2014

Plugging Up the Leaky STEM Pipeline with a Stereotype Threat Mentoring Intervention

Luiz Xavier
University of Central Florida

PLUGGING UP THE LEAKY STEM PIPELINE WITH A STEREOTYPE THREAT MENTORING INTERVENTION

by

LUIZ FRANCISCO XAVIER
B.A. San Francisco State University, 2006
M.S. San Francisco State University, 2008

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Industrial Organizational Psychology
in the Department of Psychology
in the College of Sciences
at the University of Central Florida
Orlando, Florida

Summer Term
2014

Major Professor: Barbara Fritzsche

ABSTRACT

The present study compared the effectiveness of different mentoring programs at reducing feelings of stereotype threat experienced by women in science, technology, engineering, and math (STEM) fields. Stereotype threat refers to the extra pressure a person feels to disprove a negative stereotype that applies to him or her. Because stereotype threat has been found to undermine performance and interest in stereotyped domains, it may be a key factor contributing to female underrepresentation in STEM fields. Mentors and protégés were placed in either a stereotype threat reduction condition in which mentors and protégés were encouraged to participate in discussions designed to reduce stereotype threat, an academic condition in which mentors and protégés were encouraged to discuss academic goals and challenges, or a non-academic condition in which mentors and protégés were encouraged to discuss the challenges of balancing non-school commitments. It was hypothesized that mentoring that focused specifically on stereotype threat reduction would be the most effective in reducing stereotype threat and increasing intentions to remain in STEM fields. In addition, it was hypothesized that stereotype threat reduction mentoring would be the most effective at increasing beliefs in an incremental theory of intelligence (i.e., the belief that intelligence can be developed through hard work) and decreasing beliefs in an entity theory of intelligence (i.e., the belief that intelligence is innate and is unalterable). Mentors were 36 male and 74 female upper-level STEM college students and protégés were 137 female lower-level STEM college students. Participants met online for 30 minutes, once per week, for 3 weeks. Results indicated that both mentors and protégés in the stereotype threat reduction mentoring condition reported feeling less stereotype threat in their STEM classes than mentors and protégés in the other mentoring conditions. Additionally, the

frequency in which self-theories were discussed in the mentoring sessions partially mediated the effects of the stereotype threat reduction condition on protégés' feelings of stereotype threat in their STEM classes. Mentors and protégés in the stereotype threat reduction mentoring condition also reported endorsing incremental theories of intelligence more and endorsing entity theories of intelligence less than mentors and protégés in the other conditions. In summary, the present study's findings suggest that in order maximum stereotype threat reduction to occur in a mentoring relationship, mentors and protégés engage in activities and discussions designed to reduce stereotype threat. Given that prior research has found that decreased stereotype threat, decreased entity theories of intelligence, and increased incremental theories of intelligence are associated with greater interest and performance in STEM domains, the utilization of a stereotype threat reduction mentoring program can help address the underrepresentation of women in science, technology, engineering, and math related fields

ACKNOWLEDGMENTS

I would like to thank Dr. Barbara Fritzsche for your patience and support throughout the years. Without your guidance my dissertation would not be possible. I would like to thank Dr. Ben-Zeev for inspiring me to pursue a Ph.D. and for being an integral part of my undergraduate honor's thesis, my master's thesis, and my dissertation. I would also like to thank Dr. Kimberly Smith-Jentsch and Dr. James Szalma for your invaluable input and feedback. I would also like to thank my exceptional research assistants, Estefany Sabrina Bologna, Kara Corallo, Lisa Ellis, Eurachia Gibson, Alexandra Lexi Gorman, Haily Fowler, Adam Leisher, Willow McGinty, Halona Ng, Kalan Norris, Sara Ruiz, Taylor Scotese, Palak Shah, and Katelyn Stiller. Without your dedication and hard work, the STEM Peer Mentoring program would not have been successful. I would like to thank Iliana Castro and Melissa Dagley for contacting students on my behalf. I would like to thank Kyle Heyne for taking the time to brainstorm ways of analyzing my data and for putting your research assistants at my disposal. I would like to thank Quincy for being a good dissertation dog. Lastly, I would like to thank my lab members, Dorey Chaffee, Lindsay Dhanani, Michael Reeves, Elizabeth Sanz, Brandon Scholar, Nicholas Smith, and Amanda Wolcott, for your help and support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE: INTRODUCTION

Statement of the Problem

Continued scientific progress is vital to maintaining the quality of life and economic competitiveness of the United States (Committee on Equal Opportunities in Science and Engineering, 2000; National Science Board, 2003). In order to maintain scientific progress, people must enter science, technology, engineering, and mathematics (STEM) fields in sufficient numbers. Unfortunately, the number of people currently entering into STEM careers is insufficient to meet the demands of these fields (Fassinger, 2008; Holden, 1989; National Science Board, 2003; Widnall, 1988). The current shortage of STEM workers is compounded by the likely increase in future demand for STEM employees. Estimates indicate that the number of new jobs in STEM fields will be at least three times greater than the number of new jobs in other fields (Committee on Equal Opportunities in Science and Engineering, 2000; National Science Board, 2003). Furthermore, a large portion of the STEM workforce is expected to retire within the next two decades (National Science Board, 2003).

One way of potentially addressing the current and future demands for STEM employees is to focus efforts on fully utilizing the entire workforce population. At present, STEM fields are overrepresented by Caucasian men. Despite representing 42% of the U.S. workforce, Caucasian men represent 68% of the STEM workforce (Committee on Equal Opportunities in Science and Engineering, 2000). Further reliance on Caucasian men to fill the ranks of STEM fields may prove unviable in the future as Caucasian men are predicted to represent only 26% of the U.S. workforce by 2050. Because the number of Caucasian men pursuing STEM careers in the future may be insufficient to meet the demand for STEM employees, increasing the number of women who pursue STEM careers may be one way of meeting future employment demands. In addition to women, ethnic minorities such as African Americans and Latinos are also underrepresented in STEM fields (National Science Board, 2003). Efforts to increase the number of ethnic minorities who pursue STEM fields can also help address the shortage of STEM workers. However, this study will focus primarily on improving the retention rates of women in STEM fields because they represent a potentially larger pool of future employees. Despite representing 46% of the U.S. workforce (U.S. Census Bureau, 2000), women represent only 26% of the STEM workforce (National Science Foundation, 2008a). More specifically, women represent 12% of those employed in engineering, 26% of those employed in computer science, 28% of those employed in physical science, and 39% of those employed in mathematics related professions.

The Underrepresentation of Women in STEM Majors in College

Not surprisingly, the underrepresentation of women in STEM careers is mirrored by their underrepresentation in STEM college majors. For instance, women earned only 41% of the bachelor's, 36% of the master's, and 25% of the doctorates in the physical sciences between 1997 and 2006 (National Science Foundation, 2008b). These statistics are substantially lower in math and computer science related majors (i.e., bachelor's = 31%, master's = 33%, and doctorates = 23%), and engineering related majors (i.e., bachelor's = 20%, master's = 21%, and doctorates = 16%). These statistics are in sharp contrast to the overall success women have experienced in education in general, with women earning 57% of the bachelor's, 59% of the master's, and 44% of the doctorates across all areas of study between 1997 and 2006. Increasing the proportion of women who pursue STEM careers to more closely approximate the proportion of women in the overall workforce may help meet the employment demands of STEM fields in the future.

The Attrition of Women from STEM Majors in College

Further compounding the problem of female underrepresentation in STEM majors is the consistent finding that women leave STEM majors at a higher rate than men (Bell, Spencer, Iserman, & Logel, 2003; Ceci, Williams, & Barnett, 2009; Flam, 1991; Frome, Alfred, Eccles, & Barber, 2006; Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007; Oakes, 1990; Seymour, 1995; Seymour & Hewitt, 1997; Strenta, Elliot, Adair, Matier, & Scott, 1994; Webb, Lubinski, & Benbow, 2002). A study by Frome et al. (2006) illustrates the high rate of female attrition in STEM fields. In this study, women who were interested in majoring in STEM fields at age 18 were tracked over seven years. When these women were surveyed again at age 25, 83% indicated that they switched to neutral or female-dominated fields. Similarly, Strenta et al. (1994) found that women were less likely to persist in engineering and science than men in a study of 5,000 students across four universities. Among men and women who expressed an initial interest in engineering, only 56.8% of women compared to 64.7% of men completed a degree in engineering. Among men and women who expressed an initial interest in physical science, only 19.5% of women compared to 39.5% of men completed a degree in physical science. It should be noted that other fields of study did not have large gender differences in retention rates. For example, the retention rates of men and women who reported an initial interest in biological science (42.1% and 39.9% respectively), social science (75.5% and 71.2% respectively), and humanities (54.3% and 54.0% respectively) did not vary across gender. Similarly, Bell et al. (2003) also reported higher rates of female attrition in engineering.

On a promising note, men and women were retained at approximately the same rate after the completion of introductory engineering courses (81.7% and 77.3% respectively). However, the retention rates of women (64.6%) were lower than men (80.0%) after the completion of advanced courses in engineering. An even smaller percentage of women (41.9%) completed bachelor's degrees in engineering compared to men (61.6%). Given that women appear to be leaving STEM majors at a higher rate than women in other majors, interventions that improve the retention rates of women in STEM majors can potentially help meet current and future employment needs.

The underrepresentation of women represents a tremendous loss of talent for STEM fields. With STEM fields already facing a shortage of qualified personnel and potentially greater future shortages, encouraging women to pursue and remain in STEM careers can help meet current and future demands. Encouraging women to pursue and remain in STEM careers not only benefits society, it benefits women as well. Women who opt out of pursuing STEM careers may miss out on potentially rewarding and fulfilling careers. For instance, STEM careers tend to have higher salaries and prestige than other careers (Halpern, 2000). Additionally, women may find the subject matter intrinsically rewarding. If external factors are causing women to opt out of STEM careers in greater frequency than men, research that identifies these factors can go a long way towards designing interventions to improve the retention rates of women in these fields. This in turn, will provide women an equal opportunity and enable women to achieve their full potential.

This study seeks to determine the effectiveness of a stereotype threat reduction peer mentoring program designed to improve the retention rates of women majoring in STEM fields. The intervention integrates several successful stereotype threat interventions into a mentoring program. Before discussing the specifics of the program, existing research on gender differences in STEM fields will be reviewed. Following this general review, stereotype threat theory and research will be discussed. An emphasis will be placed on discussing features of STEM environments that increase the likelihood of stereotype threat occurring. Following this general discussion of stereotype threat theory, mentoring research will be discussed. The review will end with a discussion of how successful interventions based on stereotype threat theory can be incorporated into a mentoring program.

CHAPTER TWO: LITERATURE REVIEW

Gender Differences in Abilities

One common explanation for the underrepresentation of women in STEM fields is that they lack the ability to succeed in math, science, and engineering domains (Valian, 2007). However, one limitation of this argument is that research has yet to conclusively link specific abilities to success in STEM fields (Ceci et al., 2009). Despite this limitation, many researchers believe that high mathematical, spatial, and verbal ability are necessary for success in STEM fields, particularly mathematical and spatial ability (Halpern et al., 2007; Lubinski & Benbow, 2006).

Gender Differences in Mathematical Ability

High mathematical ability is assumed to be a prerequisite for success in STEM fields by some researchers (see Halpern et al., 2007; Lubinski & Benbow, 2006). Although mathematical ability is assumed to be related to success in STEM fields, it is unclear how much mathematical ability is needed (Ceci et al., 2009). For example, does someone have to be in the top 10%, top 1%, top 0.1%, or top 0.01% of mathematical ability in order to be successful in STEM fields? Some research suggests that scoring well on standardized mathematics tests is associated with success in STEM fields. For example, individuals scoring at or above the top 1% on the SAT mathematics test have been found to secure doctorates at 25 times the national base-rate (Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000; Lubinski, 2004; Lubinski & Benbow, 2006). Among those scoring at or above the top 1% on the SAT mathematics, the top quartile receive a greater number of Ph.D.s in STEM, secure more patents, publish more, and are more likely to have tenure at a top 50 university 20 years later than the bottom quartile (Park, Lubinski, & Benbow, 2008; Wai, Lubinski, & Benbow, 2005). Furthermore, individuals scoring at or above the top 0.01% on the SAT have been found to secure doctorates at 50 times the national base-rate (Lubinski, 2004; Lubinski & Benbow, 2006; Lubinski, Benbow, Webbs, & Bleske-Rechek, 2006; Lubinski, Webb, Morelock, & Benbow, 2001). Thus, it appears that standardized mathematical tests are capable of predicting achievement in STEM. If gender differences exist on standardized mathematics tests, it may a factor contributing to gender differences in STEM representation.

Research appears to indicate that women perform worse on upper-level standardized mathematics tests. In terms of the general population, the gender gap in math achievement test scores is small to non-existent (Else-Quest, Hyde, & Linn, 2010; Hyde, Fannema, & Lamon, 1990; Hyde, Lindberg, Linn, Ellis, & Williams, 2008; Lindberg, Hyde, Petersen, & Linn, 2010). Although these meta-analyses indicate little overall difference when all studies are aggregated together, moderator analysis reveals that the gender gap increases with age. For example, Hyde and colleagues (1990) found that females perform slightly better than males at ages 5-10 (d = -.06) and 11-14 (d = -.07), but males perform better than females at ages 15-18 (d = .29) and 19-25 (d = .41). An updated meta-analysis by Lindberg and colleagues (2010) obtained similar results, with females slightly outperforming males in elementary school (d = -.06), no difference in middle school (d = .00), and males outperforming females in high school (d = .23) and college (d = .18). What is clear from both meta-analyses is that males tend to outperform females on standardized mathematics tests during the critical high school and college years in which many people make career decisions.

Gender Differences in Mathematical Admissions Tests

The standardized mathematics tests used to determine college and graduate school admissions demonstrate some of the largest gender differences in favor of males. For example, between the years 2000 and 2009, females averaged a 500 on the SAT math test, whereas males averaged a 535 on the SAT math (College Board, 2009). This gender gap in SAT math performance has remained relatively unchanged for more than 30 years, with *d*s ranging between .35 to .40 in favor of males (Ceci et al., 2009; College Board, 2009; Halpern, 2000; Halpern et al., 2007; Hyde et al., 1990; Willingham, Cole, Lewis, & Leung 1997). Similar male advantages have been noted on the ACT math test as well (Willingham et al., 1997). The gender gap becomes even larger when looking at the GRE quantitative test with *d*s ranging between .63 and .67 in favor of males (Halpern, 2000; Hyde et al., 1990; Willingham et al., 1997). Although these effect sizes are small to medium based on Cohen's (1988, 1992) standards, they can drastically affect who is admitted into a STEM program if selection ratios are small. For example, if only the top 10% of applicants are admitted, there will be 1.70 males admitted for every female admitted when $d = .30$, and 2.94 males admitted for every female admitted when $d = .60$ (Hedges & Feingold, 1993a). If only the top 5% of applicants are admitted, there will be 1.86 males admitted for every female admitted when $d = .30$, and 3.58 males admitted for every female admitted when $d = .60$. Because the SAT, ACT, and GRE are used to determine admittance into undergraduate and graduate programs respectively, the lower performance of females on these tests may hinder their ability to pursue STEM careers.

In addition to mean differences on key standardized mathematics tests, the gender gap at the upper end of the mathematics test distribution is substantial and in favor of males (Benbow &

Stanley, 1980, 1983; Ceci & Williams, 2007; Halpern, 2007; Halpern, Wai, & Saw, 2005; Hedges & Friedman, 1993b; Hedges & Nowell, 1995, Hyde et al., 2008; Strand, Deary, & Smith, 2006; Wai, Cacchio, Putallaz, & Makel, 2010; Willingham et al., 1997). It should be noted that male overrepresentation at the top of the math distribution is also mirrored by male overrepresentation at the bottom of the math distribution (Ceci & Williams, 2007; Halpern, 2007; Halpern et al., 2005; Strand et al., 2006; Willingham et al., 1997). In essence, males demonstrate more variability in math performance than women, and this greater variability results in more males at both ends of the math distribution. Given the focus of this study is on people who are likely to pursue STEM degrees, only the top of the distribution will be discussed here because it is unlikely that extremely low scoring individuals will pursue, be accepted, or succeed in STEM careers (Ceci & Williams, 2007; Ceci et al., 2009; Lubinski & Benbow, 2006; Williams & Ceci, 2007).

Research evidence suggests that males continue to be overrepresented at the top of the math distribution. Benbow and Stanley's (1983) study remains a prominent demonstration of the overrepresentation of males of the top of the math distribution. In this study, 19,937 gifted female and 19,883 gifted male middle school students completed the SAT as part of a talent search. Among these gifted students, males outperformed females by an average of 30 points on the mathematics portion of the SAT. What was more notable than the small mean difference between males and females was the finding that males substantially outnumbered females at the high end of the math distribution. For instance, males outnumbered females 2:1 among those scoring above 500, 4:1 among those scoring above 600, and 13:1 among those scoring above 700. Hedges and Nowell (1995) reported similar results in their analysis of gender differences in six nationally representative data sets representing over 150,000 test takers. They found that the overall gender difference in math was small with *d*s of .03, .08, .12, .22, .24, and .26 in favor of males. However, the gap widened at the upper ends of the distribution. At the top 10% of the distribution, males outnumbered females 1.33:1, 1.34:1, 1.67:1, 1.70:1, 1.76:1, and 1.90:1. The gap widened further at the top 5% of the distribution, with males outnumbering females 1.50:1, 1.64:1, 1.90:1, 2.06:1, 2.20:1, and 2.34:1. A more recent study by Wai and colleagues (2010) obtained similar results. Much like Benbow and Stanley (1983), Wai et al. (2010) found that seventh-grade males outnumbered seventh-grade females 2.6:1 among those scoring above 500, 5.8:1 among those scoring above 600, and 13.5:1 among those scoring above 700 during the early to mid-eighties. However, the proportion of males at the top of the distribution has decreased over the years and now males outnumbered females 1.5:1 among those scoring above 500, 2.5:1 among those scoring above 600, and 3.8:1 among those scoring above 700. Despite the greater representation of women at the top of math distribution compared to the early to mid-eighties, it should be noted that the ratio of males to females at the top of the math distribution has remained largely unchanged for the last 20 years. In summary, males have been found to be overrepresented among the highest performers on standardized mathematics tests. This overrepresentation of males at the top of the math distribution may be a factor contributing to female underrepresentation in STEM fields.

Gender Differences in Visual-Spatial Ability

In addition to mathematical ability, visual-spatial ability is another important ability to consider. Nuttall, Casey, and Pezaris (2005) define visual-spatial ability as “the ability to think and reason using mental pictures rather than words" (p. 122). Several distinct skills appear to make up visual-spatial ability. Spatial visualization refers to the ability to manipulate spatial information across several steps (Halpern, 2000; Linn & Petersen, 1985; Voyer et al., 1995). Spatial perception refers to the ability to identify the true vertical or the true horizontal despite distracting information (Halpern, 2000; Hyde, 2007; Linn & Petersen, 1985; Voyer et al., 1995). Lastly, mental rotation refers to the ability to imagine how objects will appear when they are rotated in two- or three-dimensional space (Halpern, 2000; Hyde, 2007; Linn & Petersen, 1985; Voyer et al., 1995).

Many have argued that visual-spatial ability is critical for success in STEM fields (Halpern, 2000; Halpern et al., 2007; Hyde, 2007; Nuttall et al., 2005). Initial evidence seems to support the assertion that visual-spatial ability is related to STEM achievement (Shea, Lubinski, & Benbow, 2001; Wai, Lubinski, & Benbow, 2009; Webb, Lubinski, & Benbow, 2007). For example, in an 11-year follow-up of 346,665 participants of Project Talent, Wai et al. (2009) found that a composite measure of visual-spatial ability made up of three-dimensional spatial visualization, two-dimensional spatial visualization, mechanical reasoning, and abstract reasoning was related to the likelihood of obtaining a STEM degree. For instance, those in the top 4% of visual-spatial ability in high school obtained 25% of the terminal bachelor's degrees, 30% of the terminal master's degrees, and 45% of the doctorates in STEM. Additionally, 90% of those who obtained a doctorate in STEM were in the top 23% of visual-spatial ability.

Similar to mathematical ability, research indicates that there are gender differences in visual-spatial ability in favor of males. A meta-analysis by Linn and Petersen (1985) found small differences in favor of males on spatial visualization measures (d = .13), but much larger differences in favor of males on spatial perception (d = .44) and mental rotations (d = .73) measures. A more recent meta-analysis by Voyer et al. (1995) obtained similar results with a small differences in favor of males on spatial visualization measures (d = .19), and larger differences in favor of males on spatial perception (d = .44) and mental rotations (d = .56) measures. Researchers have also found that males outnumber females 2:1 among those scoring at or above the 95^{th} percentile of visual-spatial ability measures (Hedges & Nowell, 1995). Some researchers have argued that gender differences in mental rotation may account for gender differences in mathematics test performance (Casey, Nuttall, Pezaris, & Benbow, 1995; Nuttall et al., 2005). For instance, Casey et al. (1995) found that gender gap in SAT math performance is negligible when mental rotation ability is controlled for.

Gender Differences in Verbal Ability

In addition to mathematical and visual-spatial abilities, verbal abilities are proposed to be a key determinant of success in STEM fields. Verbal abilities are needed in order to comprehend the complex text in STEM fields, write grants, as well as to communicate findings in journal articles and books (Halpern, 2007; Halpern et al., 2007). In general, studies reveal either no gender difference or gender differences favoring females on measures of verbal ability (Halpern, 2000; Halpern et al., 2007; Hyde & Linn, 1988; Strand et al., 2006). For instance, females have been found to consistently outperform males on measures of reading comprehension and writing ability (Guiso, Monte, Sapienza, & Zingales, 2008; Halpern, 2007; Halpern et al., 2007; Hedges & Nowell, 1995; Wai et al., 2010; Willingham et al., 1997). Despite the overall tendency for females to outperform males on measures of verbal ability, males perform similarly to females on the SAT (College Board, 2009; Willingham et al., 1997). For instance, between, 2000 and 2009 males averaged a 508, whereas females averaged a 502 on the SAT verbal test (College Board, 2009). Additionally, males have been found to outperform females on the GRE verbal test by $d = .23$ (Willingham et al., 1997). Thus, it appears that the underperformance of females on standardized mathematics tests used for admissions into undergraduate and graduate programs is not offset by their performance on standardized verbal tests.

Unfortunately, strengths in verbal domains do not appear to translate to greater female representation in STEM. A study by Lubinski and colleagues (2001) illustrates how high verbal ability may lead women to pursue non-STEM degrees. In this study, gifted youth (i.e., those who were the top 1 out of 10,000 in ability) were classified as having high-verbal, high-math, or flat abilities. People were classified as high-verbal if their SAT verbal scores were 1 standard deviation above their SAT math scores. Likewise, people were classified as high-math if their SAT math scores were 1 standard deviation above their SAT verbal scores. People were classified as flat if their SAT verbal and math scores were within 1 standard deviation of each other. A 10-year follow-up revealed that 69% of the high-math group pursued undergraduate STEM degrees compared to 58% of the flat group and 29% of the high-verbal group. Conversely, 42% of the high-verbal group pursued undergraduate humanities and arts degrees compared to 23% of the flat group and 8% of the high-math group. In terms of gender differences, there were more women in the high-verbal group than the high-math and flat groups combined, whereas there were more men in the high-math group than the high-verbal and flat groups combined.

Other studies have replicated Lubinski et al.'s (2004) finding that people with stronger verbal abilities pursue non-STEM degrees, whereas people with stronger math abilities pursue STEM degrees. For instance, Shea et al. (2001) found that gifted youth with relatively higher verbal abilities, but relatively lower math and visual-spatial abilities majored in the social sciences or humanities. Conversely, those with relatively higher math and visual-spatial abilities, but relatively lower verbal abilities majored in engineering, math, or computer science. Lastly, those who majored in the physical sciences were characterized as having high math, visual-spatial, and verbal abilities. Given that having higher verbal ability relative to one's math and visual-spatial abilities predicts pursuit of non-STEM degrees, the finding that females tend to have stronger verbal abilities relative to their math abilities or more balanced ability profiles may partially explain female underrepresentation in STEM fields (Ceci et al., 2009; Lubinski & Benbow, 2007).

Gender Differences in Interests

Gender differences in vocational interests are proposed to be another contributor to female unrepresentation in STEM fields. Various comprehensive reviews conclude that gender differences in interests play a larger role than gender differences in ability in explaining female underrepresentation in STEM fields (Ceci et al., 2009; Lubinski & Benbow, 2006). Holland's (1997) RIASEC model is the most widely adopted theoretical framework within the vocational interest literature. He proposes that people vary in their vocational interests and that people will experience higher performance and satisfaction when job characteristics match their interests

(Holland, 1996, 1997). When a person's interests are incongruent with the characteristics of a job or profession, the person is proposed to experience dissatisfaction and desire to turnover.

Holland's model classifies interests into six distinct dimensions. People with high realistic (R) interests prefer to work with tools, machines, and animals. They like working with their hands and solving concrete, practical problems. People with high investigative (I) interests prefer activities that enable them to better understand and control the world around them. They enjoy reading and logic-based problem solving. People with high artistic (A) interests prefer unstructured activities that enable them to use their imagination and engage in self-expression. They dislike systematic and clerical activities. People with high social (S) interests prefer to manipulate others in order to inform, train, develop, enlighten, or cure them. They enjoy working with and helping people. People with high enterprising (E) interests prefer to manipulate others to achieve economic or organizational goals. They enjoy leadership and persuasive roles. Lastly, people with high conventional (C) interests prefer structured activities and the systematic manipulation of data. They enjoy organizing and doing computational work.

Holland's model also classifies people based on their most dominant interests. Typically, people's three most dominant interests are identified and listed starting with their strongest interest, followed by their second strongest interest, and so forth. For example, a person with high investigative interests, followed by realistic interests, and conventional interests would be classified as an IRC. The utility of the RIASEC model extends to the classification of occupations, which allows researchers and practitioners to identify which interests are most stimulated by a given occupation. In regards to STEM professions, most tend to be high on investigative, realistic, and conventional interests. For example, physicists are classified as IR, chemists are classified as IRC, mathematicians are classified as ICA, computer programmers are classified as IC, civil engineers are classified as RIC, nuclear engineers are classified as IRC, and chemical engineers are classified as IR (O*NET, 2011). Based on this pattern across STEM occupations, individuals with realistic, investigative, and conventional interests may find greater satisfaction with STEM careers.

Evidence suggests that the interests of males are more congruent with STEM fields than the interests of females. An influential study by Lippa (1998) found that men and women could be distinguished based on the degree to which they prefer working with people versus things. The people-things dimension, along with the ideas-data dimension, was originally proposed by Prediger (1982) as a means of simplifying the RIASEC model. The people-things dimension refers to the degree to which a vocation involves learning about and working with people versus learning about and working with things (Lubinski & Benbow, 2006). Realistic, Investigative, and Conventional interests are proposed to be more related to things, whereas Social, Enterprising, and Artistic interests are proposed to be more related to people. The ideas-data dimension refers to the degree to which a vocation involves internal mental tasks (e.g., thinking or being creative) versus external, data-related tasks (e.g., keeping records) (Lippa, 1998). Investigative and Artistic interests are proposed to be related to ideas, whereas Conventional and Enterprising interests are proposed to be related to data. Realistic and Social interests are proposed to be intermediate on the ideas-data dimension. Lippa (1998) found no relationship between gender and the ideas-data dimension. However, gender was strongly correlated (*rs* above .50) with the people-things dimension across three studies. Men were more likely to express a stronger orientation towards things, whereas women were more likely to express a stronger orientation towards people. Lippa's (1998) findings regarding gender differences on the people-things dimension has been replicated by other researchers (Lubinski & Benbow, 2006). The tendency for females to prefer careers geared towards working with and helping others may drive women away from STEM fields. For example, Dwyer and Johnson (1997) found that females identified as gifted in math and science expressed less interest in pursuing STEM careers and were less likely to major in those fields in college than gifted males.

