box below and then click the ">>" button. You will be asked to complete a survey including a demographic questionnaire. Instructions will ask you to rate items on a provided scale. You will submit your responses when completed.

How long will I be in the study?
The completion of the survey will take approximately 10-15 minutes.

Will I receive payment or other incentive?
There is no payment or incentive to participate in the study, but the researchers would greatly appreciate your participation to help further our understanding of the research topic.

What are the possible risks or discomforts?
Participation in this research involves minimal risk. Neither the online survey nor the computer-based task are believed to contain questions or involve procedures that would cause you discomfort. The risks involved are no greater than the participant would encounter in daily life or during the performance of routine psychological exams or tests.

Are there any potential benefits?
Your participation may not directly benefit you. However, the resulting research may benefit society indirectly by furthering our understanding of the implications of women's academic choices for their career development.

Will information about me and my participation be kept confidential?
All information provided in the survey will remain confidential. Only the researchers will have access to the data, which will be downloaded from a secure internet server (qualtrics.com) and stored on the researchers' password-protected computers. Data will be deleted from their computers after it has been analyzed. Data gathered from this research may be presented in scientific outlets, but this data will be based on *average* responses, not individual responses.

What are my rights if I take part in this study?
Your participation in this study is voluntary. You may choose not to participate or, if you agree to participate, you can withdraw your participation at any time without penalty or loss of benefits to which you are otherwise entitled.

Who can I contact if I have questions about the study?
If you have questions, comments or concerns about this research project, you can talk to one of the researchers. Please contact Kathy Wierzchowski (kwierzch@purdue.edu) or Dr. Eric Deemer (edeemer@purdue.edu).
If you have questions about your rights while taking part in the study or have concerns about the treatment of research participants, please call the Human Research Protection Program at (765) 494-5942, email (irb@purdue.edu)or write to: Human Research Protection Program - Purdue University
Ernest C. Young Hall, Room 1032 155 S. Grant St., West Lafayette, IN 47907-2114

We suggest you print this page for your records.

Clicking ">>" in the lower right portion of your screen indicates that you have read and understand the information provided above, that you willingly agree to participate, that you are aware that you may withdraw your consent at any time and discontinue participation without penalty. If you choose not to participate, simply close your web browser and the study will be terminated.

>>

APPENDIX D. DEMOGRAPHIC QUESTIONNAIRE

Demographic Information

Please answer the questions below which whichever answer applies best.

1. What is your current academic standing?
    a. First-Year
    b. Sophomore
    c. Junior
    d. Senior
    e. Other (Please specify)

2. How do you identify?
    a. Woman
    b. Trans Woman
    c. Gender-Queer/Gender Non-Conforming
    d. Not listed above (please specify)

3. Age: _____

4. Do you consider yourself to be:
    a. A Domestic student
    b. An International student
    c. Other: _____

5. Race/Ethnicity
    a. Asian or Asian American
    b. Black or African American

c. Hispanic or Latina

d. Native American or Alaskan Native

e. Native Hawaiian or Pacific Islander

f. Arabic/Middle Eastern

g. White or Caucasian

h. Biracial/Multiracial

i. Not listed above (please specify)

6. What is your generational status?

a. 1st Generation (you were born outside of the United States and moved to the United States)

b. 2nd Generation (you were born in the United States and one or both parents were born outside of the United States)

c. 3rd Generation (you were born in the United States, both parents were born in the United States, and all grandparents were born outside of the United States)

d. Not listed above (please specify)

7. Was English your first language?

a. Yes

b. No

c. Learned multiple languages simultaneously

8. Major(s) or field of study: _____

9. To what extent is the breakdown of sexes equal in your field of study?

a. My sex is a very small minority in my field of study.

b. The sex breakdown is about equal.

c. My sex constitutes the vast majority in my field of study.

10. What was your overall GPA last semester? _____

11. Do you currently live in or have you ever lived in a learning community at Purdue?
    a. No
    b. If yes, which one: _____

12. Have you changed/transferred majors/academic field of study?
    a. No
    b. Yes
        i. If so, what did you transfer from/into?