A meta-analysis by Su, Rounds, and Armstrong (2009) also found evidence that males are more likely to express interests that are congruent with STEM fields. Males were found to have higher realistic (d = .84) and investigative (d = .26) interests, whereas females were found to have higher social (d = -.68), artistic (d = -.35), and conventional (d = -.33) interests. Although conventional interests are associated with some STEM occupations, the majority of STEM occupations are associated with higher realistic and investigative interests. Because people tend to pursue and remain in careers that match their vocational interests (Holland, 1996), Su et al.'s findings that males have higher realistic and investigative interests suggests that female underrepresentation in STEM may be due to in some part to differences in interests. Additional analyses on explicit interests also supports the claim that female underrepresentation in STEM may be due to differences in interests, with males reporting more explicit interest in math (d = .34), science (d = .36), and engineering (d = 1.11). Su et al.'s findings are notable in that they were based on 503,188 respondents across 47 interest inventories. Thus, across a large sample of respondents and interest inventories, males express greater interest in STEM related pursuits.

Ability and Interest

Taken together, research on ability and interest differences suggest several factors that contribute to female underrepresentation in STEM fields. First, females score worse than males at the high end of the math distribution. This is problematic because prestigious undergraduate and graduate programs tend to select people who score high on standardized tests. Second, females score worse than males on measures of visual-spatial ability. This is problematic because visual-spatial ability has been linked to both performance and success in STEM fields. Third, females express less realistic and investigative interests, as well as less interest in working with things. This is problematic because STEM fields tend to cater to realistic and investigative interests.

Although much of the research on gender differences in ability and interest differences has been done in isolation of one other and was presented as such in this review, it should be noted that interests and abilities likely mutually influence each other. For instance, Ackerman (1996, Ackerman & Heggestad, 1997) proposes that interests and abilities develop in tandem. Someone who is interested in a certain domain will likely pursue the domain and develop their ability in that domain. Likewise, someone who has high ability in a domain may become interested in that domain. Similarly, someone has low ability in a domain or performs poorly in a domain may lose interest in that domain. In integrating ability and interest research together, Ackerman and Heggestad (1997) propose that people vary on the trait complexes they have. One trait complex that is relevant to STEM achievement is the Science/Math trait complex. The Science/Math trait complex refers to someone who has Investigative and Realistic interests, along with high mathematical and visual-spatial ability. In terms of gender differences, there are more males classified in the Science/Math trait complex than females (Ackerman, Bowen, Beier, & Kanfer, 2001). In essence, gender differences in abilities and interests appear to be contributing to the underrepresentation of women in STEM. Lubinski and Benbow (2006) discuss the importance of assessing both ability and interest in a domain by highlighting evidence revealing that interests and ability are both unique predictors of academic success.

Prior Explanations for Gender Differences in Abilities and Interests

With research documenting gender differences in STEM-related abilities and interests, the question that emerges is what is causing these differences. Following a similar pattern in most areas of research in psychology, both biological and environmental explanations have been offered (Ceci et al., 2009; Halpern, 2000; Halpern et al., 2007). In terms of biological explanations, two frequently cited explanations have been offered. The first explanation focuses on brain differences, whereas the second explanation focuses on hormonal differences. In terms of environmental explanations, differences in course selection, classroom experiences, and socialization have been offered as explanations for gender differences in the abilities and interests. One limitation shared by both biological and environmental explanations for gender differences in STEM-related abilities and interests is that both bodies of research focus on stable long-term factors, making it difficult to derive theoretically-based interventions that are logistically feasible. For a comprehensive review of the biological and environmental explanations for gender differences in STEM-related abilities and interest see Appendix A.

Stereotype Threat Theory

Stereotype threat theory can potentially account for the underperformance of women on STEM-related standardized tests and gender differences in vocational interests. Stereotype threat refers to the fear that one will "be judged or treated in terms of [a] stereotype or that one might do something that would inadvertently confirm it" (Steele, Spencer, & Aronson, 2002, p. 389). This fear creates extra pressure which can undermine both performance and aspirations in a domain. For example, non-stereotyped individuals must cope with the normal stressors of a testing situation. However, negatively stereotyped individuals must deal with the normal stressors of a testing situation, as well as stereotype threat. The additional burden of the latter is theorized to deplete cognitive resources needed for successful performance in a domain (Schmader, Johns, & Forbes, 2008).

A distinguishing feature of stereotype threat theory is its focus on the influence of the immediate situation on performance and interests in a domain. The biological and environmental theories previously reviewed (see Appendix A) focused primarily on relatively stable factors such as brain lateralization, sex hormones, and childhood upbringing. Although the origins of gender differences vary across these theories, the underlying implication is the same: by the time someone is an adult, the damage is done. In other words, adult women have less interest or ability in math and that is it. With its focus on the situational context, stereotype threat theory highlights how subtle features of a person's immediate environment can negatively affect that person. For example, a female physics major may be more apprehensive about performing poorly on a physics exam if she is the only female in a class of a hundred males because poor performance could confirm the stereotype that women are bad at science. In this situation, she may fear that other students or the professor may judge her negatively because of her gender. Thus, instead of assuming that adult women majoring in STEM have stable STEM-related abilities and interests because they have already been exposed to years of socialization and biological influences, stereotype threat theory proposes that these women's surrounding environments can affect their abilities and interests further. Consequently, a woman may enter her STEM major feeling confident in her abilities and having a strong passion for her major, but over time her interests and performance may decline due to her environment inducing stereotype threat. By emphasizing the influence of the immediate situation, stereotype threat theory may be more useful for designing interventions to improve the performance and maintain the interest of women in STEM fields. A stereotype threat intervention may be more practical than other approaches because it is easier to reduce the relevance of a negative stereotype in a particular situation than to alter a person's genetics or childhood upbringing.

Tests of Stereotype Threat Theory

In the original test of stereotype threat theory, Steele and Aronson (1995) sought to determine if stereotype threat could account for the poor performance of African Americans on cognitive ability tests. Caucasian and African American participants were randomly assigned to one of two conditions. In the stereotype threat condition, participants were informed that they were going to take a test that accurately measured their verbal reasoning ability. By stating that the test was a measure of verbal ability, it was assumed that negative stereotypes regarding the intelligence of African Americans would be primed. In the threat removal condition, participants were informed that they were going to complete a measure designed to help researchers understand the psychological factors involved in solving verbal problems. By emphasizing a non-stereotyped domain (i.e., how people approach solving problems) in the threat removal condition, Steele and Aronson hypothesized that the negative stereotypes surrounding the intellectual ability of African Americans would not be activated, allowing African Americans to perform at their true potential. Supporting this hypothesis, African American participants performed similarly to Caucasian participants in the threat removal condition, but underperformed compared to Caucasian participants in the threat condition.

A second study by Steele and Aronson highlights how subtle, apparently imperceptible cues can affect negatively stereotyped individuals. Participants in the threat condition were asked to complete a demographics questionnaire prior to taking the intelligence test, whereas participants in the no-threat condition did not complete a demographics questionnaire prior to the test. One of the questions on the demographics questionnaire asked participants to indicate their race. Steele and Aronson hypothesized that priming race prior to the test would induce stereotype threat among African American participants. The results of the study supported Steele and Aronson's hypothesis. African Americans who were asked to indicate their race prior to the test underperformed compared to African Americans who were not asked to indicate their race prior to the test and Caucasians in both conditions. The implication of Steele and Aronson's findings is that situational factors unrelated to a person's actual ability, specifically, whether or not a negative stereotype is relevant to a situation, can have a profound effect on the test performance of negatively stereotyped individuals.

Generalizability of Stereotype Threat

Since Steele and Aronson's (1995) study, research on stereotype threat has proliferated in an attempt to establish the generalizability of the phenomenon. Other studies have replicated Steele and Aronson's findings and demonstrated that stereotype threat can undermine the cognitive ability test performance of African Americans (Nadler & Clark, 2011; Nguyen & Ryan, 2008). In addition to African Americans, stereotype threat has been found to undermine the cognitive ability test performance of Latinos (Gonzales, Blanton, & Williams, 2002; Nadler & Clark, 2011) and the memory performance of older adults (Abrams, Eller, & Bryant, 2006; Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Chasteen, Kang, & Remedios, 2011; Hess, Auman, Colcombe, & Rahhal, 2003).

It has also been discovered that stereotype threat is not restricted to groups defined by race, ethnicity, or gender. For instance, stereotype threat has been found to undermine the cognitive ability test performance of individuals from lower socioeconomic backgrounds (Croizet & Claire, 1998; Croizet & Millet, 2011; Harrison, Stevens, Monty, & Coakley, 2006; Spencer & Castano, 2007) and the childcare performance of gay men (Bosson, Haymovitz, & Pinel, 2004). Stereotype threat has also been found to undermine the cognitive ability test performance of psychology students when their performance is compared to STEM students (Crisp, Bache, & Maitner, 2009; Croizet, Despres, Gauzins, Huguet, Leyens, & Meot, 2004). Taken together, these findings suggest that both individuals with visible and non-visible identities can experience stereotype threat.

Research has also established that having a stigmatized status is not a prerequisite for experiencing stereotype threat. For example, Caucasian men have been found to experience stereotype threat when being compared to Asians in math domains (Aronson, Lustina, Good, Keough, Steele, & Brown, 1999). In Aronson et al.'s study, Caucasian men were randomly assigned to either a control condition or a threat condition in which they were informed that the researchers were interested in why Asian Americans perform so well on math tests. Caucasian men underperformed when they were explicitly told that the researchers were interested in Asian math superiority compared to when they were told nothing about the purpose of the study. Aronson and colleagues interpreted this pattern of results as evidence that a history of stigmatization is not a prerequisite for experiencing stereotype threat. Smith and White (2002) replicated Aronson et al.'s (1999) findings and discovered that explicit reminders of the stereotype that Asians perform well in math was unnecessary for stereotype threat to undermine the performance of Caucasian males on a math test. Recent research has also demonstrated that men experience stereotype threat on verbal tests (Keller, 2007a), social sensitivity/social intelligence tests (Cadinu, Maass, Lombardo, & Frigerio, 2006; Koenig & Eagly, 2005), and emotional processing tasks (Ben-Zeev, Scharnetzki, Chan, & Dennehy, 2012; Leyens, Desert, Croizet, & Darcis, 2000). Additionally, Caucasians have been found to experience stereotype threat on the implicit association test when they are told that it is a measure of racial bias (Frantz, Cuddy, Burnett, Ray, & Hart, 2004). These findings suggest that being a member of a traditionally non-stigmatized group does not protect people from experiencing stereotype threat.

A study by Stone, Lynch, Sjomeling, and Darley (1999) further demonstrates the situational specificity of stereotype threat. In Stone et al.'s study, Caucasian and African American participants were placed in one of two conditions. In one condition, participants were informed that a sports task was a measure of sports intelligence. In the second condition, participants were informed that a sports task was a measure of natural athletic ability. It should be noted that the sports task was the same in both conditions. One condition threatened African Americans by priming stereotypes alleging intellectual inferiority, whereas the other condition threatened Caucasians by priming stereotypes alleging athletic inferiority. As expected, Caucasians outperformed African American participants when they were told that the task measured sports intelligence, whereas African Americans outperformed Caucasian participants when they were told that the task measured natural athletic ability. The implication of Stone et al.'s findings is that different situational contexts can lead some groups to perform well and other groups to perform poorly. With a multitude of studies demonstrating the negative effects of stereotype threat on the performance of a diverse set of social groups in a variety of domains, Steele (1997, 2010; C. Steele et al., 2002) has concluded that stereotype threat can affect any group in domains in which they are negatively stereotyped. Because all social groups have negative stereotypes, stereotype threat can potentially affect anyone (C. Steele et al., 2002).

The Effects of Stereotype Threat on Women's Performance

The effects of stereotype threat on women's performance in a variety of domains has been heavily researched. Stereotype threat has been found to undermine women's performance in the domains of negotiation (Kray, Galinsky, & Thompson, 2002; Kray, Thompson, & Galinsky, 2001), management (Bergeron, Block, & Echtenkamp, 2006), political knowledge (McGlone, Aronson, & Kobrynowicz, 2006), and driving (Yeung & von Hippel, 2008). In terms of STEM-related domains, stereotype threat has been found to undermine women's visual-spatial (Martens, Johns, Greenberg, & Schimel, 2006; McGlone & Aronson, 2006), engineering (Bell, Spencer, Iserman, & Logel, 2003; Logel, Walton, Spencer, Iserman, Hippel, & Bell, 2009), physics (Miyake, Kost-Smith, Finkelstein, Pollock, Cohen, & Ito, 2010), and chemistry (Good, Woodzicka, & Wingfield, 2010) performance. In addition to undermining performance, stereotype threat has been found to undermine the ability of women to take high-quality notes in STEM domains (Appel, Kronberger, & Aronson, 2011).

Perhaps the most robust findings are the detrimental effects of stereotype threat on women's mathematics test performance (Nguyen & Ryan, 2008; Spencer, Steele, & Quinn, 1999). Typical studies in this research area randomly assign men and women to either a threat or a threat-removal condition. Women in the threat condition typically underperform compared to men across conditions and women in the threat-removal condition. Conversely, women in the threat-removal condition typically perform the same as men across conditions. In addition to undermining the math performance of adult women, stereotype threat has also been found to undermine the math test performance of girls in elementary and middle school (Ambady, Shih, Kim, & Pittinsky, 2001; Huguet & Regner, 2009; Neuville & Croizet, 2003). These findings across several studies suggest that stereotype threat can undermine women's STEM-related performance.

Perhaps the most representative studies in this line of research are a series of studies conducted by Spencer et al. (1999). In one study, male and female participants were placed in one of two conditions. Participants in the threat condition were told that the math test they were about to take demonstrated gender differences. It should be noted that the threat condition did not state that men outperform women. Participants in the no-threat condition were told that the math test they were about to take demonstrated no gender differences. By explicitly stating that there were no gender differences, Spencer et al. attempted to render the negative stereotypes regarding the math ability of females irrelevant to the testing context. The study results supported this hypothesis; women in the no-threat condition performed similarly to men in both conditions. However, women in the threat condition underperformed compared to men in both conditions and women in the no-threat condition. One limitation of this study is that it is unlikely that any real-life testing situation would explicitly draw attention to group differences on a test. Consequently, a second study was carried out in which the explicit threat condition was replaced by a more realistic threat condition.

Spencer et al.'s (1999) follow-up study replaced the explicit gender difference condition with a control condition that stated nothing about group differences on the test. Given the pervasiveness of gender stereotypes regarding the math ability of females, Spencer and colleagues argued that explicit activation of the stereotype is unnecessary for stereotype threat to occur. In other words, giving women a math test should automatically activate the stereotype that women are not good at math. In this study, male and female participants were placed in one of two conditions. The no-threat condition was the same as the previous study in which participants were explicitly told that the test demonstrated no gender differences. In the place of an explicit threat condition, a control condition was used that did not mention group differences on the math test. Mirroring the results of the previous study, women in the no-threat condition performed the same as men in both conditions. Conversely, women in the control condition underperformed compared to men in both conditions and women in the no-threat condition. The underperformance of women in the control condition compared to the no-threat condition led Spencer et al. to suggest that stereotype threat may be operating in real-life testing situations because real-life testing situations mirror the control condition more than the no-threat condition in the study. The implication of Spencer et al.'s studies is that common stereotypes regarding female inferiority in mathematics may actually affect women's performance on mathematics tests. Spencer et al.'s findings also suggest that the differences in women's performance in the control and no-threat condition could not be due to an innate inferiority in math because changing the situational context would have no effect on women's performance if women are just inherently bad at math.

A pair of studies by Shih, Pittinsky, and colleagues (Shih, Pittinsky, & Ambady, 1999; Shih, Pittinsky, & Trahan, 2006) further illustrates how different situational contexts can cause members of the same group to perform better or worse. In their first study, Shih et al. (1999) placed high achieving (i.e., minimum SAT math score of 600, mean SAT math score of 750) Asian American women in one of three identity prime conditions. The female prime condition primed participants' gender by having them answer questions regarding their preferences for coed or single-sex housing. The Asian prime condition primed participants' ethnicity by having them answer questions regarding what languages they know and speak at home. Participants in the control condition were asked questions unrelated to their gender or ethnicity, such as whether they would subscribe to cable television. Because Asians are positively stereotyped in the domain of math and women are negatively stereotyped in the domain of math, Shih et al. hypothesized that Asian women would perform best on a math test when their ethnic identity was primed and worse when their gender identity was primed. The results supported their hypothesis with Asian women performing best in the Asian prime condition and worse in the female prime condition.

Shih et al. (2006) later sought to determine if the opposite results could be obtained in the verbal domain. Because the opposite stereotypes are in effect, with Asians being negatively stereotyped and females being positively stereotyped, Asian women were hypothesized to perform best on a verbal test when their gender identity was primed and worse when their ethnic identity was primed. Utilizing a similar methodology as in the previous study, Shih et al. (2006) found that Asian women performed best in the female prime condition and worse in the Asian prime condition. Both studies demonstrate the importance of situational factors in undermining the performance of a group. In each study, participants completed the same task. However, priming different social identities resulted in notable differences in performance. Thus, a person may perform better in a domain when a relevant positive stereotype is activated, but worse when a relevant negative stereotype is activated. Unfortunately for women in STEM domains, they face negative stereotypes regarding their abilities.

The Effects of Stereotype Threat on Women's Interests

Although the bulk of stereotype threat research has examined its effects on test performance, some researchers have begun to examine the effects of stereotype threat on interests. Perhaps the first study to examine the effects on stereotype threat on interest was carried out by Davies, Spencer, Quinn, and Gerhardstein (2002). Davies and colleagues wanted to determine if stereotype threat could account for the lack of female interest in STEM fields. Across three studies, stereotype threat was induced via television commercials. Participants in the no-threat condition viewed four neutral commercials. The neutral commercials were advertisements for a cellular phone, a gas station, a pharmacy, and an insurance company. No humans were depicted in the neural commercials. Participants in the threat condition viewed the four neutral commercials and two gender stereotypic commercials. The first gender stereotypic commercial featured a young women jumping for joy over a new acne product. The second gender stereotypic commercial featured a woman who was eager to try a new brownie mix. It is important to note that neither commercial referenced gender differences in math or career choices.

The first study sought to replicate stereotype threat effects on math test performance to establish that the commercial manipulations were a successful threat manipulation. Women who viewed the gender stereotypic commercial underperformed compared to men in the same condition and women in the neutral condition. Conversely, women who viewed the neutral commercials performed the same as men. Thus, it appears that the commercial manipulation was successful at inducing stereotype threat.

The second study sought to determine if stereotype threat leads women to avoid math domains in favor of verbal domains. Because women are negatively stereotyped in mathematics domains and positively stereotyped in verbal domains, stereotype threat may lead women to avoid math problems in favor of verbal problems. Only participants who strongly agreed with the statements: "I am good at math" and "it is important to me that I am good at math" were allowed to participate in the study. By only including participants who cared about performing well in math, differences in problem selection based on math identification can be ruled out. After viewing the same commercials as in the first study, participants were given a test consisting of verbal and math items. Across both conditions, men attempted more math problems than verbal problems. Similarly, women in the neutral condition attempted more math problems than verbal problems. However, women in the threat condition attempted more verbal problems than math problems. Because the number of problems attempted varied by condition, accuracy was used as the indicator of performance in this study. Across both conditions, men were more accurate on the mathematics test compared to the verbal test. Given that participants were selected on the degree to which they cared about doing well in mathematics, it makes sense that men across both conditions performed better on the math problems. Similarly, women who viewed the neutral commercials were more accurate on the mathematics test compared to the verbal test. However, women who viewed the gender stereotypic commercials were not more accurate on the mathematics test compared to the verbal test. Furthermore, women who viewed gender stereotypic commercials were also less accurate on the math test compared to women who viewed neutral commercials. The implication of the findings of this study is that in addition to undermining performance in a domain, stereotype threat can lead people to avoid a negatively stereotyped domain.

The last study reported in Davies et al. (2002) replaced the math and verbal test with a vocational interest survey as the primary dependent variable. After viewing the same commercials in the first two studies, participants were asked to indicate their interest in various career options. Some of the careers represented mathematics domains (i.e., mathematics, engineering, and computer science), whereas other careers represented verbal domains (i.e., creative writing, communication, and linguistics). The same inclusion criteria as the second study were utilized to insure that participants cared about doing well in mathematics. Given that participants were selected on the degree to which they cared about mathematics, it makes sense that men across both conditions preferred careers in mathematics domains more than careers in verbal domains. Similarly, women who viewed the neutral commercials indicated greater preferences for mathematics-related careers than verbal-related careers. In contrast, women who viewed the gender stereotypic commercials indicated greater preferences for verbal-related careers than mathematics-related careers. Direct comparisons of the preferences of women across the two conditions revealed that women in the neutral condition expressed more interest in math-related careers than women in the threat condition. Conversely, women in the threat condition expressed more interest in verbal-related careers than women in the neutral condition. The findings of this study suggest that stereotype threat may play a role in undermining women's interests in STEM fields. Given that gender stereotypes may be conveyed by parents, peers, teachers, and the media, many women may experience stereotype threat and avoid STEM careers as a result.

Steele and Ambady (2006) also found that priming women's gender identity induces stereotype consistent attitudes. In this study, Steele and Ambady primed either women's gender identity or a neutral identity. Gender identity was primed by asking women to indicate their sex on a questionnaire and answer questions regarding their preferences for co-ed or single-sex living arrangements. A neutral identity was primed by asking women to answer questions regarding their telephone service. Women who were primed with their gender identity indicated greater preferences for art-related careers compared to math-related careers. However, women who were primed with a neutral identity indicated similar preferences for art- and math-related careers. These findings illustrate how situations that prime one's gender identity can result in stereotype consistent attitudes. Thus, if female STEM-majors frequently have their gender identity primed, they may lose interest in STEM fields.

Despite being theorized as a contributor to gender differences in career interests (Steele, 1997), the role stereotype threat plays in affecting interests remains largely unexamined. Besides the studies previously discussed, studies by Davies, Spencer, and Steele (2005) on the effects of stereotype threat on leadership aspirations and a pair of studies by Gupta and colleagues (Gupta & Bhawe, 2007; Gupta, Turban, & Bhawe, 2008) on the effects of stereotype threat on entrepreneurship intentions collectively represent the bulk of the studies examining the effects of stereotype threat on interests. This is in sharp contrast to the hundreds of studies that have been carried out on the effects of stereotype threat on performance (Nguyen & Ryan, 2008). This overemphasis on performance outcomes may be problematic because performance decrements may not be the most important outcome of stereotype threat (Shapiro & Neuberg, 2007). Given that gender differences in interests tend to be larger than gender differences in mathematical performance, and that some research suggests that gender differences in interests play a larger role than gender differences in ability in explaining female underrepresentation in STEM (Ceci &Williams, 2007; Ceci et al., 2009), the effects of stereotype threat on interests may be more consequential than its effects on performance. Many researchers have called for more research to examine the effects of stereotype threat on interests (Davies et al., 2005; Inzlicht & Schmader, 2011).

The stereotype threat interest studies are also notable in a key limitation they share; they all took place in a short-term laboratory context. Given that the bulk of stereotype threat research has been carried out in laboratory settings, some have questioned if stereotype threat generalizes outside of the lab (Sackett, 2003; Sackett, Hardison, & Cullen, 2004; Sackett & Ryan, 2011; Sackett, Schmitt, Ellingson, & Kabin, 2001). Many researchers have noted that determining the generalizability of stereotype threat outside of laboratory settings is a critical research need (Bergeron et al., 2006; Chung; Ehrhart, Ehrhart, Hattrup, & Solamon 2010; Cullen, Hardison, & Sackett, 2004; Jordan & Lovett, 2007; McKay, Doverspike, Bowen-Hilton, & Martin, 2002; McKay, Doverspike, Bowen-Hilton, & McKay, 2003). Consequently, one of the purposes of the present study is to determine if stereotype threat occurs in real-world settings. Additionally although studies have examined the effects of stereotype threat on interests, they all measured interests soon after the stereotype threat manipulations. As a result, although it can be said that stereotype threat undermines immediate interests, it is unclear what effect stereotype threat has on more long-term interests.

Stereotype Threat Risk Factors

Given that stereotype threat has been found to undermine women's performance and interest in STEM-related domains, it is important to identify the risk factors that increase a person's susceptibility to experiencing stereotype threat. Unfortunately, women majoring in STEM fields likely possess the traits and are exposed to environmental factors that increase the risk of experiencing stereotype threat. These risk factors include the existence of negative ability stereotypes, the relevance of those stereotypes to the situational context female STEM majors find themselves in, the difficulty of STEM courses, numerical underrepresentation, and domain identification The combined effect of each of these environmental and trait moderators makes it highly likely that women in STEM are vulnerable to stereotype threat.

Existence of Stereotypes

A necessary condition for stereotype threat to occur is the existence of a negative stereotype. Unfortunately, it appears that women are still negatively stereotyped in STEM fields (Chipman, 2005). For instance, across 299,298 respondents, both men and women were quicker to associate science with males and females with humanities than science with females and humanities with males (Nosek et al., 2007). The stronger association between males with science and females with humanities was found on both implicit (d = .93) and explicit measures (d = .79). Overall, 72% of respondents in Nosek et al.'s (2007) study were quicker to associate science with males and females with humanities than the reverse pairing. Another study by Nosek, Banaji, and Greenwald (2002) found that both men and women were quicker to associate math with males and art with females than the reverse paring (d = 1.47).

Unfortunately, having strong implicit associations between math and science with males has negative consequences for women. For instance, Nosek et al. (2002) found that the more women implicitly associated math with male, the lower their identification with math and performance on the SAT math test. Males on the other hand demonstrated the opposite pattern; the more men implicitly associated math with male, the higher their identification with math and performance on the SAT math test. Additionally, Kiefer and Sekaquaptewa (2007) found evidence that women who hold strong implicit associations between math and male may chronically experience stereotype threat. For instance, females with high implicit associations between math and male underperformed in both a threat and no-threat condition, whereas females with weak implicit associations between math and male only underperformed in the threat condition.

In terms of explicit stereotyping, people view engineering, physics, and math professions as masculine fields (Shinar, 1975; Beggs & Doolittle, 1993). Additionally, people believe that females have more difficulty learning STEM material than males (Appel et al., 2011). Female STEM majors are aware of occupational stereotypes with research indicating that female STEM majors explicitly stereotype math and engineering as a male domain and English as a female domain (Stout, Dasgupta, Hunsinger, & McManus, 2011). These findings suggest that STEM fields are stereotyped as male-typed fields.

Stereotype Relevance

Stereotypes must be relevant to a situational context in order for stereotype threat to occur. In other words, people only experience stereotype threat when they are in situations in which negative stereotypes can be used as an explanation for their behavior. The importance of situational relevance was demonstrated by Spencer et al.'s (1999) study. By stating that there were no gender differences on the math test in the no-threat condition of their studies, Spencer and colleagues were able to render the widespread negative stereotypes regarding the math ability of women irrelevant to the testing context. Unfortunately, the control condition resulted in women underperforming on the math test similarly to women who were explicitly told that the math test they took demonstrated gender differences. The underperformance of women in the control condition suggests that negative stereotypes do not need to be explicitly stated in order for stereotype threat to occur. Other studies have also found that negatively stereotyped individuals underperform similarly in both control conditions that say nothing about group differences and threat conditions that explicitly state that groups differ in performance (Hess et al., 2003; Smith & White, 2002). In essence, doing nothing to refute a negative stereotype is just as threatening as explicitly inducing stereotype threat. Thus, taking a test in a negatively stereotyped domain is sufficient to induce stereotype threat (Davies & Spencer, 2005). This supports Steele's (1997) assertion that threat can be "in the air". Unfortunately for women in STEM fields, threat appears to be "in the air".

Negative stereotypes regarding the STEM-related abilities of women are likely relevant in many of the STEM courses female STEM majors take. It is likely that STEM classes mirror the control condition of Spencer et al.'s (1999) study more than the no-threat condition because it is unlikely that many classes will make a point of emphasizing the absence of gender differences. Additionally, the research on chilly classrooms previously discussed suggests that gender stereotypes may be primed in STEM classes. For instance, female STEM majors report frequently being treated rudely and experiencing sexually-suggestive comments and jokes from their male peers (Seymour & Hewitt, 1997). Because female STEM majors are singled out by their male peers based on gender, they are likely aware of the possibility that they are being judged based on gender stereotypes. To determine if interacting with sexist men induces stereotype threat, Logel et al. (2009) had female engineering majors interact with either sexist men or non-sexist men. Compared to the women who interacted with the non-sexist men, women who interacted with the sexist men underperformed on an engineering test and a mathematics test, but not on an English test. These results are indicative of someone experiencing stereotype threat because underperformance only occurred in negatively stereotyped domains.

It should be noted that the absence of direct experience with sexism from their male peers does not necessarily mean that female STEM majors will experience a non-threatening environment. For instance, beginning STEM courses may fit Betz's (2005) description of a null environment. According to Betz's, a null environment does not encourage or discourage people, it just ignores them. Given the ambivalent nature of null environments, it is unlikely that efforts will be taken to refute negative group stereotypes. In addition to being a null environment, many introductory STEM courses are designed to weed students out (Seymour & Hewitt, 1997). Unfortunately, a weed-out culture is unlikely to create a welcoming and supportive environment. In essence, women majoring in STEM fields likely encounter few situations in which negative stereotypes regarding their STEM abilities are actively refuted. Consequently, it is likely that females majoring in STEM fields experience situations in which they are confronted with the possibility that they will be judged based on negative stereotypes.

Difficulty

The difficulty of STEM courses is yet another factor that may induce stereotype threat among women majoring in STEM fields. Stereotype threat is theorized to only occur when individuals are faced with difficult tasks that push them to the upper limits of their ability (Steele, 1997, 2010). Easy tasks are unlikely to induce stereotype threat because the ease of the task makes it likely that the stereotyped individual will perform well. By performing well, the person disproves the stereotype. However, on difficult tasks, the person faces the possibility that he or she will fail and as a result of failing, confirm the negative stereotype. Because STEM courses progressively become more difficult, the likelihood of experiencing stereotype threat becomes greater as females advance further in their STEM education.

Empirical evidence supports the proposition that stereotype threat primarily undermines performance on difficult tasks (Ben-Zeev, Fein, & Inzlicht, 2005; Blascovich, Spencer, Quinn, & Steele, 2001; Keller, 2007b; Neuville & Croizet, 2007; Nguyen & Ryan, 2008; O'Brien & Crandall, 2003; Spencer et al., 1999). Blascovich et al. (2001) examined the effects of stereotype threat on easy, moderately difficult, and difficult problems. Only on the difficult problems did African Americans in the threat condition underperformed compared to African Americans in the no-threat condition and Caucasians in both conditions. There was no difference in performance across race (i.e., African American and Caucasian) and condition (i.e., threat and no-threat) on the easy and moderately difficulty problems. Similarly, Spencer et al. (1999) found that women underperformed compared to men only on difficult math problems. Nguyen and Ryan's (2008) meta-analysis obtained similar results with stereotype threat undermining the performance of women taking difficult math tests (d = -.36) more than moderately difficult math tests (d = -.18). Nguyen and Ryan (2008) also found evidence of an inconsistent tendency for stereotype threat to boost the performance of women on easy math tests (d = .08). Other studies have also obtained evidence that stereotype threat undermines the performance of women on difficult math tests, but boosts their performance on easy math tests (O'Brien & Crandall, 2003; Neuville & Croizet, 2007). Despite the potential beneficial effects of stereotype threat on easy math tasks, women majoring in STEM are unlikely to receive this benefit because they will most likely encounter progressively more difficult STEM-related tasks. As a result, women will likely be at greater risk for experiencing stereotype threat as they progress further in their STEM education.

Underrepresentation

Numerical underrepresentation is yet another environmental factor that has been found to induce stereotype threat (Beaton, Tougas, Rinfret, Huard, & Delisle, 2007; Ben-Zeev et al., 2005; Inzlicht & Ben-Zeev, 2000, 2003; Schmader & Johns, 2003). Research has found that being the only woman in a group of men results in women believing that they will be stereotyped more than women in a group of women (Cohen & Swim, 1995). The greater expectation of being stereotyped among those who are underrepresented increases their vulnerability to stereotype threat.

A study by Inzlicht and Ben-Zeev (2000) illustrates how being underrepresented can induce stereotype threat. In this study, female participants took either a verbal test or a math test with two male or two female test-takers present in the room. Inzlicht and Ben-Zeev hypothesized that being underrepresented in a testing context would induce stereotype threat among women taking a math test because being the only member of a given social identity draws attention to that identity. Furthermore, being the only member of a social group in a negatively stereotyped domain suggests that the stereotype may be a valid explanation for the underrepresentation of that social group. However, because women are not negatively stereotyped in verbal domains, drawing attention to their gender should not induce stereotype threat among women taking a verbal test. The results of the study were supportive of these predictions. Women who took the math test with two other women performed better (M = 70% correct) than women who took the math test with two men (M = 55%). Further supporting the hypothesis that the underperformance of women in the minority condition was due to stereotype threat, women did not differ in their verbal test performance (*M* = 44% in both conditions), regardless if they took the test with two female or two male test-takers.

A second study by Inzlicht and Ben-Zeev (2000) had women take a math test with two other female test-takers, two other male test-takers, or one male and one female test-taker. Women performed best on the math test when they took it with two other female test-takers (*M* = 70% correct). However, the performance of women declined in proportion to the number of male test-takers present, with women performing the worst in the all male test-taker condition (*M* = 58% correct), followed by the male and female test-taker condition (*M* = 64% correct). Further supporting the hypothesis that the underperformance of women was due to stereotype threat and not underrepresentation, men performed the same on the math test regardless of the gender composition of the test-takers in the room (*M* = 66 - 67% correct across conditions). Other studies have obtained similar results, finding that women underperform on math tests when they take them in the presence of men (Beaton et al., 2007; Ben-Zeev et al., 2005). Studies have also found that negatively stereotyped individuals can experience stereotype threat and underperform when a competent outgroup member administers a test (Marx & Goff, 2005; Marx & Roman, 2002). These findings suggest women in STEM majors may experience stereotype threat because they are underrepresented among both the STEM student body and STEM faculty.

Domain Identification

Domain identification is a trait theorized to increase a person's risk of experiencing stereotype threat. Domain identification refers to "the extent to which an individual defines the self through a role or performance in a particular domain" (Osborne & Jones, 2011, p. 132;

Osborne & Walker, 2006, p. 563). In essence, domain identification can be defined as how much a person cares about a given domain. Research has found evidence that domain identification is related to success in a given domain (Osborne & Jones, 2011). Intuitively this makes sense because the more a person cares about a domain, the greater the likelihood that he or she will devote the time and effort needed to master a domain.

Unfortunately, domain identification has also been found to increase a person's vulnerability to stereotype threat (Aronson, Quinn, & Spencer, 1998; Maass & Cadinu, 2003; Osborne & Jones, 2011; Schmader et al., 2008; Steele, 1997, 2010; C. Steele et al., 2002). Although some would assume that high domain identification would make one more resilient to stereotype threat, Steele (1997) argues that the more a person cares about a domain, the more negative stereotypes regarding their group's performance in a given domain is personally relevant to their self-concept. In other words, the more someone cares about something, the more failure and the resulting confirmation of a negative stereotype undermines that person's self-esteem (Aronson et al., 1998).

Conversely, non-domain identified individuals are theorized to be largely immune to stereotype threat because poor performance is not personally meaningful to them (Maass & Cadinu, 2003). However, although low domain identification protects one from stereotype threat, low domain identification is not beneficial in terms of performance. Overall, non-identified individuals are theorized to perform worse than identified individuals because they don't devote as much time and effort towards mastering a given domain (Osborne & Jones, 2011; Steele, 2010). In essence, negatively stereotyped individuals face losing propositions in negatively stereotyped domains. If they remain identified with a negatively stereotyped domain they may experience stereotype threat and underperform. If they stop being identified with a negatively stereotyped domain they may no longer experience stereotype threat, but they may still underperform because they have stopped trying to master the domain.

Empirical studies have supported the link between domain identification and increased vulnerability to stereotype threat (Aronson et al., 1999; Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003; Frantz et al., 2004; Gresky, Ten Eyck, Lord, & McIntyre, 2005; Keller, 2007b; Lesko & Corpus, 2006; Leyens et al., 2000; Stone et al., 1999). Aronson et al. (1999) were one of the first to highlight the importance of domain identification in moderating the effects of stereotype threat. The participants in this study were enrolled in a rigorous math course, scored above a 550 on the SAT math, and answered a question regarding how important math was to their self-concept. The top third of the sample were labeled as high domain identifiers and the bottom third were labeled as moderate identifiers. The bottom third of the sample were labeled as moderate identifiers instead of low identifiers because non-identified students presumably would not have enrolled in a second semester calculus course. In essence, the bottom third of the sample was not as identified with math as the top third of the sample, but were identified enough with math to take an advance course in mathematics. In terms of how stereotype threat interacted with domain identification, high domain identifiers underperformed compared to moderate domain identifiers in the threat condition. Conversely, high domain identifiers performed better than moderate domain identifiers in the no-threat condition. This study’s findings suggest that highly domain identified individuals are most negatively affected by stereotype threat.

In the case of women taking math tests, a study of Cadinu et al. (2003) is particularly illustrative of the moderating effects of domain identification. In this study, women high and low in domain identification were placed in one of three conditions. Those who were placed in the threat condition were told that women performed worse on math tests than men. Those who were placed in the no-difference condition were told that women and men perform the same on math tests. Lastly, those who were placed in the positive performance condition were told that women perform better than men on math tests. The results revealed that stereotype threat primarily affected women who were highly identified with mathematics. Women highly identified with mathematics underperformed in the threat condition (M = 5.23) compared to the no-difference (M = 13.46), and positive performance conditions (M = 16.58). The performance of women who were not identified in mathematics did not differ across the three conditions (threat condition: M = 11.36, no-difference condition: M = 10.05, and positive performance condition: M = 10.53). From this study and other studies examining the interaction between stereotype threat and domain identification (Gresky et al., 2005; Keller, 2007b), it appears that stereotype threat primarily affects the performance of high domain identifiers. In the absence of stereotype threat, high domain identifiers outperform non-domain identifiers.

One of the long-term defense mechanisms against stereotype threat is domain disidentification. Domain disidentification occurs when a person redefines their self-concept such that a threatening domain is no longer a basis for self-evaluation (Aronson et al., 1998; Steele, 1997; C. Steele et al., 2002). When a person is disidentified, his or her self-esteem is no longer affected by performance in the disidentified domain (Aronson et al., 2002; Major & Schmader, 1998; Major, Spencer, Schmader, Wolfe, & Crocker, 1998; Osborne & Jones, 2011). For example, a woman who disidentifies from mathematics no longer cares about how well she performs in math-related domains. Regardless if she performs well or poorly on a math test, it does not affect her self-esteem because math is no longer personally relevant to her. Although disidentification helps preserve self-esteem in the face of failure, it hinders development and performance in the disidentified domain. The underrepresentation of women in STEM fields may be an outcome of women becoming disidentified with STEM-related domains as a result of repeated experiences of stereotype threat (Davies & Spencer, 2005; Logel, Peach, & Spencer, 2011). Initial research suggests that stereotype threat undermines domain identification (Davies et al., 2002; Harrison et al., 2006). Interventions that reduce stereotype threat may be able to help stop the disidentification process and stem the tide of women leaving STEM fields.

In essence, women majoring in STEM fields are vulnerable to experiencing stereotype threat because they have or are exposed to several stereotype threat risk factors. First, women majoring in STEM fields are likely somewhat identified with success in their respective fields. If these women were disidentified, they would have likely chosen different majors. Additionally, as women advance further in their STEM education, they face increasing difficulty and underrepresentation. Furthermore, negative stereotypes regarding the STEM-related abilities of women are commonly known and are unlikely to be actively refuted in STEM courses. Consequently, exposure to all of these risk factors suggests that women in STEM fields may experience stereotype threat. Initial studies have found that stereotype threat undermines the performance of women in engineering (Bell et al., 2003; Logel et al., 2009), physics (Miyake et al., 2010), chemistry (Good et al., 2010), and math (Nguyen & Ryan, 2008), as well as their interests in math (Davies et al., 2002) and computer science (Cheryan et al., 2009). By undermining both their performance and interests, stereotype threat may lead women majoring in

STEM to become disidentified, drop out of STEM fields, and pursue other careers in which they do not have to deal with the extra burden of stereotype threat.

A study by Steele, James, and Barnett (2002) provides some initial evidence that stereotype threat may be a pervasive problem for female STEM majors. J. Steele et al. (2002) examined the degree to which college women and men self-reported experiencing stereotype threat in a variety of majors. Given the prevalence of negative stereotypes regarding female math ability, women majoring in STEM were hypothesized to report the most stereotype threat. As predicted, women in STEM majors reported experiencing more stereotype threat than women in non-STEM majors and men in STEM and non-STEM majors. Female STEM majors also reported experiencing more discrimination and having a greater desire to change majors. Unlike women in STEM majors, men in female-dominated majors did not report experiencing more stereotype threat than men in STEM majors. These initial findings suggest that stereotype threat may be a problem women face in STEM fields.

The Mediators of the Stereotype Threat-Performance Relationship

Given that stereotype threat is likely to be a problem for female STEM majors, understanding the mechanisms behind stereotype threat is necessary in order to develop theoretically sound interventions. After stereotype threat was found to generalize across different groups in different contexts, researchers sought to uncover the mechanisms behind stereotype threat. Initial research on the mediators of stereotype threat failed to identify consistent mediators (see Smith, 2004). Null findings and conflicting results were common across studies. However, since the first wave of mediation research, more consistent findings have emerged. These consistencies have led to various process models being proposed, some focusing on working memory (Schmader et al., 2008) and others focusing on motivational factors (Ryan & Ryan, 2005; Smith, 2004).

Working Memory

Schmader and colleagues' (Schmader & Beilock, 2011; Schmader & Croft, 2011; Schmader et al., 2008) mediation model highlights the role of working memory in the stereotype threat process. Schmader et al. (2008) define working memory as "a limited-capacity executive process that coordinates cognition and controls behavior to achieve performance goals in the presence of exogenous or endogenous information that competes for attention" (p. 340). In general, working memory is a key determinant of successful performance on complex task. In this model, stereotype threat is argued to lead to three immediate responses, physiological stress, negative thoughts/emotions, and situational monitoring/vigilance. Physiological stress refers to the arousal/anxiety a person experiences due to stereotype threat. Physiological stress is argued to boost performance on easy tasks but undermine performance on difficult talks (Schmader & Croft, 2011). In addition to experiencing physiological stress, stereotype threat is argued to lead people to have negative thoughts and emotions (Cadinu, Maass, Rosabianca, & Kiesner, 2005). Lastly, people experiencing stereotype threat are proposed to increase their monitoring of external cues and internal states. These three responses are argued to mutually influence each other and lead people to try to suppress their negative thoughts and feelings (Carr & Steele, 2009; Johns, Inzlicht, & Schmader, 2008; Logel et al., 2009). Because working memory is a limited resource and stereotype threat diverts working memory towards suppressing negative emotions and monitoring for signs of whether a person is confirming a stereotype, there is less working memory remaining for task performance (Beilock, 2008; Johns et al., 2008). In essence, people experiencing stereotype threat do not devote all of their working memory towards task performance, some of it is redirected towards suppression and monitoring processes. It is this redirection of working memory away from the task that undermines performance on cognitively demanding tasks. Studies have confirmed that working memory mediates the effects of stereotype threat on performance (Croizet et al., 2004; Johns et al., 2008; Rydell, McConnell, & Beilock, 2009; Schmader & Johns, 2003).

Performance-Avoidance Goals

In contrast to Schmader and colleagues' (Schmader & Beilock, 2011; Schmader & Croft, 2011; Schmader et al., 2008) working memory model, Smith (2004) and Ryan and Ryan (2005) have proposed complementary mediation models highlighting the role of goal-orientation in mediating the effects of stereotype threat. Originally, research on goal-orientation proposed two types of goal orientations, performance and learning goal-orientation. Learning goals, also known as mastery goals, are driven by the desire to increase competence and task mastery (Dweck, 1986, 1999). Conversely, performance goals are driven by the desire to gain favorable judgments of competence and to avoid judgments of incompetence (Dweck, 1986, 1999). In essence, learning goals are focused on performance on the task itself, whereas performance goals are focused on performance in relation to other people (Ryan & Ryan, 2005). Learning goals have been found to be positively related to intrinsic motivation, self-efficacy, effort, persistence, deep information processing, and learning (Elliot, 1999; Elliot & Church, 1997, Elliot &

McGregor, 2001; Elliot & Murayama, 2008; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Middleton & Midgley, 1997; Payne, Youngcourt, & Beaubien, 2007; Rawsthorne & Elliot, 1999). Unlike research on learning goals, the relationship between performance goals and outcomes was originally inconsistent (Elliot, 1999).

The inconsistent findings regarding performance goals led researchers to distinguish between performance-approach and performance-avoidance goals. Performance-approach goals focus on the desire to obtain favorable judgments of competence (Elliot & Church, 1997; Elliot & Harackiewicz, 1996; VandeWalle, 1997). Conversely, performance-avoidance goals focus on the desire to avoid unfavorable judgments of competence (Elliot & Church, 1997; Elliot & Harackiewicz, 1996; VandeWalle, 1997). Research has supported the distinction between performance-approach and performance-avoidance goals. Performance-avoidance goals have been found to be negatively related to performance, intrinsic motivation, and self-efficacy, and positively related to state anxiety, distractions, and shallow information processing (Elliot, 1999; Elliot & Church, 1997; Elliot & Harackiewicz, 1996; Elliot & McGreggor, 1999, 2001; Elliot & Murayama, 2008; Middleton & Midgley, 1997; Payne et al., 2007; Rawsthorne & Elliot, 1999). Conversely, performance-approach goals have been found to be positively related to performance (Elliot & Church, 1997; Elliot & McGreggor, 1999, 2001; Elliot & Murayama, 2008; Harackiewicz et al., 2002).

Both Smith (2004) and Ryan and Ryan (2005) propose that stereotype threat leads people to adopt performance-avoidance goals because stereotype threat is driven by people's desire to avoid confirming negative stereotypes regarding their social group. The adoption of performance-avoidance goals is argued to result in increased anxiety, reduced self-efficacy, and impaired cognitive processing (Smith, 2004; Ryan & Ryan, 2004). Despite not explicitly including performance-avoidance goals in their model, Schmader and colleagues (Schmader & Beilock, 2011; Schmader & Croft, 2011; Schamder et al., 2008) discuss how the desire to avoid failure is what drives the stereotype threat process. For example, Schmader and Beilock (2011) state that, "by definition, stereotype threat characterizes a concern that one might inadvertently confirm an unwanted belief about one's group. As a result, those who experience stereotype threat have a motivation to avoid enacting any behavior that might be seen as stereotypical (p. 35)." They also later state that "the experience of threat activates a goal to avoid confirmation of the stereotype" (p. 41). In essence, stereotype threat is driven by the desire to avoid failure, which is by definition what performance-avoidance goals are. Thus, across Smith's (2004), Ryan and Ryan's (2005), and Schmader et al.'s (Schamder & Beilock, 2011; Schmader et al., 2008) models, performance-avoidance goals appear to be the key initial driver of the stereotype threat process.

Initial research suggests that performance-avoidance goals may mediate the effects of stereotype threat. For instance, studies have demonstrated that women underperform more in negatively stereotyped domains when they are situations that can identify those who are weak in a negatively stereotyped domain versus situations that can identify those who are strong in a negatively stereotyped domain (Brown & Josephs, 1999; Keller & Bless, 2008). Within the goal-orientation research literature, situations that identify those who are weak in a domain are argued to induce performance-avoidance goals, whereas situations that identify those who are strong in a domain are argued to induce performance-approach goals (Elliot & Harackiewicz, 1996). Consequently, the underperformance of women on math tests that identify those who are weak in math compared to math tests that identify those who are strong in math can be used as initial evidence that women are concerned about avoiding confirmation of negative group stereotypes.

Research has also directly tested the link between stereotype threat and performance-avoidance goals. Smith (2006) found that women experiencing stereotype threat expressed more performance-avoidance goals than women not experiencing stereotype threat and men across conditions. Performance-avoidance goals in turn were found to mediate the relationship between stereotype threat and performance expectancies. Brodish and Devine (2008) extended Smith's (2006) findings by demonstrating that performance-avoidance goals mediate the relationship between stereotype threat and performance. Brodish and Devine found that experiencing stereotype threat leads people to adopt performance-avoidance goals. Performance-avoidance goals were found to influence state test anxiety (i.e., worry), which in turn resulted in underperformance. Although preliminary, these findings suggests that stereotype threat undermines performance by getting people to adopt performance-avoidance goals. The adoption of performance-avoidance goals in turn undermines performance by increasing state anxiety.

State Anxiety

Unlike performance-avoidance goals, the role of state anxiety in mediating the effects of stereotype threat has been heavily researched. Steele and Aronson (1995) were the first to propose and study anxiety as a mediator of stereotype threat. After completing the intelligence test in Steele and Aronson's (1995) study, participants completed the Spielberger State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970). Despite being theorized to increase anxiety, there was no difference in self-reported anxiety across conditions. Unfortunately, other studies that utilized the Spielberger State-Trait Anxiety Inventory have also failed to demonstrate a link between stereotype threat and state anxiety (Aronson et al., 1999; Chasteen et al., 2005; Good et al., 2010; Klein et al., 2007; Schmader, 2002; Schmader & Johns, 2003; Smith, 2004). These null findings have led some researchers to rule out state anxiety as a mediator of stereotype threat.

In contrast to the lack of findings across studies utilizing self-report measures of anxiety, studies utilizing nonverbal and physiological measures of anxiety have uncovered supporting evidence that stereotype threat may be mediated by anxiety. Blascovich et al. (2001) were one of the first researchers to use a non-self-report measure of anxiety. In this study, the mean arterial blood pressure of participants was measured. Compared to African Americans in the no-threat condition, African Americans in the threat condition had higher mean arterial blood pressure and lower performance on an intelligence test. Although formal tests of mediation were not carried out, Blascovich et al.'s findings suggest that arousal may be a mechanism by which stereotype threat undermines performance. Studies by Ben-Zeev et al. (2005), Neuvile and Croizet (2007), and O'Brien and Crandall (2003) also highlight the importance of arousal in the stereotype threat process. In these studies, stereotype threat undermined performance on difficult problems, but increased performance on easy problems. This pattern of results suggests that stereotype threat pushes a person's arousal level beyond the optimal point for performing well on difficult tasks. Unfortunately, none of these studies carried out formal mediation tests.

In terms of more direct mediation evidence, Bosson et al. (2004) demonstrated the link between stereotype threat and anxiety. In this study, homosexual and heterosexual men participated in a study examining how college students interacted with children. Homosexual men were assumed to be vulnerable to stereotype threat because of the common stereotype alleging that homosexual men are dangerous around children. Judges who were blind to the procedures and hypotheses of the study were asked to code the videotaped interactions between participants and children. Specially, judges were asked to rate the discomfort of participants based on behaviors such as fidgeting, playing with hair, biting nails, nervous smiling, and stiff posture. Homosexual men in the threat condition were found to display more nonverbal signs of discomfort than homosexual men in the no-threat condition. These nonverbal signs of discomfort mediated the relationship between the threat manipulation and childcare performance. In contrast to the behavioral measures of anxiety, self-reported anxiety did not differ across conditions. In other words, homosexual men reported the same levels of anxiety across conditions but displayed more signs of discomfort in the threat condition. The inconsistencies between the self-report and behavioral measures of anxiety led Bosson et al. (2004) to conclude that people may be either unwilling to admit being more anxious due to the possibility of being stereotyped or unaware that they are more anxious.

The degree to which stereotype threat is a conscious process has become a point of contention among stereotype threat researchers. Other researchers have echoed Bosson et al.'s (2004) proposition that stereotype threat may be an unconscious process (Croizet & Claire, 1998; Davies et al., 2002; Kiefer & Sekaquaptewa, 2007; Major & O'Brien, 2005; Oswald & Harvey, 2000; Schmader & Beilock, 2011; Schmader et al., 2008; Sekaquaptewa & Thompson, 2003; C. Steele et al., 2002). However, other researchers argue that stereotype threat is a conscious process (Hess et al., 2003; Keller & Molix, 2008; Marx, 2011; Wheeler & Petty, 2001). For example, Wheeler and Petty (2001) state the people must be consciously aware that a stereotype could be used to explain their behavior in order to experience stereotype threat. Similarly, Keller and Molix (2008) discuss how conscious awareness is a necessary condition for trait factors such as group identification to moderate the effects of stereotype threat. The finding that group identified people are the ones who underperform and non-group identified people do not underperform suggests that people must consciously recognize that their poor performance can validate a negative group stereotype. If stereotype threat was entirely an unconscious process, all members of negatively stereotype groups should underperform in the presence of stereotype threat, regardless of their group identification.

Additionally, studies have utilized self-report measures of stereotype threat and found people can self-report their experiences of stereotype threat. For example, Marx and Goff (2005) found that African Americans in a threat condition reported experiencing more stereotype threat than African Americans in a no-threat condition. Additionally, Roberson, Deitch, Brief, and Block (2003) found evidence that African Americans who were underrepresented in a workplace reported experiencing more stereotype threat than African Americans who were not underrepresented in a workplace. If stereotype threat is not a conscious process, the self-reported stereotype threat of African American managers should not have varied as a function of underrepresentation. Given that people may be consciously aware of the experience of stereotype threat, the null findings of previous studies utilizing anxiety self-report measures may have been due to imprecise measurement.