13. Please select all that apply. Do you plan on completing:
    a. A Cooperative Education Program (Co-Op)
    b. An engineering learning experience or internship
    c. Undergraduate research experience

14. What are your intended career aspirations?

APPENDIX E. STEREOTYPE VULNERABILITY SCALE (SPENCER, 1994)

For each question, please select the number that best indicates how true the statement is of you. Please answer all items.

How often do you feel that because of your gender…

1. Some people believe that you have less ability.

1 2 3 4 5
(Never) (Almost Always)

2. If you're not better than average, people assume you are limited.

1 2 3 4 5
(Never) (Almost Always)

3. Professors expect you to do poorly.

1 2 3 4 5
(Never) (Almost Always)

4. Professors are less likely to encourage you.

1 2 3 4 5
(Never) (Almost Always)

5. You are not fully accepted or included into your program.

1 2 3 4 5
(Never) (Almost Always)

6. If you ask a simple question, people will think it is because of your gender.

1 2 3 4 5
(Never) (Almost Always)

7. If you do poorly on a test, people will assume that it is because of your gender.

1 2 3 4 5
(Never) (Almost Always)

8. People of your gender face unfair evaluations because of their gender.

1 2 3 4 5
(Never) (Almost Always)

APPENDIX F. CLANCE IMPOSTOR PHENOMENON SCALE (CLANCE, 1985)

For each question, please select the number that best indicates how true the statement is of you. It is best to give the first response that enters your mind rather than dwelling on each statement and thinking about it over and over.

1. **I have often succeeded on a test or task even though I was afraid that I would not do well before I undertook the task.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

2. **I can give the impression that I'm more competent than I really am.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

3. **I avoid evaluations if possible and have a dread of others evaluating me.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

4. **When people praise me for something I've accomplished in my major, I'm afraid I won't be able to live up to their expectations of me in the future.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

5. **I sometimes think I obtained my present position or gained my present success because I happened to be in the right place at the right time or knew the right people.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

6. **I'm afraid people important to me may find out that I'm not as capable as they think I am.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

7. **I tend to remember the incidents in which I have not done my best more than those times I have done my best.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

8. **I rarely do a project or task as well as I'd like to do it.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

9. **Sometimes I feel or believe that my success in my major has been the result of some kind of error.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

10. **It's hard for me to accept compliments or praise about my intelligence or accomplishments.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

11. **At times, I feel my success in my major has been due to some kind of luck.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

12. **I'm disappointed at times in my present accomplishments and think I should have accomplished much more.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

13. **Sometimes I'm afraid others will discover how much knowledge or ability I really lack.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

14. **I'm often afraid that I may fail at a new assignment or undertaking in my major, even though I generally do well at what I attempt.**

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

15. When I've succeeded at something and received recognition for my accomplishments in my major, I have doubts that I can keep repeating that success.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

16. If I receive a great deal of praise and recognition for something I've accomplished, I tend to discount the importance of what I've done.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

17. I often compare my ability to those around me and think they may be more intelligent than I am.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

18. I often worry about not succeeding with a project or examination, even though others around me have considerable confidence that I will do well.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

19. If I'm going to receive a promotion or gain recognition of some kind, I hesitate to tell others until it is an accomplished fact.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

20. I feel bad and discouraged if I'm not "the best" or at least "very special" in situations that involve achievement in my major.

1	2	3	4	5
(Not true at all)	(Rarely)	(Sometimes)	(Often)	(Very true)

APPENDIX G. STEM SELF-EFFICACY SCALE (ADAPTED FROM FRANZ, 2011)

In this questionnaire, you will find a number of statements. For each statement, a scale from 1 to 7 is provided, with 1 representing strong agreement and 7 strong disagreement. Please answer all items.

I'm confident I can understand the basic concepts in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I expect to do well in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I'm certain I can master the skills being taught in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I'm confident I can do an excellent job on the assignments in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

Considering the difficulty of my science and engineering courses and teachers, and my skills, I think I will do well in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I'm confident I can do an excellent job on the tests in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I'm confident I can understand the most complex material presented by the instructors in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I'm certain I can understand the most difficult material presented in the readings for my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

I believe I will receive excellent grades in my STEM classes.