Studies utilizing more precise measures of state anxiety provide initial evidence that the effects of stereotype threat on performance are mediated by state anxiety. As discussed previously, Brodish and Devine (2008) found that stereotype threat led people to adopt performance-avoidance goals, which in turn led to more state anxiety, which resulted in decreased math performance. More specifically, the worry component of state anxiety was what mediated the relationship between performance-avoidance goals and performance. Prior research has identified two distinct forms of state anxiety, emotionality and worry (Liebert & Morris, 1967; Morris, Davis, & Hutchings, 1981). Worry refers to the cognitive aspects of the anxiety experience. It focuses on negative expectations and self-preoccupation. Emotionality refers to the physiological and affective aspects of state anxiety such as nervousness and sweating. In terms of predicting performance, worry has been found to be negatively related to performance, whereas emotionality has been found to be generally unrelated to performance (Liebert & Morris, 1967; Morris et al., 1981; Morris & Liebert, 1970). Worry is theorized to undermine performance by misdirecting attention away from the task at hand towards self-evaluation. Given that worry is theorized to be situationally induced and experienced by people who feel that they are inadequate for the task at hand (Morris et al., 1981), stereotype threat may be a key antecedent of worry. A study by Cadinu et al. (2005) demonstrated that intrusive thoughts, a hallmark of worry, mediated the relationship between stereotype threat and performance. Within the goal-orientation literature, Elliot and McGregor (1999) found evidence that the negative relationship between performance-avoidance goals and test performance is mediated by worry.

These findings suggest that previous studies utilizing general measures of state anxiety may have obtained null results because of imprecise measures (Cadinu et al., 2005; Klein, Pohl, & Ndagijimana, 2007; Steele & Aronson, 1995). For instance, the Spielberger State-Trait Anxiety Inventory appears to contain both worry and emotionality items (e.g., “I am worried”, “I feel nervous”, and “I am jittery”). By not separating the worry and emotionality components, the effects of worry may be washed out by the null effects of emotionality (Brodish & Devine, 2008). Additionally, it may be the case that performance-avoidance goals are a necessary antecedent of worry. Therefore, prior studies that failed to measure performance-avoidance goals may have failed to obtain significant effects because worry was too far down the mediation chain from stereotype threat. For instance, Smith (2004) discusses how the stereotype threat process may be a long mediation chain and that testing only a single mediator in a study may result in insufficient power to detect mediation.

Research has begun to paint a picture of how stereotype threat undermines performance. It appears that stereotype threat causes people to adopt performance-avoidance goals, which results in increased state anxiety, specifically worry. Anxiety in turn undermines performance. The mediators of the stereotype threat to performance relationship are depicted in Figure 1.

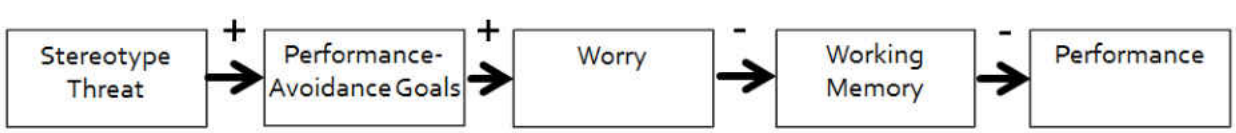


Figure 1: Graphical Representation of the Mediators of the Stereotype Threat-Performance Relationship

The Mediators of the Stereotype Threat-Interest Relationship

In addition to uncovering the mediators of the relationship between stereotype threat and performance, initial research has begun exploring the mediators of the relationship between stereotype threat and interests. Although the same mediators may be involved in mediating the effects of stereotype threat on interests, initial research suggests that different variables may mediate the relationship between stereotype threat and interests. As stated previously, few studies have examined the effects of stereotype threat on interests. Even fewer studies have explored the mediators of the relationship between stereotype threat and interests. Despite these limitations, one promising potential mediator is sense of belonging.

Sense of belonging refers to the degree to which a person feels accepted and valued by fellow members of a given discipline (Good, Rattan, & Dweck, 2012). Those who feel a sense of belonging believe that their "individual qualities, characteristics, and contributions are recognized and valued by others in the setting" (Walton & Carr, 2011, p. 91). Stereotype threat researchers argue that negative stereotypes imply that one's social group does not belong in a given domain (Good et al., 2012; Walton & Carr, 2011). Instead of viewing someone as a unique individual, negative stereotypes result in people perceiving those who are targets of stereotypes as representatives of their group (Walton & Carr, 2011). Repeatedly encountering a negative stereotype in a given domain may lead people to question their belonging in that domain. Diminished sense of belonging in turn may lead people to leave the domain altogether.

Initial studies have uncovered evidence that the effects of stereotype threat on interests may be mediated by sense of belonging. For instance, Good et al. (2012) found that sense of belonging was positively related to perceived usefulness of math and math confidence, and negatively related to math anxiety. Given that perceived usefulness of math corresponds to the subjective task value component of Eccles' (1987, 1994) model and that math confidence corresponds to the expectations of success component of Eccles' model, it is reasonable to conclude that sense of belonging may predict intentions to pursue a major/career given that subjective task value and expectations of success have been found to be strong predictors of intentions. A study by Cech, Rubineau, Silbey, and Seron (2011) is supportive of the claim that sense of belonging predicts intentions. They found that engineering majors who felt a sense of belonging reported more intention to remain in engineering than engineering majors with a lower sense of belonging. Similarly, a follow-up study by Good et al. (2012) tracked students across time and found that sense of belonging positively predicted math course grades and one's intentions to take future math classes. Additionally, the more females perceived gender stereotyping in their math environment, the more their sense of belonging declined. These findings led Good et al. to propose that the effects of stereotype threat on one's sense of belonging may account for variance unaccounted by the effects of stereotype threat on one's performance in explaining the underrepresentation of women in STEM fields.

Other studies have found that environmental cues that induce stereotype threat result in diminished sense of belonging. For instance, Murphy, Steele, and Gross (2007) had male and female STEM majors watch one of two STEM conference videos. The first video depicted a 1 to 1 ratio of male to female conference attendees. The second video depicted a 3 to 1 ratio of male to female conference attendees, a ratio not uncommon in STEM fields. Women who viewed the male dominated video reported a lower sense of belonging and less desire to attend the conference than women who watched the gender balanced video. The gender ratios did not affect men as they reported the same level of belonging regardless of the video they saw.

Similarly, Cheryan, Plaut, Davies, and Steele (2009) examined the effects of stereotypical environmental cues on students' interest in majoring in computer science. In the first study, participants completed an interest survey in one of two rooms. One room contained many stereotypical cues such as comics, video game boxes, soda cans, junk food, electronics, computer parts, technical books/magazines, and a Star Trek poster. Another room contained neutral cues such as art, water bottles, healthy snacks, coffee mugs, general interest books/magazines, and a nature poster. Compared to women exposed to neutral cues, women exposed to stereotypical cues expressed less interest in computer science. Men on the other hand were not affected by the environmental cues and expressed similar levels of interest in majoring in computer science across conditions. In subsequent studies, participants were asked to imagine that they were choosing between two work groups or two companies. One group and company had stereotypical features, whereas the other group and company had neutral features. Across the studies, women expressed less interest in working for the stereotypical group and company. Additionally, sense of belonging was found to mediate the relationship between the stereotypical features of the environment and interest in joining the group/company. Thus, as environments become more stereotypically masculine, women's sense of belonging in that environment declines, which results in less interest in remaining in the environment. The implication of Cheryan et al.'s (2009) and Murphy et al.'s (2007) findings is that cues in an environment signal who belongs in the environment. In the case of women in STEM fields, environmental cues may signal that they do not belong there. Diminished sense of belonging in turn undermines women's desire to pursue STEM careers.

Stereotype Threat Interventions

Given the possibility of stereotype threat undermining the performance and interests of women in STEM fields, any intervention that can minimize the effects of stereotype threat can go a long way towards improving female retention. Knowing how stereotype threat affects performance and interests allows researchers and practitioners to design theoretically based interventions to reduce the effects of stereotype threat. Given that it is difficult to increase people's working memory capacity, interventions that target processes earlier in the mediation chain may be more effective. The extant literature on stereotype threat highlights several promising interventions that target stereotype threat mediators. Although many stereotype threat interventions exist, the most commonly used interventions include reducing the relevance of stereotypes, adopting an incremental view of intelligence, misattributing arousal, and self-affirming important values. These interventions primarily prevent people from adopting performance-avoidance goals or experiencing worry, or help people already experiencing stereotype threat cope with the anxiety induced by stereotype threat.

Stereotype Relevance

The most common intervention used in laboratory studies involves reducing the relevance of negative stereotypes (Steele & Aronson, 1995; Spencer et al., 1999). One approach designed to reduce the relevance of negative stereotypes involves reframing a task as a measure of a non-stereotyped or a positively stereotyped trait instead of a negatively stereotyped trait. For example, stereotype threat studies focused on women in math domains have reframed math tests as puzzle solving (Carr & Steele, 2009) and problem solving exercises (Johns, Schmader, & Martens, 2005; Schmader & Johns, 2003). These studies find that reframing a negatively stereotyped task as a non-stereotyped task reduces stereotype threat and increases performance. Unfortunately, task reframing is unlikely to be effective outside of laboratory settings (Davies & Spencer, 2005). In most real-world testing situations people know what performance dimensions are being evaluated. For example, students in a calculus class know that their calculus knowledge is being assessed when they take a test in that course. It may be impossible to reframe a calculus test as a measure of a less threatening construct.

Another common approach for reducing the relevance of negative stereotypes is to explicitly tell people that no differences in performance exist between various social groups. General findings suggest that telling women that there are no gender differences on a math test reduces stereotype threat and improves math test performance (Brown & Pinel, 2003; Cadinu et al., 2003; Cadinu et al., 2005; Dar-Nimrod & Heine, 2006; Good, Aronson, & Harder, 2008; Keller, 2007ab; Keller & Dauenheimer, 2003; O'Brien & Crandall, 2003; Quinn & Spencer, 2001; Spencer et al., 1999). Similar to the task reframing approach, the no group difference approach is also likely to be ineffective in real-world settings. Test takers may find it odd that a test administrator would explicitly draw attention to the lack of group differences on a test. As a result, test takers may actually react against such a statement and suspect that group differences actually do exist. This manipulation may only be effective in laboratory settings because research participants may find it plausible that researchers are able to construct a math test that produces no gender differences. Unfortunately, the prevalence of negative stereotypes regarding female math and science abilities may make it difficult for people to believe that there are no gender differences on math or science tests outside of a laboratory setting. Furthermore, it may be unethical and/or illegal to tell test takers that there are no group differences when group differences exist. Given that reframing a task and explicitly stating that no group differences exist is unlikely to be an effective intervention in non-laboratory settings, this study will not incorporate these interventions.

Adopting an Incremental View of Intelligence

One potential way of reducing the negative effects of stereotype threat is to get people to adopt an incremental theory of intelligence. Dweck (1986, 1999) proposes that people vary on the degree to which they endorse an incremental or entity theory of their abilities. People who endorse an incremental self-theory believe that their abilities can be developed through hard work and effort. Conversely, people who endorse an entity self-theory believe that their abilities are fixed. In other words, people are born with a certain amount of ability and that cannot be changed. It is important to note that people may not universally endorse an incremental or entity self-theory for all abilities (Dweck & Molden, 2005). For example, a person may believe their intelligence is fixed, but believe their athletic ability can be developed. Those who endorse an entity view of their abilities are proposed to adopt performance goals, whereas those who endorse an incremental view of their abilities are proposed to adopt learning goals (Dweck 1986, 1999; Dweck & Leggett, 1988; Dweck & Molden, 2005; Elliot, 1999). Initial evidence suggests that women experiencing stereotype threat adopt an entity theory of their abilities. For instance, Koch, Muller, and Sieverding (2008) found that women experiencing stereotype threat were more likely to attribute failure to internal factors, a hallmark of those who endorse an entity theory of ability.

Having an incremental theory of intelligence has been linked to positive STEM outcomes. For instance, people who endorse an incremental theory of intelligence have been found to get better math grades than people who endorse an entity theory of intelligence (Blackwell, Trzesniewski, & Dweck, 2007). In Blackwell et al.'s study, middle school students were tracked over a two year period. When students first entered middle school, there were no differences between the math grades of those endorsing an incremental versus an entity theory of intelligence. However, at the end of middle school, incremental theorists had significantly higher math grades than entity theorists. A study by Burkley, Parker, Stermer, and Burkley (2010) found that women who endorsed an entity theory of math ability reported less math identification, less enjoyment of math, less desire to major in math, and less desire to pursue a math career than women who endorsed an incremental theory of math ability. These findings are especially troubling due to the finding that high achieving females have a greater tendency to endorse an entity theory of intelligence than high achieving males (Dweck, 1986, 1999; Gunderson et al., 2012). Lastly, Good et al. (2012) examined the relationship between self-theories, stereotype threat, and sense of belonging. As discussed previously, they found that women exposed to stereotype threat reported a lower sense of belonging, which predicted calculus course grades and intentions to take future math courses. Although stereotype threat lowered women's sense of belonging, women exposed to environments that emphasized an incremental theory of math ability were buffered against the effects of stereotype threat. In other words, the presence of stereotype threat did not affect women if they were in an environment that emphasized an incremental theory of math abilities. These findings suggest that having an entity theory of one's abilities is associated with negative STEM outcomes, whereas having an incremental theory of one's abilities is associated with positive STEM outcomes.

Initial lab studies suggest that adopting an incremental theory of intelligence can buffer people against the effects of stereotype threat. For instance, Dar-Nimrod and Heine (2006) placed women in one of four conditions. The first two conditions mirrored previous threat and no-threat conditions. In the threat condition, women read about the role of the female body in art.

In the no-threat condition, women read about how meta-analyses reveal that men and women perform equally well on math tests. In addition to the first two conditions, some women were placed in a genetic or experiential condition. Women in the genetic condition read about how males perform better than females because of genes found on the Y chromosome. Conversely, women in the experiential condition read about how males perform better than females because teachers bias their expectations during the early school years. Conceivably, the genetic explanation supports an entity theory of math ability because people are born with a certain amount of math talent tied to their genetic code. Alternatively, the experiential explanation supports an incremental theory of math ability because it argues that men and women may perform similarly if both were given the same experiences. In terms of math performance, women in the threat and genetic condition performed the same. Additionally, women in the experiential and no-threat condition performed the same as each other and outperformed women in the threat and genetic condition. Thus, it appears that adopting an incremental theory of intelligence may buffer people against the effects of stereotype threat on performance.

Aronson, Fried, and Good (2002) demonstrated the effectiveness of an incremental theory intervention at buffering people against the effects of stereotype threat on real-world outcomes. In this study, college participants were led to believe that they were going to mentor troubled middle school students. In actuality there were no troubled middle school students. What the college participants did not realize was that the mentoring program was designed to help them. Participants were randomly assigned to either a malleability, multidimensional, or control condition. The malleability condition sought to get mentors to adopt an incremental view of their intelligence. Conversely, the multidimensional condition sought to get mentors to acknowledge that there are multiple forms of intelligence. Because research has not linked the endorsement of multiple forms of intelligence to either performance or learning goals, this condition served as second control condition and was used to determine if the act of mentoring was enough to reduce stereotype threat. Lastly, the control condition did not participate in any mentoring exercises.

Mentors in the malleability and multidimensional conditions were asked to advocate those respective beliefs to their fictitious protégés. Mentors participated in three sessions spread across 10 days. Mentors were first asked to write a letter to a troubled middle school student. Those in the malleability conditions were asked to advocate the malleability of intelligence in their letter. Specifically, they were encouraged to discuss how intelligence can be developed through hard work. Those in the multidimensional condition were asked to advocate the multidimensionality of intelligence in their letter. Specifically, they were encouraged to discuss how there are multiple types of intelligence. When the mentors reported back to the lab on the second day, they were asked to write another letter advocating the same message to a different middle school student. The second letter was designed to reinforce the original message. On the third session, mentors were asked to convert their letters into a brief speech. Mentors were asked to read the speech and were audio recorded for future interventions for at risk children.

Aronson et al. (2002) hoped to stop the stereotype threat process by getting people to adopt an incremental theory of intelligence. Given the stereotype that African Americans are less intelligent than Caucasians, African Americans were hypothesized to receive the most benefit from the malleability intervention. In support of their hypotheses, the GPAs of African American college students in the malleable condition were significantly higher (M = 3.32) at the end of the semester than the GPAs of African Americans in the multidimensional condition (*M* = 3.05) and the control conditions (*M* = 3.10). Furthermore, African American college students in the malleable condition reported more enjoyment and identification with academics than African American college students in the multidimensional condition and the control condition. Given the lack of difference between the multidimensional condition and the control condition, it appears that the act of mentoring is insufficient by itself to reduce the effects of stereotype threat. As further evidence that the malleability condition reduced stereotype threat, the GPAs, enjoyment of academics, and identification with academics of Caucasian participants did not differ significantly between the conditions. Because Caucasians are not negatively stereotyped in academic domains, they did not reap the full benefits of the intervention.

The effectiveness of Aronson et al.'s (2002) malleability intervention may have been due to its use of self-persuasion techniques. Self-persuasion consists of getting people to persuade themselves to carry out a particular course of action. Research finds that self-persuasion is more effective than direct persuasion from other people (Aronson, 1999). The key mechanism behind self-persuasion is cognitive dissonance (Festinger, 1957). In essence, if someone says something that is contrary to their personal beliefs they experience cognitive dissonance, an unpleasant feeling. To reduce cognitive dissonance, people can either change their behaviors or beliefs. In the case of the self-persuasion techniques utilized by Aronson et al. (2002), participants told middle school students that intelligence is either malleable or multidimensional. Because the behavior already occurred, the only thing participants could do to reduce the cognitive dissonance associated with espousing a belief contrary to their own beliefs was to alter their beliefs to become more congruent with what they advocated. Thus, if a participant attempted to persuade middle-school students that intelligence is malleable, the participant is left wondering why he or she advocated that particular position. If there are no strong external incentives (e.g., money) that prompted participants to take a particular stance, the participant rationalizes to him or herself that his or her actions must have been due to personal beliefs. Consequently, participants persuade themselves that intelligence is malleable.

The approach utilized by Aronson et al. (2002) is consistent with the counterattitudinal advocacy approach utilized by self-persuasion researchers. Counterattitudinal advocacy consists of getting people to "convince others of the rightness of a position that differs from their own privately held belief" (Aronson, 1999, p. 877). In the case of entity theorists who advocated an incremental theory of intelligence, they must address the cognitive dissonance associated with advocating a viewpoint contrary to their beliefs. To reduce this cognitive dissonance, entity theorists may have convinced themselves that they believe that intelligence is malleable. In the case of incremental theorists who advocated an incremental theory of intelligence, no cognitive dissonance occurs because the person's beliefs and behaviors are congruent. Given that stereotype threat may induce an entity view of intelligence, getting people to persuade themselves that intelligence is malleable can help buffer people from experiencing stereotype threat. Follow-up studies utilizing Aronson et al.'s (2002) methods indicate that entity theorists do become incremental theorists after the intervention and that these effects last for at least six weeks (Blackwell et al., 2007; Heslin, Latham, & Vanderwalle, 2005).

A field study by Good, Aronson, and Inzlicht (2003) demonstrated the effectiveness of both an incremental theory and a misattribution intervention in a non-laboratory setting. In this study, middle school students were mentored by college students. Mentors interacted with their protégés through weekly e-mails throughout the school year and two face-to-face meetings. Mentors advocated one of four messages, a malleability message, a misattribution message, a combination message, or a message emphasizing the dangers of drug use. The malleability message consisted of getting middle school students to view intelligence as malleable. Mentors in this condition taught their protégés that intelligence was not finite and could grow through hard work. The misattribution message consisted of getting middle school students to attribute their difficulties to external factors. Mentors in the misattribution condition taught protégés that many students experience difficulty when they transition to a new educational setting. For example, mentors discussed how they experienced adjustment difficulties when they entered middle school and how they overcame those difficulties. Additionally, mentors pointed out how middle school students have to adjust to changes such as more difficult subject matter and a greater variety of teaching styles. In essence, mentors tried to get their protégés to realize that the difficulties they were experiencing were due to situational factors, not personal factors. The third message was a combination of the malleability and attribution messages. The last message consisted of getting middle school students to view drugs as bad. Mentors in this condition discussed the dangers of drug use. Because the message had nothing to do with academic performance, this condition functioned as a control condition. To reinforce the message, middle school students engaged in self-persuasion exercises similar to Aronson et al. (2002). Specifically, middle school students were asked to create websites that corresponded to the message that their mentors advocated.

The incremental, difficulty, and combined conditions appeared to have been successful at minimizing the effects of stereotype threat. The middle school girls in the incremental, misattribution, and combined conditions obtained standardized math test scores a standard deviation higher than girls in the drug use condition. In addition to performing better than girls in the drug use condition, girls in the incremental, misattribution, and combined conditions performed as well as boys on the standardized math test. Conversely, girls in the drug use condition underperformed on the standardized math test compared to boys in the drug use condition.

One issue that remains unresolved is why the combined intervention did not differ significantly from the incremental and misattribution interventions. Good et al. (2003) proposed that the incremental and misattribution interventions may address similar underlying concerns. For example, both interventions attempt to prevent people from making internal attributions for failure. The similarity in target mechanisms may have prevented the combined intervention from having any additive effects independent of the individual interventions. However, although the mechanisms may appear similar, they are not identical. The malleability intervention appears to work by targeting the self-theory → goal-orientation → anxiety pathway, whereas the misattribution intervention appears to target anxiety directly. Given that both interventions may target different points in the stereotype threat process, a combined intervention may be more effective than either intervention done in isolation. It may have also been the case that a ceiling effect occurred and that females in the combined intervention would have performed better than females in the incremental and misattribution conditions if a more sensitive test were used.

Misattribution

Misattribution interventions reduce the effects of stereotype threat by minimizing the effects of the arousal/anxiety induced by stereotype threat. Specifically, misattribution interventions provide people with an external reason for their arousal/anxiety. By providing people an explanation as to why they are anxious, people no longer have to search for an explanation for their anxiety. It is this preoccupation with explaining why they are anxious that leads people experiencing stereotype threat to underperform because searching for an explanation diverts cognitive resources away from the task. Instead of devoting all of their cognitive resources towards task performance, people experiencing stereotype threat allocate cognitive resources towards monitoring how they are performing and how other people are reacting to their performance. Additionally, when a person is anxious due to stereotype threat, he or she may begin to believe that their anxiety is due to their lack of ability because if one has ability in a domain, one should be confident and not anxious/aroused. By getting people to attribute their anxiety to an external source, people are no longer concerned about explaining why they are anxious, enabling them to devote all of their cognitive resources to the task.

A lab study by Ben-Zeev et al. (2005) demonstrates the effectiveness of misattributing arousal to an external source as a means of buffering people against stereotype threat. In this study, women completed a math test with two male test-takers (i.e., threat condition) or two female test-takers (i.e., no-threat condition). Additionally, participants were randomly assigned to a misattribution or a control condition. Participants in the misattribution condition were told that a subliminal noise machine in the testing room may increase arousal, nervousness, and heart rate. Participants in the control condition were told that the subliminal noise machine in the testing room has no effect on performance. The study's results were supportive of the idea that misattributing anxiety to an external source can reduce the effects of stereotype threat. Women in the misattribution condition performed the same regardless if they were in the stereotype threat or no-threat condition. However, women who did not receive the misattribution manipulation performed worse in the stereotype threat condition compared to the no-threat condition. Presumably, women in the misattribution/threat condition were able to attribute their arousal to the subliminal noise machine instead of the presence of the two men. This option was not available to women in the control/threat condition. Although the specific manipulation utilized in Ben-Zeev et al.'s study is unlikely to be viable in non-laboratory settings, Ben-Zeev et al.'s study demonstrates the effectiveness of getting people to attribute their anxiety to an external source.

Schmader and colleagues have also demonstrated the effectiveness of misattributing arousal. For instance, Jamieson, Mendes, Blackstock, and Schmader (2010) demonstrated the effectiveness of a misattribution intervention at improving GRE scores. In this study, participants were randomly assigned to a misattribution or control condition. Those in the misattribution condition were told that feeling arousal during a test does not harm performance and may actually improve performance. Compared to participants in the control condition, participants in the misattribution condition performed better on a practice GRE quantitative test ($d = .82$) after the intervention and better on the actual GRE quantitative test ($d = 1.03$) several weeks later. Those in the misattribution condition were also found to exhibit greater physiological signs of being in a challenge/approach state than those in the control condition during the practice GRE quantitative test. This suggests that misattribution interventions may minimize the effects of anxiety by getting people to adopt performance-approach goals in place of performance-avoidance goals. Johns et al. (2008) used a similar misattribution manipulation as Jamieson et al. (2010) to reduce the effects of stereotype threat on women's math test performance. In this study, women were assigned to either a threat condition, a no-threat condition, or a threat condition with arousal misattribution. The misattribution condition appeared to reduce the effects of stereotype threat because women in the threat condition who were told to misattribute their arousal had the same working memory scores and performed the same on the math test as women in the no-threat condition. Furthermore, both conditions outperformed women in the threat condition who were not told to misattribute their arousal.

Walton and Cohen (2007, 2011) also demonstrated the effectiveness of a misattribution intervention in a field setting. In this study, African American and Caucasian college freshmen were randomly assigned to a misattribution or control condition. In the misattribution condition, students were shown the results of a survey that found that most college students worry about whether they belong in college during their first year and that these feelings diminish with time. Students in the control condition were shown the results of a survey that found that students' social–political views become more sophisticated with time. To reinforce the message, participants engaged in similar self-persuasion exercises as Aronson et al., (2002). First, participants were asked to write an essay reiterating the message they were exposed to, using examples from their own lives. Second, participants were asked to make a filmed speech reiterating the message they were exposed to. Participants were told that the speech would be shown to future freshmen to help them adjust to college.

The misattribution intervention appeared to be effective at buffering African Americans against stereotype threat. African Americans who were in the misattribution condition reported a greater sense of belonging and higher confidence in their ability to succeed after the intervention and had higher GPAs the semester following the intervention than African Americans who were in the control condition (Walton & Cohen, 2007). A follow-up study by Walton and Cohen (2011) found that the effects of the intervention persisted three years later. Whereas African Americans in the control condition showed no change in their GPA between their freshmen year and senior year, the GPAs of African Americans in the misattribution condition improved between their freshmen year and senior year. Additionally, the post-intervention GPAs of African Americans in the misattribution condition were significantly higher than the GPAs of African Americans in the control condition and African Americans who did not participate in the study. The GPAs of African Americans in the control condition and African Americans who did not participate in the study did not differ. African Americans in the misattribution condition also reported being happier and healthier than African Americans in the control condition. These longitudinal findings are particularly notable because the intervention itself lasted only one hour.

Self-Affirmation

Self-affirmation interventions have also been found to be effective at reducing the negative effects of stereotype threat. These interventions are based on self-affirmation theory (Steele, 1988). The main proposition of self-affirmation theory is that people have a desire to protect their sense of self-integrity. Self-integrity refers to a person's sense that he or she is a good person. When a person's sense of integrity is threatened, he or she has three possible responses to that threat (Sherman & Cohen, 2006). The first possible response is to accept the threatening information. By accepting the threatening information, a person can change their behaviors and attitudes accordingly. For example, if Marie fails a math test, she could accept that she failed the test. Acceptance can lead Marie to study more next time to prevent herself from failing again or lead her to start believing that she is bad at math and stop trying.

However, if the information threatens a core aspect of a person's identity, it becomes difficult to accept the information. In cases in which a person is unwilling to accept the threatening information, a person can directly address the threatening information. Direct responses include defensive reactions such as dismissing, denying, and/or avoiding the threat. In the case of Marie, she could reject the feedback and view the test as biased or unfair. Unfortunately, such an approach is unlikely to result in learning and development.

The last response available to the person is to focus on aspects of their self-integrity unrelated to the threat. In this case, Marie could reflect upon unrelated values such as her dedication to body pump (i.e., a workout routine). By reflecting upon important values unrelated to the threatening domain, the threat becomes less threatening to the person because it does not reflect upon the person as a whole. In other words, Marie's self-worth is not solely contingent on her success in math because she has other traits that make her a worthwhile human being.

The three responses identified by Sherman and Cohen (2006) can be applied to the experience of stereotype threat. In terms of the first response, accepting the threatening information implies that a stereotyped individual accepts the validity of the stereotype. Assuming that a person is identified with the negatively stereotyped domain, he or she is most likely unwilling to accept the accuracy of the stereotype because it implies that he or she will not be successful in the domain. At the very least, the domain identified person will likely deny that the stereotype applies to him or her. Thus, the first response is unlikely to be a viable option for domain identified individuals. In terms of the second response, directly addressing the threatening information appears to be at the heart of the stereotype threat experience. In essence, people experiencing stereotype threat often dismiss, deny, or suppress threatening information. Unfortunately, these responses increase anxiety and divert working memory from the task. Thus, it appears that the first two responses available to people experiencing identity threat are ineffective for overcoming the threat. Recent empirical studies have tested the effectiveness of self-affirming values in unrelated domains in the face of stereotype threat.

Laboratory studies have found that self-affirmation is an effective means of reducing the effects of stereotype threat. Studies by Martens and colleagues (2006) found that women who engaged in self-affirmation after experiencing stereotype threat performed better on mathematics and visual-spatial tests than women who did not engage in self-affirmation after experiencing stereotype threat. In the first study, men and women were randomly assigned to a threat or no-threat condition. However, some of the women under threat were given a self-affirmation exercise in which they were asked to write about their most important value. Women in the threat condition underperformed on a math test compared to men in the threat condition and women in the no-threat condition. However, women who self-affirmed in the threat condition performed better than women who did not self-affirm in the threat condition. In a follow-up study, all of the participants were placed in a threat condition, but half of the participants were given a self-affirmation exercise. Women who self-affirmed performed better on a spatial ability test than women who did not self-affirm. Conversely, there was no difference between the men across the two conditions. Presumably, the men did not benefit from self-affirmation because their sense of self-integrity was not threatened. Similarly, other studies have found that activating positive and/or alternative identities also reduces the effects of stereotype threat on performance (Ambady et al., 2001; Gresky et al., 2005; Kray et al., 2002; McGlone & Aronson, 2006, 2007; McIntyre, Paulson, & Lord, 2003; Rydell & Boucher, 2010; Rydell et al., 2009; Schimel, Arndt, Banko, & Cook, 2004; Shih et al., 1999, 2006). Activating positive/alternative identities may restore a person's sense of self-integrity in a manner similar to self-affirmation by getting people to realize that their stigmatized status is not their only defining characteristic.

Cohen and colleagues (Cohen, Garcia, Apfel, & Master, 2006; Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009) carried out a field study testing the effectiveness of self-affirming positive characteristics in unrelated domains at reducing the effects of stereotype threat among African American middle school students. In these studies, middle school students were randomly placed in one of two conditions in their classes. In the first condition (i.e., self-affirmation), students wrote about their most important value for 15 minutes. In the second condition (i.e., control), students wrote about why their least important value may be important to someone else for 15 minutes. Students completed three to four of these exercises over the course of a year. Cohen and colleagues found that the GPAs of African American students in the self-affirmation condition were .24 points higher than the GPAs of African American students in the control condition during a two year follow-up. The effects of the intervention were found to be moderated by previous class standing. African Americans who were previously low performers and moderate performers benefited the most from the intervention. Although stereotype threat is theorized to affect the best performing students the most, it may be the case that the high performing African Americans in this study were not sufficiently challenged enough to experience stereotype threat. Consistent with stereotype threat theory, the self-affirmation exercise had no effect on Caucasian students. Presumably, Caucasians did not benefit from the self-affirmation exercises because their sense of self-integrity was not threatened by negative stereotypes in academic settings.

In addition to improving the academic performance of African American middle school students, initial research evidence suggests that self-affirmation may be an effective means of reducing stereotype threat among female STEM majors. Utilizing the same techniques as the field studies by Cohen et al. (2006, 2009), Miyake et al. (2010) randomly assigned male and female physics students to either a self-affirmation or a control condition. Consistent with stereotype threat theory, female STEM majors benefited the most from the intervention. The gender gap in exam grades was reduced in the self-affirmation condition to $d = .18$ in favor of men, as compared to $d = .93$ in favor of men in the control condition. In terms of practical outcomes, the average grade of women in the self-affirmation condition at the end of the semester was a B, whereas the average grade of women in the control condition was a C. In addition to the reduction in the gender gap in course performance, the gender gap in a standardized physics test was reduced in the self-affirmation condition. These consistent findings across different groups and across time have led many to endorse the use of self-affirmation interventions as a stereotype threat reduction technique (Croizet, Desert, Dutrevis, & Leyens, 2001; Shapiro & Williams, 2012).

In terms of how self-affirmation buffers against stereotype threat, research suggests that self-affirmation reduces state anxiety (Sherman & Cohen, 2006). For instance, a study by Creswell et al. (2005) found that people who self-affirmed important values experienced less physiological stress than those who did not self-affirm. By reducing anxiety, self-affirmation can prevent stereotype threat from undermining working memory. Presumably, self-affirming unrelated values reduces the impact of failure in a domain on one's sense of self-integrity. In the case of women in STEM fields, by affirming values unrelated to STEM, there is less overwhelming pressure to disprove negative stereotypes regarding their STEM abilities because poor performance does not invalidate them as people. In essence, self-affirmation may reduce stereotype threat because it reduces the need/desire of people to restore their self-integrity (Croizet et al., 2001).

It should be noted that the intervention previously discussed are subtle and indirect. The effectiveness of these interventions may be directly tied to their subtlety and ability to affect people without their conscious awareness (Walton & Cohen, 2011). For instance, Walton and Cohen warn against the use of interventions that directly/overtly target stereotype. Specifically, they warn that "conscious awareness may undo the effects of an intervention. More overt interventions risk sending the stigmatizing message that the beneficiaries are seen as in need of help. They may also cause resistance and reactance and undermine the sense of accomplishment people take in their success" (p. 1450). In other words, an intervention that directly targets stereotype threat in an open manner may ironically induce stereotype threat among its intended beneficiaries. After all, designing an intervention to openly combat stereotype threat suggests that a large number of people in a negatively stereotyped group confirm and live up to the stereotype. Further highlighting the importance of using indirect methods, research shows that self-affirmation interventions are ineffective when people are consciously aware of the positive effects that self-affirmation is designed to achieve (Sherman et al., 2009).

Summary of Stereotype Threat Intervention Research

In summary, stereotype threat research has identified several methods of reducing stereotype threat. Reducing stereotype relevance is perhaps the most researched and is effective at reducing stereotype threat in laboratory settings. However, stereotype relevance reduction techniques are unlikely to be effective in non-laboratory settings. In contrast, incremental theory, misattribution, and self-affirmation interventions have been found to be effective in non-laboratory settings, producing positive effects lasting up to three years. One question that remains unanswered is whether mentoring interventions can reduce stereotype threat or if mentoring interventions need to specifically address stereotype threat in order to reduce stereotype threat.

Mentoring

Mentoring can be defined as a relationship between a more experienced individual (i.e., the mentor) and a less experienced individual (i.e., the protégé) in which the more experienced individual helps develop the less experienced individual (Eby, 2010; Kram, 1985). Mentoring relationships are often defined based on the presence of two types of behaviors, career development and psychosocial support. Career development refers to behaviors geared towards the advancement of the protégé, and consists of five dimensions, sponsorship, exposure, coaching, protection, and challenging assignments (Eby, 2010; Kram, 1985; Noe, 1988a). Sponsorship consists of nominating protégés for desirable projects and promotions. Exposure consists of behaviors that increase the visibility of the protégé to organizational decision makers. Coaching consists of providing protégés with feedback and strategies. Protection consists of protecting a protégé's reputation from harm. Lastly, challenging assignments consists of providing protégés with projects and tasks that contribute to their growth and demonstrate their capabilities. Psychosocial support refers to behaviors designed to increase a protégé's confidence and identity, and consists of four dimensions, acceptance, counseling, friendship, and role modeling (Eby, 2010; Kram, 1985; Noe, 1988a). Acceptance consists of providing protégés with unconditional positive regard. Counseling consists of allowing protégés to openly discuss their anxieties and fears. Friendship consists of interacting with protégés informally. Lastly, role modeling consists of demonstrating appropriate values and behaviors. It is important to note that mentoring relationships vary on the extent to which different mentoring behaviors are present. Some mentors carry out all of the mentoring behaviors previously identified, whereas other mentors may carry out only some of the previously identified mentoring functions (Ragins, 1997; Ragins & Cotton, 1999). Additionally, the specific mentoring functions provided in any given relationship may vary across time, depending on the needs of the protégé and capabilities of the mentor.

Outcomes Associated with Mentoring

Research indicates that being mentored is associated with positive outcomes (Eby, 2010; Greenhaus, 2003). Meta-analyses have found that being mentored is positively correlated with job satisfaction, career satisfaction, organizational commitment, compensation, and promotions, and negatively correlated with work stress and work-family conflict (Allen, Eby, Poteet, Lentz, & Lima, 2004; Eby et al., in press; Kammeyer-Mueller & Judge, 2008; Underhill, 2006). Although career development is proposed to be more strongly related to objective outcomes such as compensation and promotions, and psychosocial support is proposed to be more strongly related to subjective outcomes such as job and career satisfaction, Allen et al. (2004) found that both types of mentoring behaviors yielded comparable effects on objective and subjective outcomes. A meta-analysis by Eby, Allen, Evans, Ng, and DuBois (2008) examined the effectiveness of faculty-student mentoring relationships and found that academic mentoring is positively correlated with academic performance, satisfaction, and motivation, and negatively correlated with withdrawal. Similarly, Eby et al. (2013) found that protégé's perceptions of psychosocial support and career development are positively correlated with satisfaction, sense of belonging, and socialization/learning, and negatively correlated with intentions to turnover. Furthermore, career development was also positively correlated with perceptions of career success and compensation, whereas psychosocial support was also positively correlated with self-efficacy. Thus, it appears that mentoring relationships are associated with several positive outcomes.

Although mentoring relationships are assumed to primarily benefit protégés, mentors also receive benefits from participating in mentoring relationships. However, given that mentoring relationships are geared towards developing protégés, most research has focused on the benefits protégés receive from mentoring and relatively less research has focused on the benefits mentors receive from mentoring (Allen, Eby, O'Brien, & Lentz, 2008; Eby, 2010; Ragins, 1997). For instance, Allen et al.'s (2008) review of 207 studies found that 80.2% of the studies focused on protégés, whereas only 30.9% focused on mentors. Despite the relative lack of research on the mentor's perspective, the reciprocal nature of mentoring relationships makes it likely mentors benefit as well (Jacobi, 1991). For instance, being a mentor has been found to be related to positive work attitudes, personal satisfaction, and recognition from others (Allen, Poteet, & Burroughs, 1997; Eby, 2010; Ragins, 1997). Additionally, mentors may gain knowledge from their protégés and can leverage their protégés' skills to remain up to date (Allen & Eby, 2003; Eby, 2010; Ragins, 1997). Mentors may also get a sense of personal fulfillment from helping develop another person. Despite initial findings suggesting that mentors benefit from mentoring relationships, this body of literature remains relatively sparse. This lack of research on mentor benefits has led several researchers to call for more research to examine the mentor's perspective (Allen & Eby, 2003; Eby, 2010; Ragins, 1997).

A notable limitation of mentoring research is that the majority of mentoring studies have been correlational studies. For instance, Allen et al.'s (2008) review of 207 mentoring studies found 149 correlational studies, but only 9 experimental/quasi-experimental studies. Similarly, Underhill's (2006) review of 106 mentoring studies found only 3 experimental studies, whereas Eby et al.'s (2013) meta-analysis of 165 studies included no experimental studies. The overreliance on correlational studies makes causal inferences regarding the relationship between mentoring and outcomes ambiguous. For instance, if high performing protégés are selected to be mentored and low performing employees are not selected to be mentored, the correlation between mentoring and promotions may be due to performance, not mentoring (Chao, Waltz, & Gardner, 1992). These limitations have led several researchers to call for more experimental/quasi-experimental studies (Allen et al., 2008; Allen et al., 2004; Jacobi, 1991; Ragins, 1997; Scandura, 1992).

Although mentoring has been found to be related to many positive outcomes, the relationship between mentoring and stereotype threat reduction remains unclear. Some have proposed that receiving mentoring can reduce the effects of stereotype threat (Logel et al., 2011; C. Steele et al., 2002). However, only one study has examined the relationship between being mentored and stereotype threat reduction (Good et al., 2003). As discussed previously, Good et al. (2003) paired middle school students with mentors who advocated one of four messages. Female middle school students who were paired with mentors that discussed the incremental nature of intelligence, the difficulty of transitioning into middle school, or both the incremental nature of intelligence and the difficulty of transitioning into middle school performed better on a standardized math test than female protégés who were paired with mentors who emphasized dangers of drug use. In terms of the act of being a mentor and stereotype threat reduction, Aronson et al.'s (2002) study remains the only study that has examined the relationship between being a mentor and stereotype threat reduction. In Aronson et al.'s study, African American mentors who were instructed to advocate the incremental nature of intelligence to fictitious at-risk middle school students had higher identification with academics and GPAs following the intervention than African American mentors who were instructed to advocate the existence of multiple intelligences to fictitious at-risk middle school students and African American participants who did not act as mentors. Although preliminary, the results of these two studies suggests that stereotype threat reduction only occurs when mentoring relationships specifically address issues related to stereotype threat.

It remains unclear if similar mentoring interventions will be effective for women majoring in STEM fields. Unlike female middle school students who face fairly standardized course curriculums and African American college students who contend with negative stereotypes regarding their intellectual abilities in almost all academic domains, female college students have positive alternatives readily available. In other words, female middle school students realize they have little choice in the courses they take and African American college students know they will be negatively stereotyped in most academic domains they pursue. Consequently, both groups may try to make the best of the situation they are in. Female STEM majors, however, can avoid dealing with the stressors of science and math domains by switching into verbal or people-oriented domains, domains in which they do not have to deal with chilly classrooms and underrepresentation. Thus, given that female STEM majors have a positive alternative readily available, it is imperative to determine if a mentoring intervention can reduce the effects of stereotype threat among female STEM majors.

Additionally, it is unclear what effect the previously discussed stereotype threat mentoring interventions have on a person's interest in and intentions to remain in a given field. The primary outcome in both Aronson et al.'s (2002) and Good et al.'s (2003) studies was performance. Although performance is important in deciding which fields to major and remain in, it is not the only factor. It is conceivable that some people may perform well but decide to switch into other fields to avoid dealing with the pressures of being negatively stereotyped. Furthermore, given that gender differences in interests and intentions tend to be larger than gender differences in standardized math test performance, the effects of stereotype threat on interests may play a larger role in female underrepresentation in STEM fields than the effects of stereotype threat on performance.

Formal vs. Informal Mentoring

The relationship between mentoring relationships and positive outcomes has led some to advocate the use of formal mentoring programs. Most mentoring research has focused on informal mentoring relationships, which develop without outside assistance and are based on mutual attraction and shared interests (Eby, 2010). Conversely, formal mentoring relationships are often developed by a third party that pairs a mentor with a protégé (Eby, 2010). In addition to differences in how they are developed, formal and informal mentoring relationships have been found to differ in how long they last. Formal mentoring relationships tend to last six months to a year, whereas informal mentoring relationships tend to last three to six years (Kram, 1985; Ragins & Cotton, 1999). Formal mentoring programs are often instituted by organizations in an attempt to replicate the positive outcomes associated with informal mentoring and have been proposed as a means of proving mentors to groups of people who face difficulty finding mentors. Given that formal mentoring programs are becoming increasingly popular, one question that needs to be answered is whether formal mentoring programs yield similar or different outcomes from informal mentoring programs.

In terms of effectiveness, research has found that informal mentoring relationships tend to result in more beneficial outcomes to protégés than formal mentoring relationships (Allen, Day, & Lentz, 2005; Chao et al., 1992; Eby, 2010; Eby et al., 2013; Ragins & Cotton, 1999; Scandura & Williams, 2001; Underhill, 2006). For instance, in an early study examining the relationship between relationship formality and protégé outcomes, Chao et al. (1992) found that protégés in informal mentoring relationships reported higher salaries and receiving more career development than protégés in formal mentoring relationships. Whereas protégés in informal mentoring relationships reported higher organizational socialization, job satisfaction, and salaries than non-mentored individuals, protégés in formal mentoring relationships only reported higher organizational socialization than non-mentored individuals. Similarly, Ragins and Cotton (1999) found that protégés in informal mentoring relationships reported receiving more career development and psychosocial support, having higher salaries, and being more satisfied with their mentors than protégés in formal mentoring relationships. Eby et al.'s (2013) meta-analysis of 14 studies examining the relationship between relationship formality found consistent but small effects favoring informal mentoring relationships. Across these 14 studies, protégés perceived receiving more psychosocial support and career development in informal mentoring relationships than formal mentoring relationships. Taken together, these results suggest that informal mentoring relationships are more effective than formal mentoring relationships.

Despite findings suggesting that formal mentoring relationships may be less effective than informal mentoring relationships, the present study will focus on formal mentoring relationships for a variety of reasons. First, receiving formal mentoring may be better than receiving no mentoring. Second, it is easier to manipulate conditions in a formal mentoring relationship than in informal mentoring relationships that naturally develop. Third, it is unlikely that informal mentoring relationships will spontaneously address the specific topics that the present study's stereotype threat reduction mentoring program will address. In order to address the effectiveness of integrating stereotype threat interventions with mentoring, it is necessary to formalize the stereotype threat interventions into the mentoring program itself. Such a feat may be difficult to accomplish in informal mentoring relationships.

Peer-Mentoring

The majority of mentoring research has examined hierarchical and supervisory mentoring relationships. Hierarchical mentoring relationships are characterized by mentors being several levels above the protégé (Eby, 2010). Conversely, supervisory mentoring relationships occur when a supervisor takes a special interest in a subordinate that goes beyond his or her official supervisory responsibilities (Eby, 2010). A common theme across both types of mentoring relationships is that the mentor does not have the same status as their protégé.

Recent research has begun examining the effectiveness of peer-mentoring. Peer-mentoring can be defined as a mentoring relationship that occurs been two people with similar status and experience within an organization (Eby, 2010). Studies examining the effectiveness of peer mentoring have found that peer mentoring is positively correlated with socialization into a university setting, satisfaction with one's university, and coping with stress (Allen, McManus, & Russell, 1999; Sanchez, Bauer, & Paronto, 2006). One potential advantage of peer-mentoring is that protégés likely perceive peer mentors as more similar to themselves than hierarchical mentors. Another advantage of peer-mentoring is that in certain settings, such as a university setting, there are likely more peers available to serve as mentors than higher-level employees. For these reasons, peer-mentors will be used in the present study.

E-Mentoring

Research has also begun to examine the effectiveness of electronic mentoring (i.e., e-mentoring). Electronic mentoring consists of a mentor providing career development and psychosocial support primarily through computer-mediated technologies such as email and instant messaging (Eby, 2010; Smith-Jentsch, Scielzo, Yarbrough, & Rosopa, 2008). Ensher, Heun, and Blanchard (2003) have noted that electronic mentoring relationships can vary on the degree to which they are computer-mediated. For instance, some mentoring relationships may take place entirely online via email, chat-rooms, and instant messaging, whereas other mentoring relationships may consist of varying levels of face-to-face interactions that are supplemented by email, chat-rooms, and instant messaging. Ensher et al. (2003) highlighted several potential benefits of electronic mentoring such as reduced costs and decreased emphasis on demographics, as well as having access to a larger and more diverse pool of potential mentors. Despite these benefits, Ensher et al. (2003) identified unique challenges associated with electronic mentoring such as an increased risk of miscommunication, higher written and technical skill requirements for protégés and mentors, and concerns regarding privacy and confidentiality. Given that electronic mentoring is associated with unique benefits and challenges, it is important for research to determine if electronic mentoring yields similar, better, or worse outcomes than face-to-face mentoring.

Smith-Jentsch et al.'s (2008) study was one of the first studies to directly compare the effectiveness of electronic mentoring to face-to-face mentoring. In Smith-Jentsch et al.'s study, upper-level biology students were asked to mentor freshmen in biology classes. Protégés were randomly assigned to mentors, and each mentor had one face-to-face protégé and one online protégé. Compared to face-to-face mentors, electronic mentors made fewer psychosocial and career development statements. Additionally, protégés in the electronic mentoring condition perceived receiving less psychosocial support than protégés in the face-to-face mentoring condition. Although these results appear to indicate that electronic mentoring may be less effective than face-to-face mentoring, the interaction between the gender of the mentor and mentoring functions provided indicates that electronic mentoring may be just as effective as face-to-face mentoring when the mentor is female. For instance, protégés with female mentors reported similar levels of psychosocial support, career development, and self-efficacy, regardless if mentoring was carried out electronically or face-to-face. However, protégés with male mentors reported receiving less psychosocial support and career development, and reported lower self-efficacy in the electronic mentoring compared to the face-to-face condition. These findings suggest that females may be more effective e-mentors than males. However, given that few studies have examined the relationship between gender and e-mentoring, it remains to be determine if women are more effective e-mentors than men.

The effectiveness of e-mentoring has also been explored in studies examining the effectiveness of MentorNet. MentorNet is an electronic mentoring program in which a STEM student is matched with a STEM professional. It was originally created to help improve the retention of female STEM majors by pairing women with STEM mentors. As part of the MentorNet program, mentors and protégés exchange emails over the course of eight months. Although MentorNet was originally designed to help women in STEM find mentors, men are also allowed to participate in MentorNet. Initial evaluation of the effectiveness of MentorNet appears to indicate that is associated with beneficial outcomes (MentorNet, 2007). For instance, over 65% of protégés felt that MentorNet was a good use of their time, over 60% of protégés regarded their mentoring relationship as successful or highly successful, and 60% of protégés recommended MentorNet to a friend. Additionally, over 50% of protégés reported that they were more confident that they could succeed in their field and more motivated to succeed in their field because of MentorNet. In terms of retention, 95% of the protégés in the 1998-1999 cohort remained in STEM fields one year after participating in MentorNet, and 91% of those protégés remained in STEM fields three years later. MentorNet also appears to result in positive outcomes for mentors as well with over 70% of mentors indicating that they felt like they helped the next generation.

Mentoring Women

Many have proposed that mentoring relationships may help address female underrepresentation in STEM fields. For instance, Seymour and Hewitt (Seymour, 1995; Seymour & Hewitt, 1997) propose that female undergraduates majoring in STEM would benefit from the guidance and support of upper-level female STEM majors who have successfully survived the masculine culture of STEM fields. They further argue that without a support network, it is easy for females majoring in STEM fields to attribute their struggles to personal deficits and assume that they are the only ones struggling. By learning about other people who struggle in STEM courses, female STEM majors can attribute their difficulties to the inherent difficulty of STEM courses, not their lack of ability. In essence, female mentors may be helpful because they can help their protégés understand that their struggles are normal and can provide strategies and techniques to help overcome the challenges of STEM courses.

Despite the potential benefits of having a mentor, women in STEM fields face obstacles in developing meaningful mentoring relationships. The first challenge women face is finding a mentor. Research indicates that women face more difficulty than men finding mentors (Fassinger & Asay, 2006; Ragins & Cotton, 1991, 1996). Given that men tend to occupy more senior-level positions across several domains, women who are able to find mentors are more likely to be in cross-gender mentoring relationships than men (Eby, 2010; Ragins & Cotton, 1991, 1996). Unfortunately, there are several challenges associated with cross-gender mentoring relationships such as increased risk of stereotyping, attributions of incompetence, negative visibility, interpersonal discomfort, and rumors of sexual involvement (Noe, 1988b; Ragins, 1997). Furthermore, Eby's (2010) review concluded that cross-gender and cross-race mentoring relationships tend to be more superficial and less satisfying than same-gender and same-race mentoring relationships.

Although cross-gender mentoring relationships are theorized to be less effective than same-gender mentoring relationships, existing empirical research examining the effects of gender similarity on protégés' reports of mentoring outcomes have produced inconclusive results. For instance, Ragins and Cotton (1999) found no differences in protégés' reports of mentoring functions received (i.e., career development and psychosocial support) across different gender combinations (i.e., male mentors with female protégés, female mentors with female protégés, male mentors with male protégés, and female mentors with male protégés). However, protégés with a history of male mentors reported higher compensation than protégés with a history of female mentors. Other researchers have also found no association between gender similarity and protégés' reports of mentoring functions received (Lankau, Riordan, & Thomas, 2005; Scandura & Ragins, 1993).

In terms of women majoring in STEM fields, a study by Blake-Beard, Bayne, Crosby, and Muller (2011) found that female STEM students placed greater importance in having a same-gender mentor than male STEM students. Additionally, STEM students in same-gender mentoring relationships reported receiving more psychosocial support and career development than STEM students in cross-gender mentoring relationships. Although gender matching was associated with perceiving more psychosocial support and career development, it was unrelated to protégés' grades, career-efficacy, or sense of belonging.

Existing empirical research examining the effects of gender similarity on mentors' reports of mentoring outcomes have also produced inconclusive results. For instance, Allen and Eby's (2003) study of mentors found no relationship between gender similarity and mentors' evaluations of relationship quality and learning. Lankau, et al. (2005) on the other hand found that mentors in same-gender relationships liked their protégés more and reported providing more role modeling than mentors in different-gender relationships. Another study by Allen and Eby (2004) found that mentors in same-gender and cross-gender mentoring relationships did not differ in their reported amount of psychosocial and career development provided. Although there was no difference in the reported psychosocial and career development provided across same-gender and cross-gender mentoring relationships, female mentors reported providing more psychosocial support than male mentors, whereas male mentors reported providing more career development than female mentors. Additionally, mentors in both same-gender and cross-gender mentoring relationships reported providing more psychosocial support to female protégés. This finding was further qualified by a significant interaction between mentor gender and protégé gender, with male mentors not differing in the amount of reported psychosocial support they provided to male and female protégés, and female mentors reporting they provided more psychosocial supported to female protégés than male protégés.