1 2 3 4 5 6 7

(Strongly Agree) (Agree) (Somewhat Agree) (Neither Agree Nor Disagree) (Somewhat Disagree) (Disagree) (Strongly Disagree)

APPENDIX H. FEAR OF SUCCESS SCALE (ZUCKERMAN & ALLISON, 1976)

In this questionnaire, you fill find a number of statements. For each statement, a scale from 1 to 7 is provided, with 1 representing extreme disagreement and 7 representing extreme agreement. This is a measure of personal attitude. There are no right or wrong answers. Please answer all items.

When it comes to my STEM major/field…

1. I expect other people to fully appreciate my potential.
   1 2 3 4 5 6 7

2. Often the cost of success is greater than the reward.
   1 2 3 4 5 6 7

3. For every winner, there are several rejected and unhappy losers.
   1 2 3 4 5 6 7

4. The only way I can prove my worth is by winning a game or doing well on a task.
   1 2 3 4 5 6 7

5. I enjoy telling my friends that I have done something especially well.
   1 2 3 4 5 6 7

6. It is more important to play the game than to win it.
   1 2 3 4 5 6 7

7. In my attempt to do better than others, I realize I might lose many of my friends.
   1 2 3 4 5 6 7

8. In competition, I try to win no matter what.
   1 2 3 4 5 6 7

9. A person who is at the top faces nothing but a constant struggle to stay there.
   1 2 3 4 5 6 7

10. I am happy only when I am doing better than others.
    1 2 3 4 5 6 7

11. I think “success” has been emphasized too much in our culture.
    1 2 3 4 5 6 7

12. In order to achieve, one must give up fun things in life.
    1 2 3 4 5 6 7

13. The cost of success is an overwhelming responsibility.
    1 2 3 4 5 6 7

14. Achievement commands respect.
    1 2 3 4 5 6 7

15. I become embarrassed when others compliment me on my work.
    1 2 3 4 5 6 7

16. A successful person is often considered by others to be both aloof and snobbish.
    1 2 3 4 5 6 7

17. When you're on top, everyone looks up to you.
    1 2 3 4 5 6 7

18. People's behavior changes for the worst after they become successful.
    1 2 3 4 5 6 7

19. When competing against another person, I sometimes feel better if I lose than if I win.
    1 2 3 4 5 6 7

20. Once you're on top, everyone is your buddy and no one if your friend.
    1 2 3 4 5 6 7

21. When you're the best, all doors are open.
    1 2 3 4 5 6 7

22. Even when I do well on a task, I sometimes feel like a phony or a fraud.
    1 2 3 4 5 6 7

23. I believe that successful people are often sad and lonely.
    1 2 3 4 5 6 7

24. The rewards of a successful competition are greater than those received from cooperation.
    1 2 3 4 5 6 7

25. When I am on top the responsibility makes me feel uneasy.
    1 2 3 4 5 6 7

26. It is extremely important for me to do well in all things that I undertake.
    1 2 3 4 5 6 7

27. I believe I will be more successful than most of the people I know.
    1 2 3 4 5 6 7

APPENDIX I. ADAPTED ACHIEVEMENT MOTIVES SCALE – FEAR OF FAILURE SUBSCALE (GJESME & NYGARD, 1970; ADAPTED BY LANG & FRIES, 2006)

Please indicate to what extent you agree with the following statements. Please answer all items.

1. I am afraid of failing in somewhat difficult situations when a lot depends on me.
   1 2 3 4
   (Strongly disagree) (Strongly Agree)

2. I feel uneasy to do something if I am not sure of succeeding.
   1 2 3 4
   (Strongly disagree) (Strongly Agree)

3. Even if nobody would notice my failure, I'm afraid of tasks which I'm not able to solve.
   1 2 3 4
   (Strongly disagree) (Strongly Agree)

4. Even if nobody is watching, I feel quite anxious in new situations.
   1 2 3 4
   (Strongly disagree) (Strongly Agree)

5. If I do not understand a problem immediately, I start feeling anxious.
   1 2 3 4
   (Strongly disagree) (Strongly Agree)

APPENDIX J. ACADEMIC MAJOR SATISFACTION SCALE (NAUTA, 2007)

Please indicate to what extent the following statements apply to you. Please answer all items.