In an attempt to reconcile these inconsistent findings, O’Brien, Biga, Kessler, and Allen’s (2010) conducted a meta-analysis on the effects of gender in mentoring relationships. They found small but consistent differences associated with gender differences in mentoring relationships. For instance, O’Brien et al. found that female protégés report receiving more psychosocial support than male protégés, whereas no gender differences emerged in female and male protégés reports of the amount of career development received. Gender differences were also found in mentors’ reports of mentoring functions provided with male mentors reporting they provide more career development than female mentors and female mentors reporting they provide more psychosocial support than male mentors. However, a more recent meta-analysis by Eby et al. (2013) found no relationship between protégé and mentor gender and protégés’ perceptions of psychosocial and career development received. It should also be noted that although the gender differences found in O’Brien et al.’s (2010) meta-analysis were significant, the correlations were small, with the largest correlation equaling .06. Taken together, these meta-analyses suggest that there may be no differences in the mentoring behaviors of male and female mentors.

Despite finding no relationship between gender and mentoring behaviors, the gender of mentors may play a role in stereotype threat reduction. Unfortunately, no study has examined the relationship between mentor gender and stereotype threat reduction. Although research has not examined the effects of mentor gender on stereotype threat reduction, research has examined the relationship between having a same-gender role model and stereotype threat reduction. A series of studies by Marx and Roman (2002) revealed that presenting women with a successful female role model in the domain of math reduced the negative effects of stereotype threat on math test performance. In their first study, male and female participants were placed in either a male or female experimenter condition. In both conditions, the competence of the experimenter was established by having the experimenter state that he or she developed the math test used in the study and would be providing participants feedback regarding their performance. Female participants who were in the competent male experimenter condition underperformed compared to male participants. However, female participants who were in the competent female experimenter condition performed as well as male participants. Follow-up studies by Marx and Roman found that the competent role model did not even have to be present in the testing context to reduce the effects of stereotype threat. Simply learning about a female who excelled in math was enough to prevent women from underperforming compared to women who learned about a male who excelled in math.

Other studies have also found that exposure to competent role models buffers people against the effects of stereotype threat. For instance, Good et al. (2010) found that seeing female scientists in chemistry textbooks helps females overcome the effects of stereotype threat on chemistry test performance. In this study, high school students were given a three page excerpt regarding chemical reactions and equations. Each page had an image of a scientist. In one condition, all three images were of male scientists. In another condition, all three images were of female scientists. Females who saw the three male scientists underperformed on a chemistry comprehension test compared to females who saw the three female scientists. Similarly, other studies have found that learning about competent women in negatively stereotyped domains protects women against the effects of stereotype threat on math test performance (McIntyre, Lord, Gresky, Ten Eyck, Jay Frye, & Bond, 2005; McIntyre et al., 2003; McIntyre, Paulson, Taylor, Morin, & Lord, 2011). In addition to improving the test performance of women in math, the presence of competent ingroup role models has also been found to be an effective means of reducing stereotype threat among African Americans taking intelligence tests (Marx & Goff, 2005). These findings suggest that being aware of members of one's social group who are successful in a negatively stereotyped domain is enough to reduce the effects of stereotype threat.

Competent role models have also been shown to be an effective way of reducing the effects of stereotype threat on interests. For instance, Stout et al. (2011) had female undergrads majoring in engineering read either five biographies of female engineers, five biographies of male engineers, or five descriptions of engineering inventions. Women who read about the female engineers had more positive implicit attitudes toward math and implicit identification with math than women who read about the male engineers or engineering inventions. Additionally, the more women identified with the female engineers, the greater their intention to pursue an engineering career.

Although the relationship between role model gender similarity and stereotype threat reduction suggests that female mentors may be more effective than male mentors in reducing stereotype threat among female STEM protégés, it is conceivable that male mentors may be as effective as female mentors in reducing stereotype threat among female STEM majors. For instance, a male mentor who conveys that he struggled through his early STEM courses and achieved success because of hard work may reduce stereotype threat to a greater degree than a female mentor who conveys the same message because he is in the majority group. In other words, if men struggle as well, it is not an inherent deficiency in women that causes them to struggle in STEM courses. This in turn will help female protégés to attribute their anxiety to external factors (e.g., the difficulty of STEM courses) instead of internal factors (e.g., lack of ability). Female protégés may not necessarily make these conclusions if they have female mentors because it is still a possibility that the struggles of their female mentors were due to the inherent inability of women to do math and science. Thus, male mentors may be as effective as female mentors in reducing stereotype threat if they acknowledge the difficulty of STEM courses and the importance of hard work in achieving success.

Supporting this line of reasoning, the attributions of success associated with a role model have been found to be more important than the gender of the role model in reducing stereotype threat. For instance, Bages and Martinot (2011) exposed participants to role models who achieved success either through hard work or innate talent. Similar to other stereotype threat studies, females underperformed on a math test compared to males when they were exposed to male role models but performed the same as males when they were exposed to female role models. However, the main effect of role model gender was moderated by the attributions of success associated with the role model. When presented role models who were successful because of innate talent, females participants underperformed on a math test when the role model was male compared to when the role model was female. However, when presented role models who were successful because of hard work, female participants performed the same on the math test, regardless if the role model was male or female. These findings suggest that male and female role models may be equally effective if their success is attributed to hard work, a hallmark of an incremental theory of ability.

An Integrated Stereotype Threat Intervention

The present study will combine the previously discussed self-theories, misattribution, and self-affirmation interventions into an integrated stereotype threat reduction intervention. The incremental and misattribution components of the integrated intervention will be similar to the ones used by Good et al. (2003). The misattribution intervention will consist of prompting participants to discuss the difficulty of adjusting to college and STEM-related courses in attempt to get participants to misattribute their anxiety to external factors. The incremental intervention will consist of prompting participants to discuss how intelligence can be increased through hard work. The self-affirmation exercise will be similar to self-affirmation exercises used in other studies (Cohen et al., 2006; Cohen et al., 2009; Creswell et al., 2006; Martens et al., 2006; Miyake et al., 2010). Specifically, participants will be asked to indicate their most important values and to discuss their top ranked value.

One question that emerges is why an integrated stereotype threat intervention is needed. After all, the interventions previously discussed were found to be effective individually. Furthermore, Good et al. (2003) found no difference in the standardized math test performance of female middle school students in the incremental, misattribution, and integrated interventions. Good et al.'s finding on the surface suggests that there may be nothing to be gained from integrated different stereotype threat interventions together. However, one should be cautious to conclude that an integrated stereotype threat intervention is no more effective than a single method stereotype threat intervention. After all, Good et al.'s (2003) study remains the only study that has compared the effectiveness of different stereotype threat interventions. It is difficult to make definitive conclusions based on the results of one study. It may have been the case that the lack of performance difference between the conditions occurred because of a ceiling effect. In other words, the test may have been insensitive to actual performance differences between females in the different interventions.

Furthermore, the value of an integrated intervention may be more pronounced on non-performance outcomes. The majority of stereotype threat intervention studies have only examined performance outcomes (Ben-Zeev et al., 2005; Cohen et al., 2006; Cohen et al., 2009; Good et al., 2003; Martens et al., 2006; Miyake et al., 2010). Only a small handful of intervention studies included non-performance outcomes (Aronson et al., 2002; Walton & Cohen, 2007, 2011). Of the studies that examined non-performance outcomes, they have only utilized a single stereotype threat intervention. It may be the case that an integrated stereotype threat intervention yields additive effects on non-performance outcomes (e.g., sense of belonging, interest in pursuing STEM major).

An integrated stereotype threat intervention may be more effective than any individual intervention because it can target multiple points in the stereotype threat process. For example, Cohen, Purdie-Vaughns, and Garcia (2011) propose that misattribution interventions can help prevent stereotype threat from occurring, whereas self-affirmation interventions can help people experiencing stereotype threat to cope with it. By utilizing both interventions, one can both prevent stereotype threat from occurring and treat those who are experiencing stereotype threat. Although misattribution interventions are proposed to prevent stereotype threat from occurring, it is also conceivable that misattribution interventions help minimize the effects of stereotype threat once it occurs by reducing arousal. By targeting multiple points in the stereotype threat process, the overall effectiveness of the intervention should be increased because there are multiple redundancies to compensate for potential breaches.

An integrated stereotype threat intervention may also be more desirable for pragmatic reasons. Given that mentors and protégés in the present study will be interacting with each other for three consecutive weeks, undertaking the same activity each week (e.g., discussing the malleability of intelligence) may lead to boredom and disengagement, which may increase the risk of attrition. Thus, to keep participants engaged, they will undertake different activities and discussions each week.

In conclusion, the present study will integrate the incremental theory, arousal misattribution, and self-affirmation interventions used in other stereotype threat studies into a three week mentoring program. Each week, mentors and protégés will participate in different exercises based on the previously mentioned stereotype threat interventions. During the first week, mentors and protégés will complete a self-affirmation exercise. The self-affirmation exercise will be framed as an icebreaker to help mentors and protégés get to know each other better. Mentors and protégés will be instructed to identify their most important values and write about their highest ranked value. Afterwards mentors and protégés will be encouraged to discuss their responses. The act of discussing their most important values should reinforce the self-affirmation exercise and help mentors and protégés get to know each other better. During the second week, mentors and protégés will be encouraged to discuss the difficulty adjusting to college and STEM courses. By discussing how many students struggle initially in college and STEM courses, mentors should be able to help their protégés to attribute their anxiety to non-trait factors by getting their protégés to realize that they are not the only ones struggling. In essence, college and STEM courses may be inherently difficult. During the third week, mentors and protégés will be encouraged to discuss the malleability of intelligence. The act of encouraging their protégés to attribute anxiety to external sources and to adopt an incremental theory of intelligence should result in mentors changing their own attitudes and beliefs via self-persuasion processes. Protégés may also change their attitudes and beliefs via self-persuasion processes because mentors will be encouraged to get their protégés to discuss specific times in which they developed their abilities and experienced difficult circumstances.

Hypotheses

The present study randomly assigned participants to a stereotype threat reduction mentoring condition, an academic mentoring condition, or a non-academic mentoring condition. All three conditions were framed as a mentoring program designed to help freshmen transition into college. Female freshmen and sophomores who intended to major in STEM fields were recruited to participate as protégés and upper-level male and female STEM majors were recruited to serve as mentors. Participants were unaware that the true purpose of the study was to examine the effectiveness of mentoring at reducing stereotype threat and increasing female retention in STEM fields. The stereotype threat mentoring reduction condition was structured such that mentors and protégés engaged in activities and discussions designed to buffer people against the effects of stereotype threat (i.e., self-affirmation, incremental theories of intelligence, and misattribution). The academic mentoring condition was structured such that mentors and protégés engaged in discussions regarding academic-related topics such as goals for the semester, building relationships with faculty advisors, and things to do to be competitive for graduate school. The non-academic mentoring condition was structured such that mentors and protégés engaged in discussions regarding non-academic topics such as life goals, maintaining relationships with friends and family, and extra-curricular activities. The academic and non-academic mentoring conditions were designed to serve as control conditions and were used to determine if receiving mentoring in and of itself is enough to reduce stereotype threat. If the academic and non-academic mentoring conditions reduced stereotype threat to the same degree as the stereotype threat mentoring reduction condition, it would show that other interventions may not be necessary to reduce stereotype threat if one has a good mentor. However, if the stereotype threat mentoring reduction condition resulted in greater stereotype threat reduction, it would help show that having other interventions besides mentoring may be necessary to achieve the greatest stereotype threat reduction.

Prior stereotype threat studies have not examined the relationship between stereotype threat and psychosocial support and career development. Neither Aronson et al. (2002) or Good et al. (2003) measured psychosocial support or career development in their studies. Given that the focus of career development is the advancement of the protégé, it is unclear if receiving career development would reduce feelings of stereotype threat. For instance, being sponsored for desirable projects and being introduced to key decision makers may not necessarily reduce a person's fears that he or she may confirm a negative stereotype. However, it is conceivable that receiving career development may reduce stereotype threat if the protégé perceives the career development provided by their mentor as a sign that the mentor believes in him or her. Additionally, prior research has found that perceived career development is positively correlated with sense of belonging and negatively correlated with strain (Eby et al., 2013). These findings suggest that receiving career development can minimize the effects of stereotype threat by bolstering a person's sense of belonging and reducing the strain he or she experiences. Given that no prior study has examined the relationship between career development and stereotype threat, the present study explored such a relationship as a research question.

Research question 1. Is career development related to stereotype threat?

Similar to the relationship between career development and stereotype threat, the relationship between psychosocial support and stereotype threat reduction remains unexplored. Much like research on career development, prior research has found that perceived psychosocial support is positively correlated with sense of belonging and negatively correlated with strain (Eby et al., 2013). These findings also suggest that receiving psychosocial support can minimize the effects of stereotype threat by bolstering a person's sense of belonging and reducing the strain he or she experiences. However, given that no prior study has examined the relationship between psychosocial support and stereotype threat, the present study explored such a relationship as a research question.

Research question 2. Is psychosocial support related to stereotype threat?

Given that academic and non-academic mentoring conditions may or may not discuss things related to stereotype threat reduction, it is likely that the stereotype threat reduction mentoring condition would result in greater stereotype threat reduction. Both female mentors and protégés were expected to benefit from the stereotype threat mentoring condition because they were prompted to discuss their self-affirmation responses, the incremental nature of intelligence, and external factors related to the difficulty of STEM courses. Consequently, the stereotype threat reduction mentoring condition was expected to reduce stereotype threat for both female mentors and protégés. Male mentors were not expected to experience stereotype threat reduction because they do not contend with negative stereotypes in STEM fields. Stereotype threat reduction in turn should result in better performance on a standardized math test and higher intentions to remain in STEM fields. Furthermore, given that the stereotype threat mentoring program targets the mediators of stereotype threat, women in the stereotype threat mentoring condition should report less performance-avoidance goals and worry while taking a standardized math test, as well as a greater sense of belonging to STEM fields than women in the academic mentoring and non-academic mentoring conditions. Furthermore, performance-avoidance goals and worry were expected to mediate the effects of stereotype threat on performance and sense of belonging was expected to mediate the effects of stereotype threat on intentions. Additionally, participants in the stereotype threat mentoring condition should report having a more incremental view of intelligence than participants in the academic and non-academic mentoring conditions.

Additionally, the present study examined if female protégés experienced less stereotype threat when paired with female mentors, as opposed to male mentors. It is important to determine what effect mentor gender has on stereotype threat reduction because of the implications towards designing STEM mentoring programs. For instance, if stereotype threat reduction only occurs when female protégés are paired with female mentors, such a finding would suggests that mentoring interventions may not be a practical solution for stereotype threat reduction because of the limited number of available female mentors. However, if male mentors can be just as effective as female mentors in reducing stereotype threat, the viability of mentoring interventions is increased substantially because of the larger pool of available male mentors. It is conceivable that female protégés will be more comfortable discussing their experiences related to stereotype threat with female mentors than male mentors. However, it is also conceivable that male mentors will be able to reduce stereotype threat by demonstrating that they also experience frustration, stress, and anxiety in STEM courses. Prior stereotype threat studies have found that exposure to female role models buffers women against the effects of stereotype threat (Marx & Roman, 2002). However, more recent research suggests that the message a role model sends is more important than the gender of the role model. For instance, Bages and Martinot's (2011) study suggests that the attributions of success associated with a role model is more important than the gender of the role model in reducing stereotype threat. In other words, male and female mentors may be equally effective at reducing stereotype threat if they utilize strategies and techniques that have been found to reduce stereotype threat (e.g., attributing anxiety to external factors, encouraging an incremental theory of intelligence). Given that the stereotype threat reduction mentoring condition utilized interventions that have been found to reduce stereotype threat, the gender of the mentor may not matter in stereotype threat reduction mentoring condition. In other words, male and female mentors in the stereotype threat mentoring condition may be equally effective at reducing protégés' feelings of stereotype threat. However, in the academic and non-academic mentoring conditions, the absence of interventions that have been found to reduce stereotype threat may result in mentor gender playing a more prominent role in stereotype threat reduction. Consequently, female mentors may be more effective than male mentors at reducing protégés' feelings of stereotype threat in the academic and non-academic mentoring conditions. Thus, mentor gender and mentoring condition were predicted to interact in such a way that male and female mentors were expected to be equally effective at reducing protégés' feelings of stereotype threat in the stereotype threat reduction mentoring condition, whereas female mentors were expected to be more effective than male mentors at reducing protégés' feelings of stereotype threat in the academic and non-academic mentoring conditions. For a breakdown of the present study's hypotheses, refer to Figure 2. Given the above arguments, the following hypotheses will be tested:

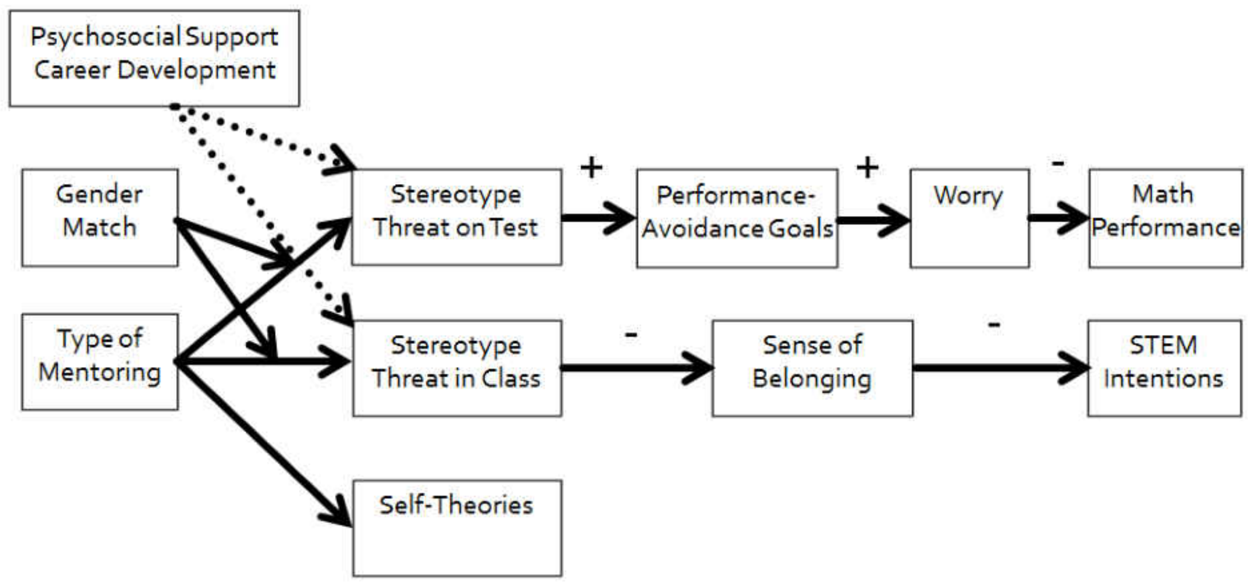


Figure 2: Graphical Representation of Hypothesized Relationships

Hypothesis 1a. Participants in the stereotype threat reduction mentoring condition were expected to endorse an incremental theory of intelligence more than participants in the academic and non-academic mentoring conditions.

Hypothesis 1b. Participants in the stereotype threat reduction mentoring condition were expected to endorse an entity theory of intelligence less than participants in the academic and non-academic mentoring conditions.

Hypothesis 2a. Protégés and female mentors in the stereotype threat reduction mentoring condition were expected to report experiencing less stereotype threat in their STEM classes than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 2b. Protégés with female mentors were expected to report experiencing less stereotype threat in their STEM classes than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender was expected to have no effect on protégés' feelings of stereotype threat in their STEM classes in the stereotype threat reduction mentoring condition.

Hypothesis 3a. Protégés and female mentors in the stereotype threat reduction mentoring condition were expected to report greater intentions to remain in their major than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 3b. Protégés with female mentors were expected to report greater intentions to remain in STEM than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender was expected to have no effect on protégés' intentions to remain in STEM in the stereotype threat reduction mentoring condition.

Hypothesis 4. Sense of belonging was expected to mediate the effects of stereotype threat on intentions such that higher stereotype threat is expected to predict lower sense of belonging, which is expected to predict lower intentions to remain in STEM.

Hypothesis 5a. Protégés and female mentors in the stereotype threat mentoring condition were expected to experience less stereotype threat while taking a standardized math test than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 5b. Protégés with female mentors were expected to report experiencing less stereotype threat while taking the math test than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender was expected to have no effect on protégés' feelings of stereotype threat during the math test in the stereotype threat reduction mentoring condition.

Hypothesis 6a. Protégés and female mentors in the stereotype threat reduction mentoring condition were expected to perform better on a standardized math test than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 6b. Protégés with female mentors were expected to perform better on a standardized math test than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender was expected to have no effect on protégés' performance on a standardized math test in the stereotype threat reduction mentoring condition.

Hypothesis 7a. Protégés and female mentors in the stereotype threat mentoring intervention were expected to report less performance-avoidance goals during the test than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 7b. Protégés and female mentors in the stereotype threat mentoring intervention were expected to report less worry during the test than protégés and female mentors in the academic and non-academic mentoring conditions.

Hypothesis 7c. Performance-avoidance goals and worry were expected to mediate the effects of stereotype threat on performance such that higher stereotype threat was expected to predict higher performance-avoidance goals, which was expected to predict higher worry, which was expected to predict lower performance.

CHAPTER THREE: METHODS

Experimental Design

This study consisted of a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, and Non-Academic control) x 2 (Gender Match: Male vs. Female Mentor) factorial design. Mentors and protégés were randomly assigned to one of the three mentoring conditions. Additionally, protégés were randomly assigned to either a male or female mentor.

Participants

Participants in this study were 247 undergraduates from the University of Central Florida, resulting in a total of 137 mentor/protégé dyads. All dyads completed their online chat sessions. However, 8 mentors and 6 protégés failed to attend the in-person debriefing session after the completion of the online chat sessions.

A total of 110 participants agreed to mentor incoming science, technology, engineering, and math students. There were 74 female and 36 male mentors. Ages ranged from 18 years to 35 years (M = 21.70, SD = 2.63). Approximately 38% identified as Caucasian, 21% identified as Hispanic, 15% identified as Asian American, 14% identified as multi-racial, 10% identified as African American, and 3% identified as other. A breakdown of the academic majors of mentors can be found in Table 1. Due to a shortage of mentors, 19% of mentors mentored more than one protégé. Seven male mentors and 24 female mentors were randomly assigned the non-academic control condition, 15 male mentors and 25 female mentors were randomly assigned to the academic control condition, and 14 male mentors and 25 female mentors were randomly assigned to the stereotype threat reduction condition. Of the 110 mentors, 13 participated for course credit in their psychology courses.

A total of 137 female participants agreed to be mentored by an upper-level science, technology, engineering, and math student. Ages ranged from 17 years to 20 years (M = 18.13, SD = 0.69). Approximately 45% identified as Caucasian, 16% identified as African American, 12% identified as Hispanic, 10% identified as multi-racial, 7% identified as Asian American, 7% identified as other, and 4% did not report their race. A breakdown of the academic majors of protégés can be found in Table 1. Seven protégés were randomly assigned to male mentors in the non-academic control condition, 24 protégés were randomly assigned to female mentors in the non-academic control condition, 17 protégés were randomly assigned to male mentors in the academic control condition, 36 protégés were randomly assigned to female mentors in the academic control condition, 17 protégés were randomly assigned to male mentors in the stereotype threat reduction condition, and 36 protégés were randomly assigned to female mentors in the stereotype threat reduction condition. Of the 137 protégés, 126 participated for course credit in their psychology courses.

Table 1: Academic Majors of Mentors and Protégés

Major	Number of Mentors	Number of Protégés
Biology	49	18
Biomedical Sciences	18	48
Health Sciences	8	24
Mechanical Engineering	8	2
Electrical Engineering	4	2
Industrial Engineering	4	3
Civil Engineering	3	1
Chemistry	3	6
Nursing	3	19
Computer Science	2	2
Information Technology	2	2
Environmental Engineering	2	1
Forensic Science	1	2
Mathematics	1	2
Statistics	0	2
Aerospace Engineering	0	1
Physics	0	1
Environmental Engineering and Mathematics	1	0
Electrical Engineering and Computer Engineering	1	0
Civil and Environmental Engineering	0	1

Procedure

Participants were recruited via in-class announcements, mass emails, and flyers posted around campus over two semesters. Protégés and mentors were first asked to complete a protégé/mentor profile (see Appendix C) to determine their eligibility for the study. Upon completion of the questionnaire, participants were scheduled to participate in an in-person training session. During the in-person training session, participants completed measures of anticipated career development, anticipated psychosocial support, sense of belonging, self-theories, intentions of remaining in STEM, stereotype threat experienced in classes, and demographics (see Appendix D). Upon completing these measures, participants were asked to complete a practice GRE Quantitative test. Prior to taking the test, participants were told the following:

> *We ask that you take a brief test of mathematical ability. Mathematical ability has been established as one of the strongest predictors of success in STEM fields. To help establish the effectiveness of the mentoring intervention, it is important to measure the mathematical ability of those participating in the program to help us determine that successful outcomes are due to the mentoring program and not mathematical ability. Consequently, we would like you to take a well-validated measure of mathematical ability that can identify a person's strengths and weaknesses in quantitative domains. You will have 20 minutes to complete as many questions as you can.*

Similar manipulations have induced stereotype threat in other studies (Johns et al., 2008; Martens et al., 2006; Schimel et al., 2004). Participants were given 20 minutes to complete the test. After completing the test, participants completed measures of stereotype threat, goal-orientation, and state anxiety.

After completing the post-test measures, participants received a 30-minute orientation detailing the rules of conduct of the mentoring program (e.g., no racially or sexually-offensive comments, no discussion of illegal activity, etc.). In order to control for the amount of communication between conditions, protégés and mentors were asked to communicate solely through the e-mentoring system at designated times and to avoid communicating with each other outside of their scheduled sessions.

Stereotype Threat Reduction

Prior to the first chat session, participants were emailed their partner's profile and an overview of the program. Additionally, participants were asked to complete a self-affirmation exercise (see Appendix E) prior to the first chat session and to discuss their responses with their partner. Mentors were asked to discuss their responses to the self-affirmation exercise and to get their protégés to discuss their responses to the self-affirmation exercise in order to identify shared values during the first chat session (see Appendix F). The self-affirmation exercise was adapted from Cohen, Aronson, and Steele (2000) and Miyake et al. (2010). As part of the self-affirmation exercise participants were asked to rank 15 values/personal characteristics (e.g., sense of humor, artistic skill) from most important (1) to least important (15). After ranking the values/characteristics, participants were asked to describe in a few sentences why their highest ranked value/characteristic was important to them and to write about a particular time it had a meaningful impact on their lives (Cohen et al., 2000; Sherman, Nelson, & Steele, 2000.

For the second chat session, participants were prompted to discuss external factors related to academic difficulties. Prior to the chat session, participants received a short electronic prompt (see Appendix G) directing them to focus the chat session on addressing the difficulty of transitioning to college and courses in one's major. The prompt informed participants that many students experience difficulty when they enter new educational situations (e.g., transitioning from high school to college, transitioning from general education to courses in one's major). The prompt also highlighted how many students mistakenly conclude that they may not be capable of succeeding in college or STEM fields, when in actuality they are capable of succeeding. Additionally, participants were informed that many students do not realize that they are not the only ones experiencing these difficulties. Consequently, participants were encouraged to discuss times when they had difficulty adjusting to college and/or their specific STEM major.

For the final chat session, participants were prompted to discuss the incremental nature of intelligence. Prior to the chat session, participants received an electronic prompt (see Appendix H) directing them to discuss how intelligence could be developed. The prompt informed participants that many students believe that their intelligence is a fixed trait. In contrast to the beliefs of many students, the prompt discussed how research has found that intelligence is malleable and can be developed through hard work. Furthermore, the prompt discussed the importance of getting students to adopt an incremental theory of intelligence in order to prevent students from becoming discouraged when they experience setbacks. Participants were encouraged to discuss things that they initially struggled with but learned to do well through practice and hard work.