1. I often wish I hadn't gotten into this major.*

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

2. I wish I was happier with my choice of an academic major.*

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

3. I am strongly considering changing to another major.*

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

4. Overall, I am happy with the major I've chosen.

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

5. I feel good about the major I've selected.

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

6. I would like to talk to someone about changing my major.*

   1 2 3 4 5
   (Strongly disagree) (Strongly Agree)

*** Reverse scored items**

APPENDIX K. PERCEIVED CHILLY CLIMATE FOR WOMEN SCALE (PASCARELLA, 1997)

Please indicate to what extent the following statements apply to you in the department of your field of study/academic major. Note that an answer of 1 means Strongly Agree and an answer of 5 means Strongly Disagree. Please answer all items.

I have never been singled out in class or treated differently than other students because of my gender.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

Few, if any, of the students in my department are prejudiced against women.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

Instructors treat all students the same whether the student is male or female.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

I have never observed discriminatory words, behaviors, or gestures toward female students.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

One seldom hears negative words about women while attending classes.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

My department promotes respect for differences (e.g., racial/ethnic, gender).

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

I am treated with respect by faculty in my department.

1 2 3 4 5
(Strongly Agree) (Strongly Disagree)

Overall, course content in my department reflects the experiences of women.

1	2	3	4	5
(Strongly Agree)				(Strongly Disagree)

*** reverse coded item (1 = strongly agree, 5 = strongly disagree)**

APPENDIX L. INTENTIONS TO PERSIST SCALE (LENT ET AL., 2007)

Please indicate how strongly you agree. Please answer all items.

0 1 2 3 4 5 6 7 8 9
(Strongly disagree) (Strongly agree)

1. I intend to major in a STEM field.
2. I plan to remain enrolled in a STEM major over the next semester.
3. I think that earning a bachelors degree in STEM is a realistic goal for me.
4. I am fully committed to getting my college degree in a STEM field.

APPENDIX M. DEBRIEFING INFORMATION AND POST-SURVEY INTERVIEW RECRUITMENT

The purpose of this study is to gain a clearer understanding of how women's choices to major in a STEM field may be related to their thoughts and emotions about themselves. In particular, we are interested in understanding how experiencing stereotype threat and feelings of impostorism may increase fears of success and failure and may impact one's STEM self-efficacy, academic major satisfaction, and intent to remain in a STEM major.

Contact Information:
If you currently have questions that may aid in your decision to participate in this research or if you have any general questions or concerns, please contact Kathy Wierzchowski (kwierzch@purdue.edu), Department of Educational Studies, Purdue University. If you have concerns about the treatment of research participants, you can contact the Institutional Review Board at Purdue University. Contact information for the Purdue University IRB is 1032 Ernest C. Young Hall, 155 S. Grant Street, West Lafayette, IN 47907-2114. The phone number for the Board is (765) 494-5942. The email address is irb@purdue.edu.

I am also recruiting participants who have taken this survey to participate in a follow-up interview, in person or over phone, to ask more about their experiences in STEM. Interview participants will be selected from the pool of volunteers. Your involvement would be confidential, anonymous and would not be linked to the responses you provided in the previous survey.

If you would be interested in participating, please click ">>" below and follow the link to enter your email address and answer a short questionnaire about your demographic information.

>>

APPENDIX N. POST-SURVEY INTERVIEW PARTICIPANT EMAIL AND DEMOGRAPHIC INFORMATION

1. Please enter an email address where we can contact you if you are selected for a follow-up interview:

2. What is your current academic standing?
    a. First-Year
    b. Sophomore
    c. Junior
    d. Senior
    e. Other (Please specify)

3. How do you identify?
    a. Woman
    b. Trans Female/Trans Woman
    c. Gender-Queer/Gender Non-Conforming
    d. Not listed above (please specify)

4. Age: _____

5. Do you consider yourself to be:
    a. A Domestic student
    b. An International student
    c. Other: _____

6. Race/Ethnicity
    a. Asian or Asian American
    b. Black or African American

c. Hispanic or Latina

d. Native American or Alaskan Native

e. Native Hawaiian or Pacific Islander

f. Arabic or Middle Eastern

g. White or Caucasian

h. Biracial/Multiracial

i. Not listed above (Please specify)

7. Major(s) or field of study: _____

8. Have you changed/transferred majors/academic field of study?

a. Yes

b. No

APPENDIX O. QUALITATIVE INTERVIEW PROTOCOL (SCRIPT AND ITEMS)

Thank you for agreeing for a follow-up interview with me. This interview will take approximately 30 minutes. All your responses to my questions will be recorded and later transcribed. At no time will I identify your actual name in the reporting of your responses during this and any other interviews. I will assign a pseudonym and I will store and label all the files with your pseudonym. Additionally, this is a voluntary interview. You may withdraw at any point in time and your responses will not be used in the study.

The purpose of this interview is to learn about your experiences majoring in a STEM field. First, I would like to make sure the demographics you listed are correct, as they will also help me understand your answers.

PART I – Academic and Career goals
The first part I will talk with you about are your academic and career goals.

1. What are some of your academic goals? In other words, what are your goals while working on your undergraduate degree?

2. What are your career goals? For example, what do you see yourself doing in five years? In ten years?

3. What are some things you foresee happening if you do not reach your academic or career goals?

4. What motivates you to achieve or avoid your goals?

PART II – Perceptions of failure and success
The second part I will talk with you about are your experiences with failure and success.

5. If you were to fail at meeting your goals, what do you think it would mean (or say) about you as a person?

6. Think back about a time when you experienced failure [wait a few moments]. Please describe this experience for me. What do you think contributed to this failure?

7. Think back about a time when you experienced success [wait a few moments]. Please describe this experience for me. What do you think contributed to this success?

PART III – Stereotypes
The last thing I will talk with you about are what you think are stereotypes of your field of study.

8. What do you think are examples of stereotypes in your field of study?

9. In what ways (or to what extent) do you feel you have experienced one or more these stereotypes? Can you describe an example for me? (Follow up: Have these stereotypes affected your progress in succeeding and achieving your goals?)

10. Is there anything you would like to share with me about your goals, expectations, and stereotypes, that you did not get a chance to share earlier in this interview and would like to do so at this time?

VITA

Kathy A. Wierzchowski, M.S.

10295 48th Ave., Apt. N106
Allendale, MI 49401
Phone: (224) 578-0730 Email: kwierzch@purdue.edu

Education

Doctor of Philosophy, Counseling Psychology (APA Accredited)**,** anticipated August 3rd, 2019
Purdue University, West Lafayette, IN
Dissertation: *The Role of Stereotype Threat and Impostor Phenomenon in Predicting Female Undergraduate Students' Academic Major Satisfaction in STEM*

Master of Science, Clinical Mental Health Counseling (CACREP accredited)**,** May 18th, 2014
Marquette University, Milwaukee, WI

Bachelor of Arts, Psychology, with minors in Biological Sciences and Sociology, May 20th, 2008
Marquette University, Milwaukee, WI

Clinical Experience

Doctoral Psychology Intern, University Counseling Center, Grand Valley State University, Allendale, MI
July 2018-Present

- Provide direct services to the campus community via individual and general group psychotherapy using a short-term model.
- Direct services include: triage, urgent care, after-hours crisis intervention, personal and career counseling, career and therapeutic assessment, outreach, and consultation.
- Engage in individual and group supervision, as well as rotating weekly seminars and case conferences.

Pre-Doctoral Practicum Student, Purdue Counseling & Psychological Services, West Lafayette, IN
August 2016-May 2017

- Conducted intake screenings, documented therapeutic contact and progress, and provided individual therapy to undergraduate and graduate students.
- Co-led Quick Start skills group with staff during Fall 2016 semester; observed an undergraduate Understanding Self and Others group and provided feedback during the Spring 2017 semester.
- Provided outreach to the community in collaboration with CAPS staff members.