Academic Control

Similar to participants in the stereotype threat mentoring condition, participants in the academic control condition chatted with each other for 30 minutes, once a week, for three consecutive weeks. However, the chat sessions were focused on addressing general academic issues (see Appendix I).

Non-Academic-Control

Participants in the non-academic control condition also chatted with each other for 30 minutes, once a week, for three consecutive weeks. However, the chat sessions were focused on addressing general non-academic issues (see Appendix J).

Post-Mentoring

Upon completion of the third mentoring session, mentors and protégés were asked to complete an online post-mentoring survey containing measures of career development, psychosocial support, sense of belonging, self-theories, intentions of remaining in STEM, and stereotype threat experienced in classes. After completing these measures, participants were scheduled for an in-person debriefing session. During the debriefing session, participants were asked to take the same practice GRE Quantitative test they took during the pre-session. Participants were given the same verbal instructions as they were given during the pre-session and given 20 minutes to complete the test. After completing the test, participants completed measures of stereotype threat, goal-orientation, and state anxiety. Upon completing these measures, participants were thanked for their participation and debriefed.

Measures

Theories of Intelligence

Participants' theories of intelligence were assessed by Dweck's (1999) eight-item Theories of Intelligence scale (see Appendix K). Four items assessed the degree to which respondents endorse an entity theory of intelligence. A sample item is as follows: "you have a certain amount of intelligence, and you can't really do much to change it". The items were internally consistent during both pre- (α = .91) and post-mentoring (α = .91). Four items assessed the degree to which respondents endorse an incremental theory of intelligence. A sample item is as follows: "you can always substantially change how intelligent you are". The items were internally consistent during both pre- (α = .91) and post-mentoring (α = .91). Items were rated on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicate greater endorsement of entity and/or incremental theories of intelligence.

Stereotype Threat Experienced in Classes

Spencer's (1993) eight-item Stereotype Vulnerability Scale was used to assess the degree to which participants experience stereotype threat in their STEM classes. Because the Stereotype Vulnerability Scale was originally designed to assess stereotype threat during testing, it had to be modified in order for it to assess the degree to which stereotype threat was experienced in STEM classes (see Appendix L). Consequently, two items had to be altered. The item: "the experimenters expected me to do poorly on the test because of my gender", was altered to state: "professors expect me to do poorly on tests in S.T.E.M. classes because of my gender". Similarly, the item: "the test may have been easier for people of my gender", was altered to state: "S.T.E.M. tests may be easier for people of my gender". Items were rated on a 5-point Likert scale that ranged from 1 (*never*) to 5 (*almost always*). Higher scores indicated greater perceived stereotype threat. The internal consistency of Stereotype Vulnerability Scale was somewhat low during both pre- (α = .54) and post-mentoring (α = .69). Analysis revealed that the second item, "S.T.E.M. tests may be easier for people of my gender" had a negative item-total correlation during pre-mentoring (r = -.21) and a low item-total correlation during post-mentoring (r = .05). Because this item lowered internal consistency, it was excluded from further analyses. Deletion of the item increased internal consistency during both pre- (α = .63) and post-mentoring (α = .74).

Sense of Belonging

Participants' sense of belonging was assessed by Good et al.'s (2012) Math Sense of Belonging Scale. The items in the scale were altered to refer to sense of belonging in the STEM community (see Appendix M) instead of sense of belonging in the math community. A sample item is as follows: "I feel that I belong to the S.T.E.M community". Items were rated on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated greater sense of belonging. The 28 items were internally consistent during both pre- (α = .94) and post-mentoring (α = .94).

Intentions of Remaining In STEM

A variety of measures were used to assess participants' intentions of remaining in STEM. Two items adapted from Stout et al. (2011) assessed participants' intentions to pursue a career in their major. Participants were asked to indicate their agreement with the following statements: "I will pursue graduate study in my major" and "I will pursue a professional job in my major". Participants' intention to take future S.T.E.M. courses was assessed by the following item from Good et al. (2012): "I will take S.T.E.M. classes in the future". These 3 items were rated on a 5-point Likert scale that ranged from 1 (*not at all likely*) to 5 (*very likely*). Participants were also asked to respond to the following statement "What is the highest degree you plan on obtaining". Response options included 1 (*associates degree*), 2 (*bachelor's degree*), 3 (*master's degree*), 4 (*doctoral degree*), and 5 (*other*). Participants who choose other were excluded from further analysis. Thirteen mentors and 16 protégés were excluded for selecting other or not responding to the item. The items did not appear to be correlated enough to justify aggregation into a composite intention scale. Correlations between the items ranged from .05 to .41 on the pre-measures and .05 to .48 on the post-measures.

Stereotype Threat during Testing

Participants' feelings of stereotype threat while taking the math test was assessed by Marx, Stapel, and Muller's (2005) three-item scale (see Appendix N). The items were internally consistent during both pre- (α = .83) and post-mentoring (α = .91). A sample item is as follows: "I worry that if I perform poorly on this test, the experimenter will attribute my poor performance to my gender". Items were rated on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated greater perceived stereotype threat during the math test.

Performance-Avoidance Goals during Testing

Participants' performance-avoidance goals during the math test was assessed with six-items from Brodish's (2007; Brodish & Devine, 2009) Achievement Goal Questionnaire (see Appendix O). A sample item from the performance-avoidance goal scale is as follows: "my goal is to avoid doing poorly on this test". The items were internally consistent during both pre- (α = .75) and post-mentoring (α = .83). Items were rated on a 5-point Likert scale that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicate greater endorsement of performance-avoidance goals.

Worry during Testing

Participants' worry was assessed by Morris et al.'s (1981) 5-item worry questionnaire (see Appendix P). A sample item is as follows: "I feel that others will be disappointed in me". The items were internally consistent during both pre- (α = .83) and post-mentoring (α = .82). Items were rated on a 5-point Likert scale that ranged from 1 (*the statement does not describe my present condition*) to 5 (*the statement describes my present condition very well*). Higher scores indicated greater worry.

Math Performance

Participants' math performance was assessed by a 31-item quantitative test (see Appendix Q) used by McIntyre et al. (2003, 2005). The test was constructed from sample GRE tests.

Academic Career Development

Although the majority of mentoring studies measure career development and psychosocial support with either Noe's (1988a) or Scandura's (1992; Scandura & Ragins, 1993) mentor behavior scales (Allen et al., 2008), both scales were deemed inappropriate for the context of this study. The main drawback of both scales is that they assess mentoring in a work-related context. Consequently, many of the items were not directly applicable for an academic peer-mentoring program. For example, an item from Noe's (1988) scale asks protégés to indicate the degree to which their mentor "assigned responsibilities to you that have increased your contact with people in the district who may judge your potential for future advancement". Given that the peer mentors in this study did not have any formal power over protégés, it is unlikely that would be able to assign protégés responsibilities. Similarly, many of the items in Scandura's (1992) scale are also inapplicable. For example, an item asks protégés to indicate the degree to which their mentor has "placed me in important assignments".

Given the limitation of the previously discussed scales, Kendall's (2007) Academic Career Development scale was used to assess the amount of academic career development protégés report receiving and mentors report providing (see Appendix R). Kendall's Academic Career Development scale is a revision of Allen et al.'s (1999) and Smith-Jentsch et al.'s (2008) measures of academic career development. It should be noted that Allen et al. (1999) originally based their measure on Noe's (1988) measure. The revised scale consists of 21 items, whereas the original scale consists of 11 items. A sample item from the protégé's perspective is as follows: "my mentor gave me ideas for increasing contact with school administrators and faculty". Items were rated on a 5-point Likert scale that ranges from 1 (*very slight extent*) to 5 (*very large extent*). Higher scores indicated that protégés perceived receiving more career development and mentors perceived providing more career development. It should be noted that the items presented in Appendix K are from the protégés' perspective. Mentors received the same measure, reworded to their perspective. Instead of being asked if they received various types of academic career development, mentors were asked the degree to which they provided different types of academic career development to their protégés. The items were internally consistent for the protégés' version of the scale during both pre- (α = .91) and post-mentoring (α = .94) and the mentors' version of the scale during both pre- (α = .93) and post-mentoring (α = .87).

Academic Psychosocial Support

Kendall's (2007) Academic Psychosocial Support scale was used to assess the amount of psychosocial support protégés received and mentors provided (see Appendix S). Similar to Kendall's (2007) Academic Career Development scale, Kendall's Academic Psychosocial Support scale is a revision of Allen et al.'s (1999) and Smith-Jentsch et al.'s (2008) measures of psychosocial support. The revised scale consists of 14 items, whereas the original scale consists of 10 items. A sample item from the protégé's perspective is as follows: "my mentor discussed my questions and concerns regarding commitment to academic advancement". Items were rated on a 5-point Likert scale that ranges from 1 (*very slight extent*) to 5 (*very large extent*). Higher scores indicated that protégés perceive receiving more psychosocial support and mentors perceived providing more psychosocial support. It should be noted that the items presented in Appendix L are from the protégés' perspective. Mentors received the same measure, reworded to their perspective. Instead of being asked if they received various types of psychosocial support, mentors were asked the degree to which they provided different types of psychosocial support to their protégés. The items were internally consistent for the protégés' version of the scale during both pre- (α = .91) and post-mentoring (α = .92) and the mentors' version of the scale during both pre- (α = .93) and post-mentoring (α = .85).

Coded Behaviors

Nine undergraduate research assistants who were blind to condition were trained to code for academic career development (e.g., if you have problems I recommend you go to the SARC sessions), psychosocial support (e.g., well I'm sure you'll do fine), self-affirmations (e.g., my top value was relationships with friends/family), self-theories (e.g., I don't think that you are born smart, I think that you become intelligent through experience), and misattributions (e.g., I got a C the first time I took Orgo I so I retook the class and got an A. I had too much on my plate at the time I was taking Orgo and I definitely don't recommend doing that.) using 15 pilot session transcripts. Coders were instructed to assign a code for each complete thought (i.e., complete sentence) they came across. Due to the volume of data in the present study, the transcripts were randomly divided among coders such that two coders coded each transcript. After individually coding each transcript, coders met with each other to reach consensus regarding the transcript. Interrater reliabilities were calculated as coefficient alphas for academic career development (α = .99), psychosocial support (α = .95), self-affirmation (α = .89), misattribution (α = .89), and self-theories (α = .93), treating the nine raters as items.

Manipulation Check

To determine if the stereotype threat reduction condition resulted in more discussions regarding important values (i.e., self-affirmations), self-theories, and overcoming challenges (i.e., misattributions), a one-way ANOVA was carried out comparing the frequency of coded self-affirmations, self-theories, and misattributions across the 3 mentoring conditions. In terms of coded self-affirmations, a significant effect for mentoring condition was found ($F(2, 128) = 6.74$, $p < .00$). Planned comparisons revealed that participants in the academic control ($M = 0.12$, $SD = 0.62$) and non-academic control ($M = 0.68$, $SD = 1.49$) conditions did not differ from each other ($t(128) = 0.96$, $p = .34$). However, participants in the stereotype threat reduction ($M = 1.90$, $SD = 3.80$) condition engaged in more self-affirmation discussions than participants in the academic control ($t(128) = -3.62$, $p < .01$) and non-academic control conditions ($t(128) = -2.08$, $p = .04$). In terms of coded self-theories, a significant effect for mentoring condition was found ($F(2, 128) = 10.14$, $p < .00$). Planned comparisons revealed that participants in the academic control ($M = 0.23$, $SD = 0.67$) and non-academic control ($M = 0.25$, $SD = 0.59$) conditions did not differ from each other ($t(128) = .03$, $p = .98$). However, participants in the stereotype threat reduction ($M = 2.35$, $SD = 4.12$) condition engaged in more self-theories discussions than participants in the academic control ($t(128) = -4.11$, $p < .01$) and non-academic control conditions ($t(128) = -3.41$, $p < .01$). In terms of coded misattributions, a significant effect for mentoring condition was found ($F(2, 128) = 3.28$, $p = .04$). Planned comparisons revealed that participants in the academic control ($M = 1.87$, $SD = 2.76$) and non-academic control ($M = 2.14$, $SD = 2.61$) conditions did not differ from each other ($t(128) = .38$, $p = .70$). However, participants in the stereotype threat reduction ($M = 3.37$, $SD = 3.64$) condition engaged in more misattribution discussions than participants in the academic control ($t(128) = -2.46$, $p < .05$) and non-academic control conditions ($t(128) = -1.68$, $p < .05$). Based on these findings, it appears that stereotype threat reduction condition was successful at generating discussions regarding important values (i.e., self-affirmations), self-theories, and overcoming challenges (i.e., misattributions),

CHAPTER FOUR: RESULTS

General Findings

Before reporting the results for specific hypothesis tests, some general findings will be discussed. Scale means, standard deviations, and correlations for protégés can be found in Tables 2 (pre-mentoring) and 3 (post-mentoring). Scale means, standard deviations, and correlations for mentors can be found in Table 4 (pre-mentoring) and 5 (post-mentoring).

Although not hypothesized, results suggest that there may be a link between stereotype threat and self-theories. For example, protégés' post-mentoring feelings of stereotype threat in STEM classes was significantly correlated with protégés' post-mentoring entity theory of intelligence ($r(133) = .24$, $p < .01$). Similarly, mentors' post-mentoring feelings of stereotype threat in STEM classes was significantly correlated with mentors' post-mentoring entity theory of intelligence ($r(101) = .44$, $p < .01$). Additionally, mentors' post-mentoring entity theory of intelligence was significantly correlated with mentors' feelings of stereotype threat on the post-mentoring math test ($r(97) = .27$, $p < .01$). Lastly, mentors' post-mentoring feelings of stereotype threat in STEM classes was significantly correlated with mentors' post-mentoring incremental theory of intelligence ($r(101) = -.34$, $p < .01$). Taken together, these findings suggest that endorsing an entity view of intelligence is positively related to feelings of stereotype threat and that endorsing an incremental view of intelligence is negatively related to feelings of stereotype threat.

Protégés may not have experienced stereotype threat during the math test. Protégés' self-reported feelings of stereotype threat were low during both the pre-mentoring math test (M = 1.49, SD = 0.71) and the post-mentoring math test (M = 1.41, SD = 0.69). On a 5-point Likert scale with higher scores indicating greater feelings of stereotype threat, 55.56% of protégés scored a 1, 71.85% of protégés scored below a 2, and 91.85% of protégés scored below a 3 during the pre-mentoring math test. Similarly, 65.32% of protégés scored a 1, 75.81% of protégés scored below a 2, and 91.13% of protégés scored below a 3 during the post-mentoring math test. Taken together, these results suggest that protégés may not have experienced stereotype threat during the math tests.

Mentors may not have experienced stereotype threat during the math test. Mentors' self-reported feelings of stereotype threat were low during both the pre-mentoring math test (M = 1.38, SD = 0.56) and the post-mentoring math test (M = 1.35, SD = 0.59). On a 5-point Likert scale with higher scores indicating greater feelings of stereotype threat, 57.27% of mentors scored a 1, 77.27% of mentors scored below a 2, and 96.36% of mentors scored below a 3 during the pre-mentoring math test. Similarly, 66.00% of mentors scored a 1, 78.00% of mentors scored below a 2, and 97.00% of mentors scored below a 3 during the post-mentoring math test. Taken together, these results suggest that mentors may not have experienced stereotype threat during the math tests.

Table 2: Means, Standard Deviations, and Intercorrelations among Protégé Pre-Mentoring Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Anticipated ACD	3.98	0.46						
2. Anticipated PS	3.89	0.57	.75**					
3. Sense of Belonging	3.91	0.54	.24**	.25**				
4. Entity Theory	2.18	0.80	-.24**	-.22*	-.33**			
5. Incremental Theory	3.91	0.75	.25**	.24**	.27**	-.76**		
6. Stereotype Threat in Class	2.12	0.61	-.08	-.15	-.15	.12	-.03	
7. Highest Degree Intent	3.36	0.76	.13	.14	.12	-.00	-.01	.01
8. Graduate Education Intent	4.27	1.03	.08	.01	.19*	-.12	.13	.07
9. STEM Job Intent	4.72	0.58	.19*	.08	.20*	-.22*	.24**	-.07
10. STEM Class Intent	4.09	1.06	.00	-.02	.08	.02	.04	.08
11. Math Test: Number Correct	12.09	4.24	-.18*	-.21*	-.12	.06	-.02	.17*
12. Math Test: Percent Correct	68.50	14.65	-.22**	-.16	-.11	.07	-.12	.08
13. Performance-Avoid Goals during Test	3.69	0.68	.33**	.21*	.13	-.12	.28**	-.02
14. Worry during Test	2.03	0.85	.14	.15	-.02	.06	.03	.03
15. Stereotype Threat during Test	1.49	0.71	-.02	-.10	-.21*	.20*	.00	.45**

Variable	7	8	9	10	11	12	13	14
1. Anticipated ACD								
2. Anticipated PS								
3. Sense of Belonging								
4. Entity Theory								
5. Incremental Theory								
6. Stereotype Threat in Class								
7. Highest Degree Intent								
8. Graduate Education Intent	.40**							
9. STEM Job Intent	-.05	.45**						
10. STEM Class Intent	.17	.19*	-.02					
11. Math Test: Number Correct	-.04	-.07	-.15	.11				
12. Math Test: Percent Correct	.06	-.15	-.24**	.20*	.57**			
13. Performance-Avoid Goals during Test	-.07	.16	.30**	-.08	-.13	-.24**		
14. Worry during Test	-.06	-.04	.05	-.02	-.17*	-.02	.47**	
15. Stereotype Threat during Test	-.00	.05	.00	.04	.07	-.05	.25**	.39**

$p < .05$*, $p < .01$**

Table 3: Means, Standard Deviations, and Intercorrelations among Protégé Post-Mentoring Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Reported ACD	3.57	0.68						
2. Reported PS	4.05	0.63	.75**					
3. Sense of Belonging	4.12	0.54	.35**	.33**				
4. Entity Theory	2.22	0.90	-.28**	-.30**	-.34**			
5. Incremental Theory	3.92	0.78	.32**	.27**	.35**	-.70**		
6. Stereotype Threat in Class	2.12	0.69	.00	-.13	-.29**	.24**	-.09	
7. Highest Degree Intent	3.26	0.80	-.12	-.10	-.02	-.05	.09	-.03
8. Graduate Education Intent	4.38	1.02	.07	-.01	.07	-.18*	.29**	-.05
9. STEM Job Intent	4.76	0.66	.28**	.13	.28**	-.25**	.33**	-.02
10. STEM Class Intent	4.41	0.85	.03	.07	.03	.14	-.10	.00
11. Math Test: Number Correct	14.95	4.75	-.07	-.08	.01	.08	-.14	-.03
12. Math Test: Percent Correct	67.93	15.33	-.10	-.05	.01	.07	-.21*	-.05
13. Performance-Avoid Goals during Test	3.43	0.73	.17	.19*	.08	.02	.28**	.03
14. Worry during Test	1.43	0.56	.06	.00	-.17	.13	.02	.11
15. Stereotype Threat during Test	1.41	0.69	-.01	-.09	-.31**	.11	.00	.34**
16. Coded ACD	35.51	20.67	.03	.00	.09	.08	-.02	.07
17. Coded PS	17.59	12.99	.15	.24**	.24**	-.02	.10	-.19*
18. Coded Self-Affirmation	0.93	2.61	-.02	.03	-.10	-.03	-.02	-.17
19. Coded External Attributions	2.51	3.16	-.02	.08	-.02	-.05	.06	.17
20. Coded Self-Theories	1.06	2.80	-.12	-.05	-.04	-.11	.13	-.18*

Variable	7	8	9	10	11	12	13	14
1. Reported ACD								
2. Reported PS								
3. Sense of Belonging								
4. Entity Theory								
5. Incremental Theory								
6. Stereotype Threat in Class								
7. Highest Degree Intent								
8. Graduate Education Intent	.27**							
9. STEM Job Intent	-.09	.46**						
10. STEM Class Intent	.12	.06	.02					
11. Math Test: Number Correct	-.09	-.11	-.08	.18*				
12. Math Test: Percent Correct	.03	-.18*	-.08	.20*	.62**			
13. Performance-Avoid Goals during Test	.05	.06	.04	.01	-12	-.23**		
14. Worry during Test	-.06	.03	-.02	-.01	-.13	-.02	.34**	
15. Stereotype Threat during Test	-.00	-.01	.06	.11	.03	.01	.13	.27**
16. Coded ACD	.04	-.15	-.02	-.09	.19*	.19*	.01	.02
17. Coded PS	-.00	.19*	-.21*	-.09	.02	-.14	.19*	.03
18. Coded Self-Affirmation	-.03	.05	.14	.07	.04	.07	.03	.05
19. Coded External Attributions	.01	-.03	-.01	.02	.20*	.02	.03	-.02
20. Coded Self-Theories	.14	.06	.12	-.01	-.05	-.02	-.19*	.03

Variable	15	16	17	18	19
1. Reported ACD					
2. Reported PS					
3. Sense of Belonging					
4. Entity Theory					
5. Incremental Theory					
6. Stereotype Threat in Class					
7. Highest Degree Intent					
8. Graduate Education Intent					
9. STEM Job Intent					
10. STEM Class Intent					
11. Math Test: Number Correct					
12. Math Test: Percent Correct					
13. Performance-Avoid Goals during Test					
14. Worry during Test					
15. Stereotype Threat during Test					
16. Coded ACD	.01				
17. Coded PS	-.10	.10			
18. Coded Self-Affirmation	.04	-.06	-.02		
19. Coded External Attributions	.05	.03	.01	-.02	
20. Coded Self-Theories	.08	-.06	.10	.20*	.14

$p < .05^*$, $p < .01^{**}$

Table 4: Means, Standard Deviations, and Intercorrelations among Mentor Pre-Mentoring Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Anticipated ACD	4.39	0.64						
2. Anticipated PS	4.49	0.51	.79**					
3. Sense of Belonging	4.22	0.44	.38**	.33**				
4. Entity Theory	1.89	0.80	-.23*	-.21*	-.36**			
5. Incremental Theory	4.03	0.78	.26**	.24*	.26**	-.80**		
6. Stereotype Threat in Class	2.10	0.67	-.06	-.06	-.20*	.09	-.05	
7. Highest Degree Intent	3.38	0.76	.19	.07	.17	.04	-.02	-.22*
8. Graduate Education Intent	4.10	1.27	.12	.12	.08	.16	-.17	-.05
9. STEM Job Intent	4.49	1.06	.09	.14	.04	.02	.04	.04
10. STEM Class Intent	4.42	0.92	.14	.25**	.25**	-.16	.11	-.07
11. Math Test: Number Correct	13.75	5.38	-.02	.09	.11	.11	-.15	.00
12. Math Test: Percent Correct	70.46	16.50	-.06	-.00	.01	.02	-.10	.06
13. Performance-Avoid Goals during Test	3.43	0.71	.21*	.03	-.02	-.02	.13	-.01
14. Worry during Test	1.88	0.80	-.02	-.09	-.26**	.13	-.02	.04
15. Stereotype Threat during Test	1.38	0.56	-.08	-.14	-.32**	.42**	-.25**	.21*

Variable	7	8	9	10	11	12	13	14
1. Anticipated ACD								
2. Anticipated PS								
3. Sense of Belonging								
4. Entity Theory								
5. Incremental Theory								
6. Stereotype Threat in Class								
7. Highest Degree Intent								
8. Graduate Education Intent	.26**							
9. STEM Job Intent	-.10	.39**						
10. STEM Class Intent	.07	.11	.16					
11. Math Test: Number Correct	-.02	.16	.02	.15				
12. Math Test: Percent Correct	-.17	.03	.10	.12	.66**			
13. Performance-Avoid Goals during Test	.01	-.15	-.03	-.25**	-.23*	-.02		
14. Worry during Test	-.05	-.02	-.03	-.23*	-.32**	-.20*	.64**	
15. Stereotype Threat during Test	-.16	-.00	-.03	-.17	-.24*	-.20*	.11	.25**

$p < .05$*, $p < .01$**

Table 5: Means, Standard Deviations, and Intercorrelations among Mentor Post-Mentoring Variables

Variable	*M*	*SD*	1	2	3	4	5	6
1. Reported ACD	3.55	0.51						
2. Reported PS	4.03	0.49	.49**					
3. Sense of Belonging	4.12	0.52	.23*	.22*				
4. Entity Theory	1.90	0.79	-.02	-.10	-.46**			
5. Incremental Theory	4.04	0.71	.05	.18	.27**	-.73**		
6. Stereotype Threat in Class	2.07	0.74	.03	-.00	-.49**	.44**	-.34**	
7. Highest Degree Intent	3.45	0.76	.01	.05	.13	-.12	-.06	-.06
8. Graduate Education Intent	4.03	1.33	.13	-.06	-.13	.18	-.11	.13
9. STEM Job Intent	4.58	0.92	.02	-.10	-.01	.05	-.06	-.06
10. STEM Class Intent	4.69	0.64	-.18	-.08	.05	-.08	.06	-.04
11. Math Test: Number Correct	17.11	5.60	-.03	.10	-.05	.06	-.09	-.08
12. Math Test: Percent Correct	72.08	16.19	-.12	-.07	.13	-.04	-.06	-.17
13. Performance-Avoid Goals during Test	3.16	0.80	.03	.09	-.08	.03	.02	.11
14. Worry during Test	1.39	0.64	-.11	.01	-.37**	.12	-.01	.19
15. Stereotype Threat during Test	1.35	0.59	.06	-.01	-.42**	.27**	-.14	.41**
16. Coded ACD	34.07	19.25	.24*	-.05	-.07	-.04	.06	-.06
17. Coded PS	13.96	11.65	.10	.23*	.15	-.13	.14	-.08
18. Coded Self-Affirmation	1.06	3.04	-.02	.06	.09	-.21	.10	-.20
19. Coded External Attributions	2.67	3.37	-.01	.10	.14	-.14	.13	-.05
20. Coded Self-Theories	0.84	2.68	-.34**	.09	-.10	-.16	.21	-.16

Variable	7	8	9	10	11	12	13	14
1. Reported ACD								
2. Reported PS								
3. Sense of Belonging								
4. Entity Theory								
5. Incremental Theory								
6. Stereotype Threat in Class								
7. Highest Degree Intent								
8. Graduate Education Intent	.22*							
9. STEM Job Intent	-.04	.48**						
10. STEM Class Intent	-.03	.10	.25*					
11. Math Test: Number Correct	.00	-.12	-.09	-.01				
12. Math Test: Percent Correct	.04	-.23*	-.03	.10	.67**			
13. Performance-Avoid Goals during Test	-.19	-.15	-.12	-.09	-.15	-.04		
14. Worry during Test	-.23*	-.04	.01	-.02	-.11	-.18	.40**	
15. Stereotype Threat during Test	-.08	.09	.04	.15	-.16	-.24*	.13	.38**
16. Coded ACD	-.04	-.04	-.11	-.06	.10	.07	.10	-.06
17. Coded PS	.12	-.10	.14	-.15	.06	.00	-.08	.04
18. Coded Self-Affirmation	.05	-.28*	-.42**	-.08	.04	.10	.08	.16
19. Coded External Attributions	-.03	-.05	-.09	-.00	.14	.04	-.05	-.05
20. Coded Self-Theories	-.01	-.16	-.02	.04	.21	.17	.07	.16

Variable	15	16	17	18	19	12	13	14
1. Reported ACD								
2. Reported PS								
3. Sense of Belonging								
4. Entity Theory								
5. Incremental Theory								
6. Stereotype Threat in Class								
7. Highest Degree Intent								
8. Graduate Education Intent								
9. STEM Job Intent								
10. STEM Class Intent								
11. Math Test: Number Correct								
12. Math Test: Percent Correct								
13. Performance-Avoid Goals during Test								
14. Worry during Test								
15. Stereotype Threat during Test								
16. Coded ACD	.07							
17. Coded PS	.04	.03						
18. Coded Self-Affirmation	.05	.00	.00					
19. Coded External Attributions	-.16	-.07	-.06	-.06				
20. Coded Self-Theories	-.09	-.12	.11	.23*	-.05			

$p < .05^*$, $p < .01^{**}$

Protégé Results

Research Question 1

Research question 1 sought to determine if protégés' ratings of the career development provided by their mentor, as well as the frequency of career development provided by their mentor was related to protégés' feelings of stereotype threat. Bivariate correlation analyses revealed that protégés' post-mentoring ratings of the career development provided by their mentor was not correlated with protégés' post-mentoring feelings of stereotype threat in STEM classes ($r(132) = .00$, $p = .99$) or protégés' feelings of stereotype threat during the post-mentoring math test ($r(122) = -.01$, $p = .90$). Additional bivariate correlation analyses revealed that the frequency of career development comments by protégés' mentors was unrelated to protégés' post-mentoring feelings of stereotype threat in STEM classes ($r(128) = .07$, $p = .46$) or protégés' feelings of stereotype threat during the post-mentoring math test ($r(119) = .01$, $p = .91$). Based on these findings, it appears that receiving more career development was not related to feeling less stereotype threat.