Advanced Practicum Counselor, Four County Counseling Center, Logansport, IN
August 2015 - July 2016

- Provided individual therapy to community members, ages 10 and older, while also documenting therapeutic contact, progress, and related case management paperwork (i.e., CANS, ANSA).
- Provided emergency crisis interventions, mental status exams, and individual counseling for clients hospitalized on acute care unit who presented with suicidality, homicidality, psychosis, intoxication, personality disorders, and severe mood and anxiety disorders.
- Conducted weekly psychoeducational groups for clients hospitalized on acute care unit using the evidenced-based Illness Management and Recovery curriculum.

Practicum Counselor, Purdue Counseling & Guidance Center, West Lafayette, IN
August 2014 - May 2015

- Provided individual and career counseling sessions to university students and members of the community with live supervision and feedback.
- Worked with concerns such as anxiety, depression, grief, career issues, martial distress, social anxiety, academic distress.

Master's Internship, Rogers Behavioral Health, West Allis, WI
May 2013 - May 2014

- Provided individual counseling and performed safety check-ins with internalizing teenagers, ages 13-15.
- Supported patients in developing self-esteem, social skills, coping skills, and self-advocacy skills.
- Built rapport with patients, planned and led weekly psychoeducation groups, and wrote progress notes.
- Led psychoeducation groups for adolescents and teens, ages 10-17, who demonstrated internalizing and externalizing behaviors.
- Created and implemented a five-week bullying awareness curriculum for patients (12 patients) as part of an advocacy project for Marquette's Clinical Mental Health Counseling program.

Master's Practicum, Rogers Behavioral Health, West Allis, WI
January 2013 - May 2013

- Used a perspective of Trauma Informed Care to work with clients, ages 4-7, who exhibited internalizing and externalizing behaviors.
- Built rapport and practiced milieu management with clients, helping them learn to regulate their behaviors and emotions by using coping skills and feeling words.
- Received training in: writing case conceptualizations, working on an interdisciplinary team, writing progress notes for patients, basic diagnostic and assessment skills, considering biopsychosocial components of cases, risk management, verbal de-escalation, group facilitation, etc.

Supervision Experience

Peer Education Intern/Supervisor, Grand Valley State University, Allendale, MI
August 2018 - Present

- Provide two hours of weekly supervision to the Counseling Center's Peer Educators as they table at University events, construct Social Justice programming (i.e., Unnatural Causes, psychoeducation projects), and provide outreach programming.
- Plan and coordinate the annual 7 Grand Days campaign to promote positive psychology to GVSU students.

Clinic Director, Purdue Counseling & Guidance Center, Purdue University, West Lafayette, IN
August 2017 - May 2018

- Provided peer supervision (e.g., live observation, feedback, and mentorship) to six counselors in their first doctoral practicum.
- Contacted, screened, and assigned 35+ clients to center counselors.
- Oversaw clinical paperwork (e.g., intakes, progress notes), providing revisions as needed and assist counselors with case management.

Specialized Training Experiences

Critical Incident Stress Management (CISM), Grand Valley State University, Allendale, MI
August 2018

- Received training in how to individual crisis intervention as well as how to work alongside university colleagues in group crisis intervention.

Gaining Competencies in working with Trans* and Gender Non-Conforming Clients, Melisa Bailey, PsyD
May 2017

Disaster Mental Health Fundamentals & Disaster Services: An Overview, American Red Cross
April 2015

Outreach Presentations

Self-Compassion, presented to undergraduate students through the Fostering Laker Success Program, GVSU UCC
March 2019

Stress Management, presented to undergraduate students through the Laker Strategies for Success program, GVSU UCC
February 2019

Recognizing Anxiety & Depression, presented to undergraduate students through Greek Life, GVSU UCC
February 2019

Stress Management, presented to undergraduate students through Spotlight Productions, GVSU UCC
December 2018

Junior and Senior Transitions, presented to GVSU student athletes, GVSU UCC
November 2018

Stress Management, presented to the Money Smart Lakers program in Financial Aid, GVSU UCC
October 2018

Stereotype Threat and the Impostor Phenomenon, presented to Purdue University graduate students in STEM *October 2018*

Healthy Boundaries in Mentoring Relationships, presented to graduate student mentors in the Fostering Laker Success program, GVSU UCC
September 2018

Stress Management, presented to female undergraduate students in GVSU Greek life, GVSU UCC
September 2018

Managing Test Anxiety, presented to first-year undergraduate students, GVSU UCC
September 2018

Boundaries as a Peer Educator, presented to the peer education team part of their orientation, GVSU UCC
September 2018

Mental Health 101, presented to undergraduate resident assistants during their orientation, GVSU UCC
August 2018

Out of the Darkness, tabling at the annual suicide prevention walk/run
April 2018

Stress Management & Self Care, presented to undergraduate students in the Purdue College of Education's Honors Program, Purdue Counseling & Guidance Center
October 2017

College of Engineering Wellness Fair, Purdue Counseling & Guidance Center
October 2017

Understanding and Coping with Test Anxiety, presented to undergraduate women, Purdue University CAPS
April 2017

Boilers Supporting Boilers, presentation to undergraduate students in Purdue Student Government, Purdue
University CAPS
April 2017

Shifting from Surviving to Thriving in Graduate School, presentation provided to graduate students in Purdue's School of Mechanical Engineering, Purdue University CAPS
February 2017

Hammer Down Stigma: Purdue Mental Health Awareness Week, tabling, Counseling & Development Student Group
December 2016

Gender in the Workplace, presentation to undergraduate women in the Women In Engineering Program
April 2015

University Teaching Experience

Purdue University
2014 - 2017

- *Instructor*, Collaborative Leadership: Listening (EDPS 315) - Spring 2015, Spring 2016, Fall 2017, Spring 2018
    - Instructed a total of seven sections, totaling about ~156 undergraduate students.
    - Collaborated with faculty and course instructors to establish and review course curriculum each semester.
    - Graded and gave feedback on reflection papers, midterm and final papers, in-class presentations, and role plays.
- *Instructor*, Academic and Career Planning (EDPS 105) - Fall 2014, Fall 2015
    - Instructed four sections, totaling ~100 undergraduate students.
    - Guided students through administration of career assessments (e.g., MBTI, StrengthsQuest) and interpretation of results. Focused on understanding personal values and preferences.
    - Graded and gave feedback on reflection papers, class presentations, and other major assignments.

Other Professional Experience

Graduate Assistant, Department of Counselor Education and Counseling Psychology
August 2013 - May 2014

- Served as a graduate assistantship to the department chair.

- Assisted with CACREP accreditation, assessment and management of the department website, assistance with research projects, and the development of department climate.

Tutor/Volunteer, Adult Learning Center
August 2011 - May 2012
Milwaukee, Wisconsin

- Tutored adults, studying to receive their GEDs, in multiple subjects: reading, writing, social studies, science, mathematics, and computer skills.

Research Experience

Research Team Member, Advisor: Eric Deemer, Ph.D.
August 2014 - Present
Counseling Psychology Program

- Team Focus: Career development among underrepresented groups and minorities

Contributing Team Member, Advisor: Alan Burkard, Ph.D.
November 2013 - April 2014
Department of Counselor Education and Counseling Psychology

- Topic: Analysis of Journal Editors' and Reviewer's Published Qualitative Research Experience
- Collected data through archival research on qualitative and quantitative research methods.

Contributing Team Member, Advisor: Kevin Tate, Ph.D.
March 2013 - April 2014
Department of Counselor Education and Counseling Psychology

- Topics: Career exploration among first generation college students
- Collected data for the Educational Opportunity Program.
- Entered qualitative and quantitative data, calculated the reliability of data, and transcribing interviews with students regarding the strengths that successful first generation, low-income college students have utilized to achieve success.

Transcriber, Supervisor: Sarah Knox, Ph.D.
February - March 2013
Department of Counselor Education and Counseling Psychology

- Topic: Therapists' intentional use of humor in psychotherapy
- Transcribed three, hour-long interviews of therapists regarding their use of humor in psychotherapy.

Research Assistant, Advisor: Debra Oswald, Ph.D.
August 2010 - May 2012
Department of Psychology

- Assisted in survey research for four separate studies examining how people form stereotypes, express prejudice towards stigmatized groups, the impact of stereotypes on stigmatized individuals, and how people engage in and maintain relationships.
- Oversaw and assisted student participants in the completion of surveys for different research projects.
- Participated in and regularly led lab meetings to discuss current research with other undergraduate and graduate students.

Conference Presentations

Perlus, J., & **Wierzchowski, K**. (2019, August). *Feeling Fraudulent: Impostor Phenomenon in Women in Higher*
Education. Anticipated poster session presented at the APA Annual Convention, Chicago, IL.

Perlus, J., & **Wierzchowski, K**. (2019, June). *You deserve to be here: Empowering Women to Conquer The Feeling of*
Being An Impostor. Anticipated presentation at the NCDA Global Conference, Houston, TX.

Deemer, E., **Wierzchowski, K.**, & Lin, C. (2016, August). *Social cognitive predictors of undergraduate science students'*
post-baccalaureate training intentions. Poster session presented at the annual meeting of the American Psychological Association, Denver, CO.

Deemer, E., Soto, C., **Wierzchowski, K**., & Dolson, J. (2015, August). *Stereotype threat and STEM career motivation: A*
test of Gottfredson's theory of circumscription and compromise. Poster session presented at the APA Annual Convention, Toronto, Ontario, Canada.

Wierzchowski, K., & Deemer, E. D. (2015, March). *The Interaction of stereotype threat, gender identity, and science*
identity on female college students' experience of the imposter phenomenon. Poster session presented at the Great Lakes Regional Counseling Psychology Conference, Muncie, IN.

Wierzchowski, K. & Oswald, D. (2012, April). *The Influence of Alcohol on College Males Sexually Aggressive Attitudes*
and Behaviors. Poster presentation at the 2012 Annual Wisconsin Psychological Association Convention, Madison, WI.

Publications

Tate, K. A., Frantell, K., Caperton, W., Felber, A., & **Wierzchowski, K.** (2013) Career exploration and liberation:
Evaluating an undergraduate career exploration seminar for first generation, low-income college freshman. (*In preparation.)*

Leadership Experience & University Service

Helping Hands, GVSU University Counseling Center, Fall 2018

Purdue University Dance Marathon, Communication Consultant, Fall 2017

Counseling & Development Student Group, Secretary (2015-2016) & Vice President (2016-2017)

Interview Day Planning Committee, Purdue University Counseling Psychology Program, 2014-2017

Orientation Planning Committee, Purdue Counseling Psychology Program, 2015 & 2016

Off-Site Reception Planning Committee, Purdue Counseling Psychology Program, 2015 & 2016

Counselor Education and Counseling Psychology Graduate Student Organization, Member (August 2012-May 2014), Vice President of Communications (2013-2014)

Research Exchange Chair, Marquette Counselor Education and Counseling Psychology Graduate Student Organization, 2013 & 2014

Diversity Gala Planning Committee, Marquette Counselor Education and Counseling Psychology Graduate Student Organization, 2013 & 2014

Interview Day Committee, Marquette University Department of Counselor Education and Counseling Psychology, 2013 & 2014

Psi Chi Executive Board, Member (2010-2012) & Events Planner (2011-2012)

Marquette Bands Executive Board, Vice-President (2010-2011), President (2011-2012)

Professional Affiliations

Student Affiliate, National Career Development Association
November 2018- Present

Student Affiliate, American Psychological Association**,** Division 17, Society of Counseling Psychology
September 2014 - Present

Student Affiliate – Wisconsin Counseling Association
August 2013 - May 2014

Alpha Kappa Delta – International Sociology Honor Society
March 2012

Psi Chi – National Honor Society in Psychology
November 2010

Awards & Grants

Research Grant: $3,336.00**,** Purdue University Department of Educational Studies
May 2017

Travel Grant: $300.00, Purdue University Department of Educational Studies
March 2015, September 2015, September 2016, December 2018

Irene Gryznski Scholarship, Marquette University Graduate School
December 2012

William J. Geisheker Award, Marquette University Bands
April 2012

Outstanding Contributions to Social and Arts Programming, Marquette University Division of Student Affairs
March 2012