Research Question 2

Research question 2 sought to determine if protégés' ratings of the psychosocial support provided by their mentor, as well as the frequency of psychosocial support provided by their mentor was related to protégés' feelings of stereotype threat. Bivariate correlation analyses revealed that protégés' post-mentoring ratings of the psychosocial support provided by their mentor was not correlated with protégés' post-mentoring feelings of stereotype threat in STEM classes ($r(132) = -.13$, $p = .15$) or protégés' feelings of stereotype threat during the post-mentoring math test ($r(122) = -.09$, $p = .31$). Similarly, the frequency of psychosocial support comments by protégés' mentors was unrelated to protégés' feelings of stereotype threat during the post-mentoring math test ($r(119) = -.10$, $p = .29$). However, the frequency of psychosocial support comments by protégés' mentors was negatively correlated with protégés' post-mentoring feelings of stereotype threat in STEM classes ($r(128) = -.19$, $p = .04$). Based on these findings, it appears that protégés' perception of the psychosocial support provided by their mentors was not related to feeling less stereotype threat. However, the more mentors provided psychosocial support, the less stereotype threat protégés felt in their STEM classes.

Hypothesis 1a

Hypothesis 1a stated that protégés in the stereotype threat reduction mentoring condition would endorse an incremental theory of intelligence more than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring incremental theory scores as a covariate. A significant main effect for type of mentoring was found ($F(2, 126) = 6.46$, $p < .01$, $\eta^2 = .09$; see Figure 3). Planned comparisons revealed that protégés in the academic control (M = 3.76, SD = 0.86) and non-academic control (M = 3.74, SD = 0.78) conditions did not differ from each other ($t(130) = -0.13$, $p = .90$, $d = .02$). However, protégés in the stereotype threat reduction (M = 4.18, SD = 0.63) condition endorsed incremental theories of intelligence more than protégés in the academic control ($t(130) = -2.80$, $p < .01$, $d = .56$) and non-academic control conditions ($t(130) = -2.54$, $p = .01$, $d = .62$). There was no main effect for gender match on protégés' post-mentoring incremental theories of intelligence ($F(1, 126) = 1.75$, $p = .19$, $\eta^2 = .01$, $d = .37$), as protégés paired with female mentors ($M = 4.01$, $SD = 0.71$) did not differ significantly from protégés paired with male mentors ($M = 3.71$, $SD = 0.90$). There was also no type of mentoring x gender match interaction on protégés' post-mentoring incremental theories of intelligence ($F(2, 126) = 1.66$, $p = .20$, $\eta^2 = .03$). In conclusion, hypothesis 1a was supported; protégés in the stereotype threat mentoring condition endorsed incremental theories of intelligence more after the mentoring intervention than protégés in the academic control and non-academic control conditions.

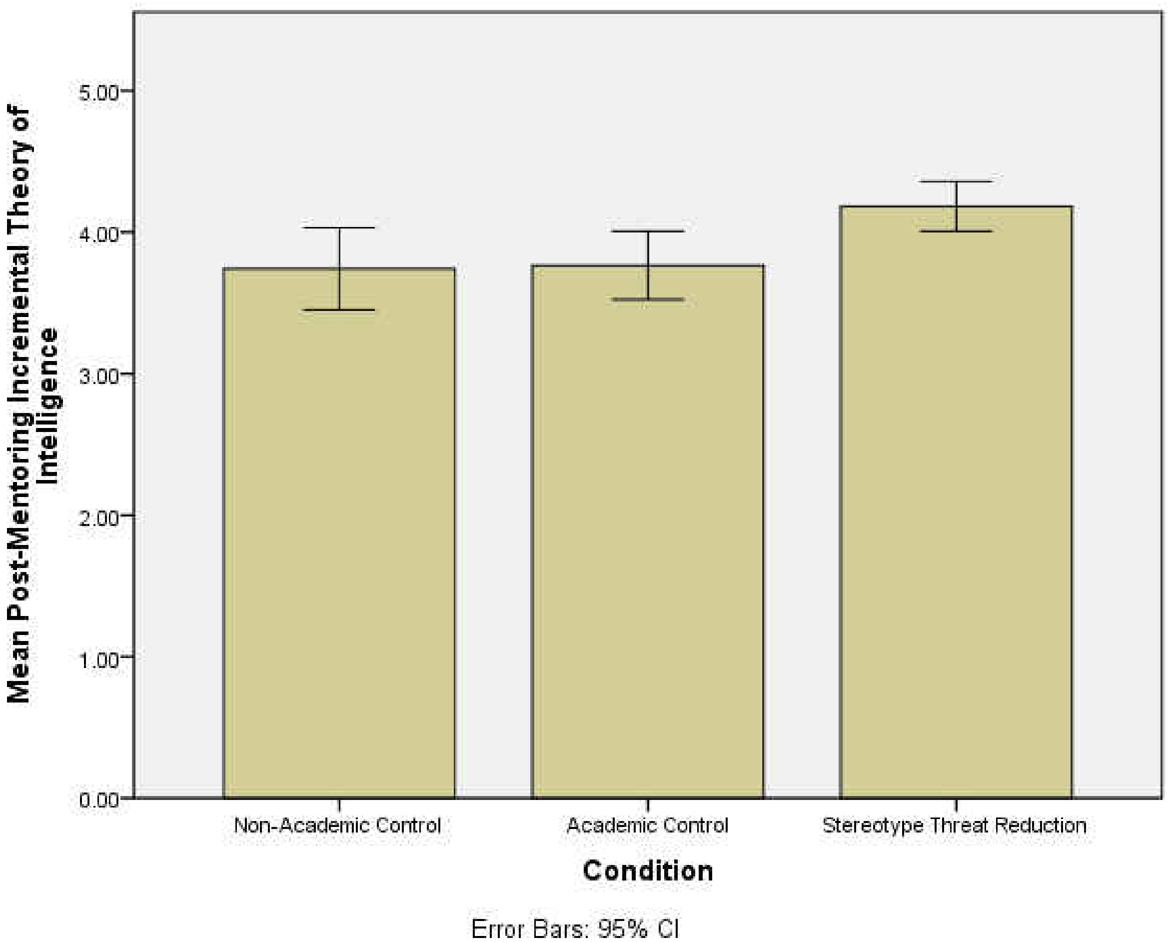


Figure 3: Protégés' Incremental Theory of Intelligence across Conditions

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring endorsements of incremental theories of intelligence was mediated by coded self-theories (see Figure 4). First, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of incremental theories of intelligence was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as predictors of post-mentoring endorsement of incremental theories of intelligence. Pre-mentoring endorsements of incremental theories of intelligence explained a significant amount of the variance in post-mentoring endorsements of incremental theories of intelligence in the first step of the regression analysis ($\beta = .71$, $t(126) = 10.13$, $p < .01$, $R^2 = .45$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of incremental theories of intelligence ($\beta = .33$, $t(125) = 3.27$, $p < .01$, $\Delta R^2 = .04$). The significant relationship between mentoring condition and post-mentoring endorsements of incremental theories of intelligence meets the first step in mediation evidence.

To meet the second step in mediation evidence, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of incremental theories of intelligence was entered in the first step, followed by coded self-theories entered in the second step as predictors of post-mentoring endorsement of incremental theories of intelligence. The inclusion of coded self-theories in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of incremental theories of intelligence ($\beta = .08$, $t(125) = 4.69$, $p < .01$, $\Delta R^2 = .08$). The significant relationship between coded self-theories and post-mentoring endorsements of incremental theories of intelligence meets the second step in mediation evidence.

To meet the third step in mediation evidence, a regression analysis was carried out in which the dummy-coded condition variable was entered as a predictor of coded self-theories. The stereotype threat reduction mentoring condition explained a significant amount of the variance in coded self-theories ($\beta = 2.12$, $t(129) = 4.52$, $p < .01$, $R^2 = .14$). The significant relationship between mentoring condition and coded self-theories meets the third step in mediation evidence.

To meet the last step for mediation, the dummy-coded condition variable and coded self-theories were simultaneously entered into a regression analysis as predictors of post-mentoring endorsements of incremental theories of intelligence. Both the dummy-coded condition variable ($\beta = .18$, $t(124) = 1.71$, $p < .05$) and coded self-theories ($\beta = .07$, $t(124) = 3.68$, $p < .01$) remained significant predictors of post-mentoring endorsements of incremental theories of intelligence. Although, the stereotype threat reduction condition remained a significant predictor of post-mentoring endorsements of incremental theories of intelligence, the decline in its beta suggests that self-theories discussions partially mediates the effects of the stereotype threat reduction condition on increased endorsement of incremental theories of intelligence.

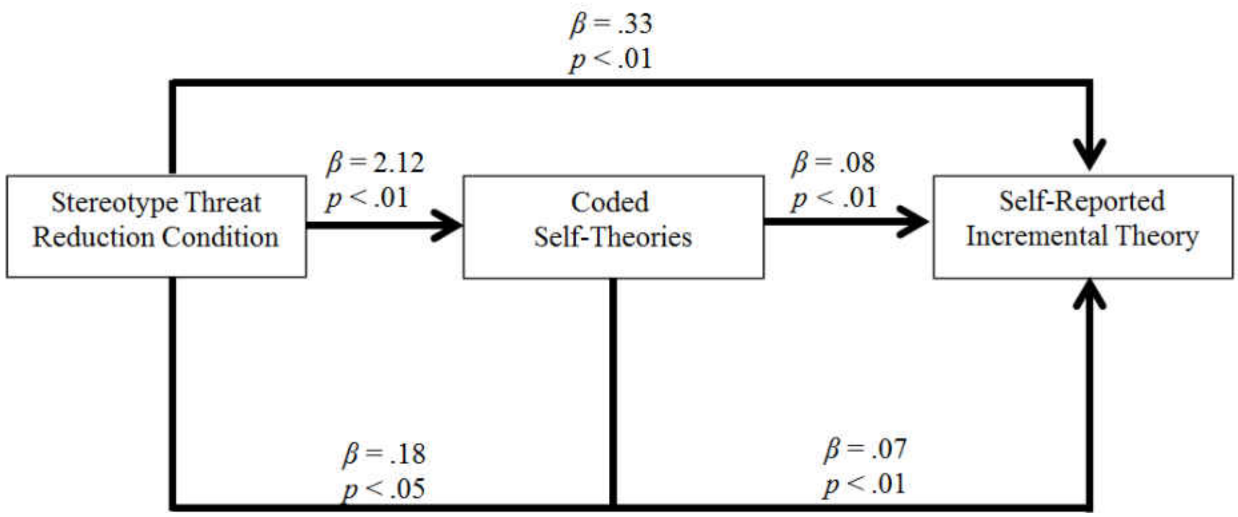


Figure 4: Protégé Incremental Theory Mediation Analysis

Hypothesis 1b

Hypothesis 1b stated that protégés in the stereotype threat reduction mentoring condition would endorse an entity of intelligence less than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring entity theory scores as a covariate. A significant main effect was found for type of mentoring ($F(2, 126) = 7.27$, $p < .01$, $\eta^2 = .10$; see Figure 5). Planned comparisons revealed that protégés in the academic control ($M = 2.42$, $SD = 1.03$) and non-academic control ($M = 2.50$, $SD = 0.92$) conditions did not differ from each other ($t(130) = 0.40$, $p = .69$, $d = .08$). However, protégés in the stereotype threat reduction ($M = 1.87$, $SD = 0.62$) condition endorsed entity theories of intelligence less than protégés in the academic control ($t(130) = 3.24$, $p < .01$, $d = .65$) and non-academic control conditions ($t(130) = 3.18$, $p < .01$, $d = .80$). There was no main effect for gender match on protégés' post-mentoring entity theories of intelligence ($F(1, 126) = 0.01$, $p = .91$, $\eta^2 = .00$, $d = .13$), as protégés paired with female mentors ($M = 2.19$, $SD = 0.90$) did not differ significantly from protégés paired with male mentors ($M = 2.31$, $SD = 0.92$). There was also no type of mentoring x gender match interaction on protégés' post-mentoring entity theories of intelligence ($F(2, 126) = 0.10$, $p = .90$, $\eta^2 = .00$). In conclusion, hypothesis 1b was supported; protégés in the stereotype threat mentoring condition endorsed entity theories of intelligence less after the mentoring intervention than protégés in the academic control and non-academic control conditions.

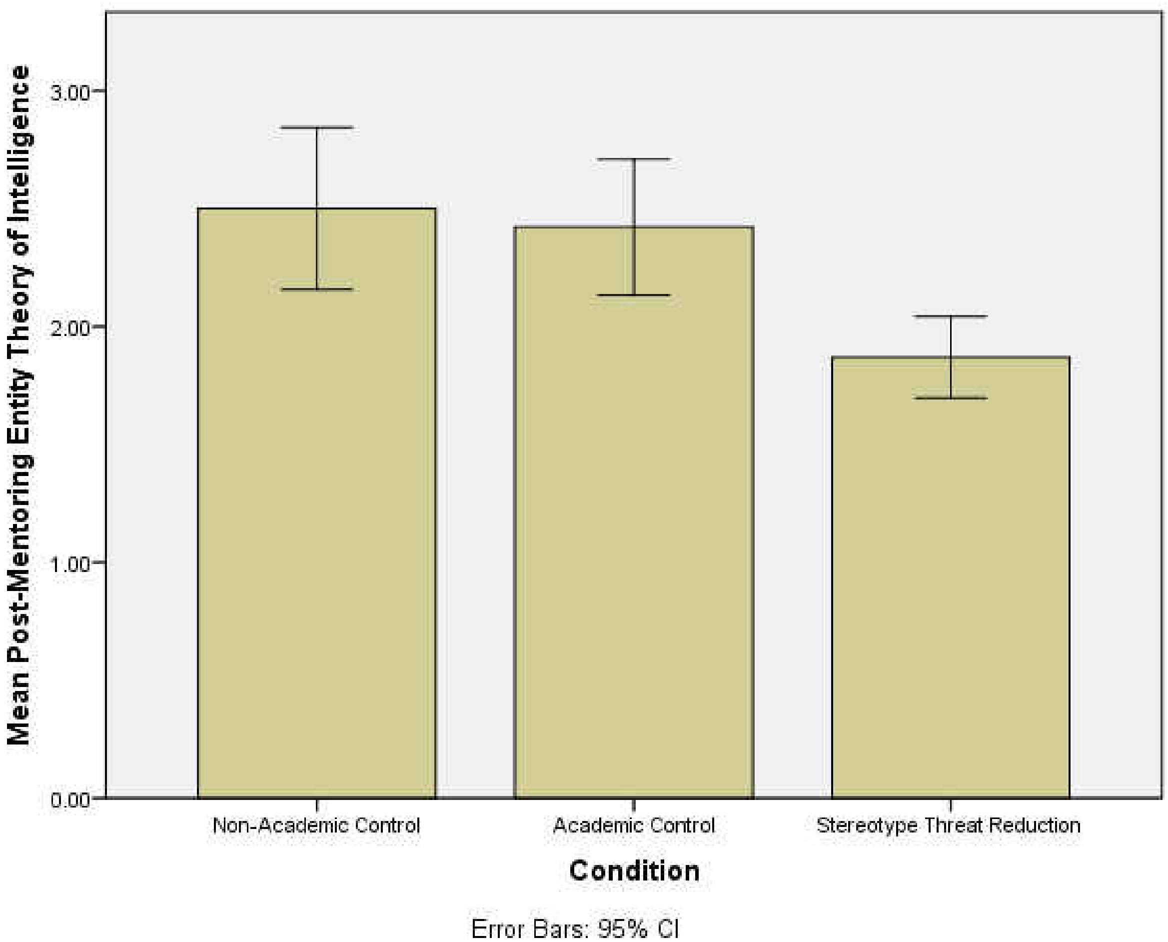


Figure 5: Protégés' Entity Theory of Intelligence across Conditions

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring endorsements of entity theories of intelligence was mediated by coded self-theories (see Figure 6). First, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of entity theories of intelligence was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as predictors of post-mentoring endorsement of entity theories of intelligence. Pre-mentoring endorsements of entity theories of intelligence explained a significant amount of the variance in post-mentoring endorsements of entity theories of intelligence in the first step of the regression analysis ($\beta = .71$, $t(126) = 8.61$, $p < .01$, $R^2 = .37$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of entity theories of intelligence ($\beta = -.51$, $t(125) = -4.09$, $p < .01$, $\Delta R^2 = .07$). The significant relationship between mentoring condition and post-mentoring endorsements of entity theories of intelligence meets the first step in mediation evidence.

To meet the second step in mediation evidence, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of entity theories of intelligence was entered in the first step, followed by coded self-theories entered in the second step as predictors of post-mentoring endorsement of entity theories of intelligence. The inclusion of coded self-theories in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of entity theories of intelligence ($\beta = -.08$, $t(125) = -3.53$, $p < .01$, $\Delta R^2 = .06$). The significant relationship between coded self-theories and post-mentoring endorsements of entity theories of intelligence meets the second step in mediation evidence.

To meet the third step in mediation evidence, a regression analysis was carried out in which the dummy-coded condition variable was entered as a predictor of coded self-theories. The stereotype threat reduction mentoring condition explained a significant amount of the variance in coded self-theories ($\beta = 2.12$, $t(129) = 4.52$, $p < .01$, $R^2 = .14$). The significant relationship between mentoring condition and coded self-theories meets the third step in mediation evidence.

To meet the last step for mediation, the dummy-coded condition variable and coded self-theories were simultaneously entered into a regression analysis as predictors of post-mentoring endorsements of entity theories of intelligence. Both the dummy-coded condition variable ($\beta = -.39$, $t(124) = -2.98$, $p < .01$) and coded self-theories ($\beta = -.05$, $t(124) = -2.20$, $p = .03$) remained significant predictors of post-mentoring endorsements of entity theories of intelligence. Although, the stereotype threat reduction condition remained a significant predictor of post-mentoring endorsements of entity theories of intelligence, the decline in its beta suggests that self-theories discussions partially mediates the effects of the stereotype threat reduction condition on decreased endorsement of entity theories of intelligence.

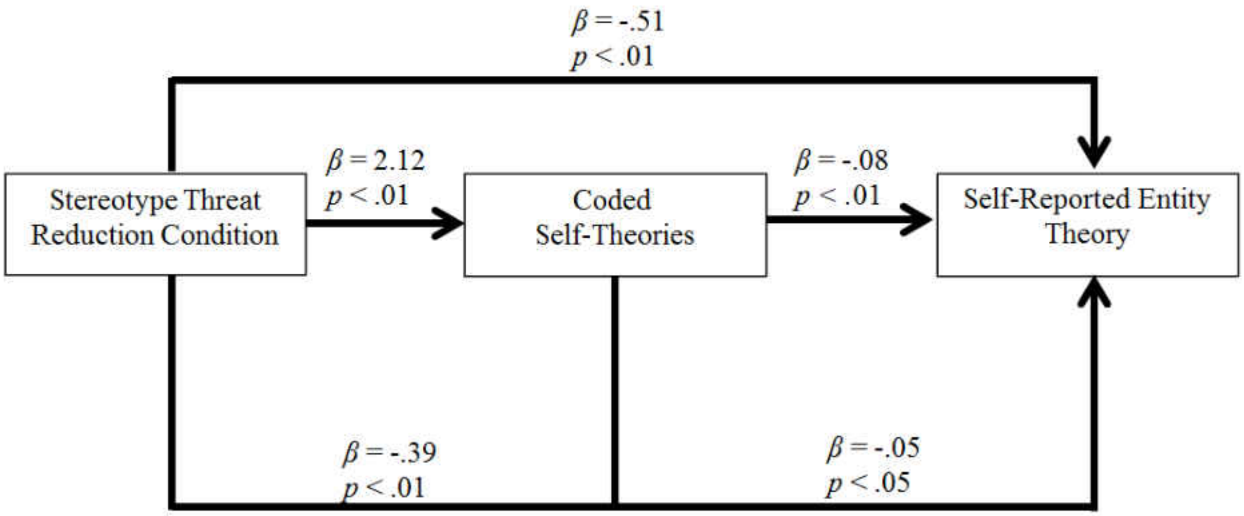


Figure 6: Protégé Entity Theory Mediation Analysis

Hypothesis 2a

Hypothesis 2a stated that protégés in the stereotype threat reduction mentoring condition were expected to report experiencing less stereotype threat in their STEM classes than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring stereotype threat in STEM classes scores as a covariate. A significant main effect for type of mentoring was found (F(2, 126) = 7.73, $p < .01$, $\eta^2 = .11$; see Figure 7). Planned comparisons revealed that protégés in the academic control ($M = 2.19$, $SD = 0.54$) and non-academic control ($M = 2.29$, $SD = 0.64$) conditions did not differ from each other (t(130) = 0.64, $p = .52$, $d = .17$). However, protégés in the stereotype threat reduction ($M = 1.95$, $SD = 0.80$) condition reported experiencing less stereotype threat in their classes than protégés in the non-academic control (t(130) = 2.19, $p = .03$, $d = .47$). Although in the expected direction, protégés in stereotype threat reduction condition did not significantly differ from protégés in the academic-control condition in the amount of stereotype threat they felt in their STEM classes ($t(130) = 1.80$, $p = .08$, $d = .35$). There was no significant main effect for gender match ($F(1, 126) = 0.15$, $p = .70$, $\eta^2 = .00$, $d = .13$) as protégés matched with female mentors ($M = 2.09$, $SD = 0.69$) did not report experiencing less stereotype threat than protégés matched with male mentors ($M = 2.18$, $SD = 0.68$). In conclusion, hypothesis 2a was supported; protégés in the stereotype threat mentoring condition reporting experiencing less stereotype threat in their STEM classes after the mentoring intervention than protégés in the academic control and non-academic control conditions.

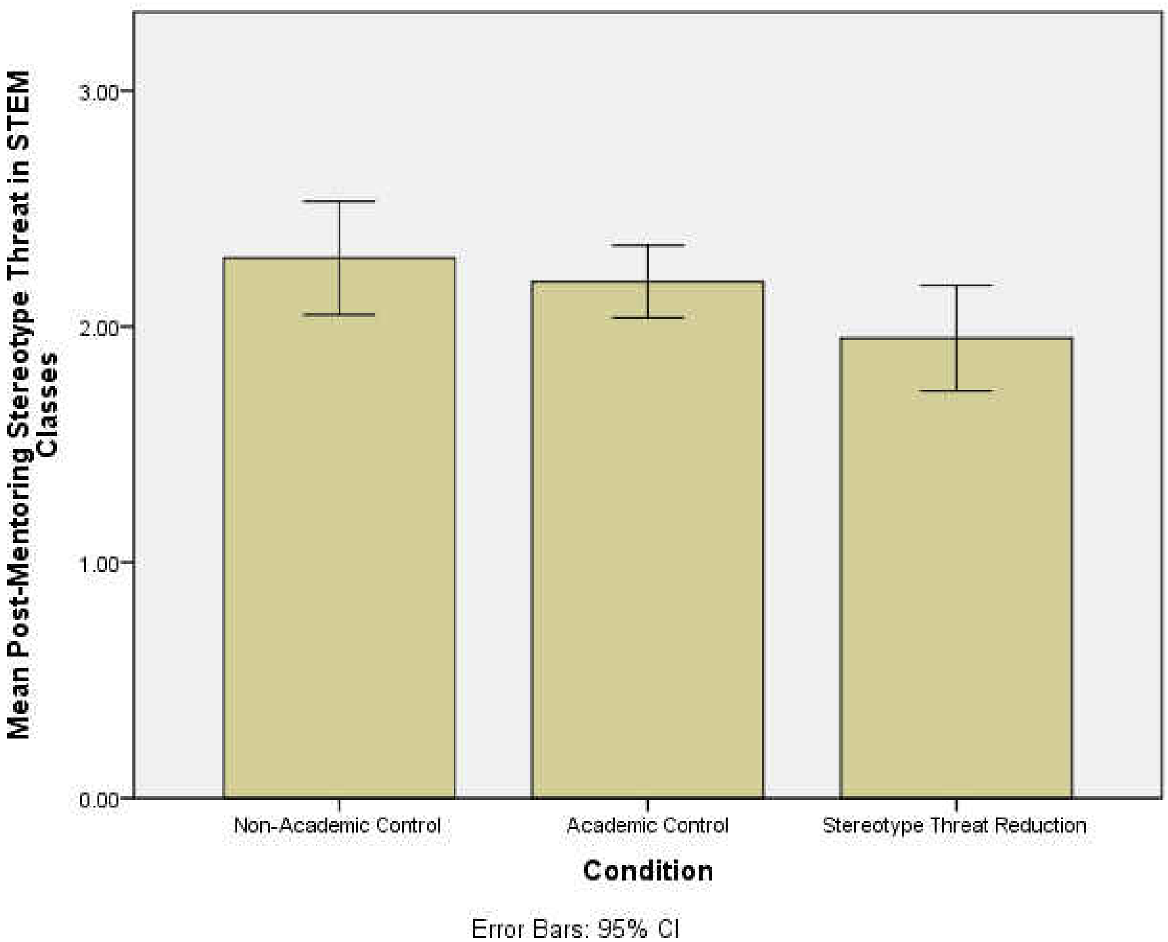


Figure 7: Protégés' Stereotype Threat in STEM Classes across Conditions

Hypothesis 2b

Hypothesis 2b proposed a type of mentoring x gender match interaction such that mentor gender was expected to have no effect on protégés' reported stereotype threat in STEM classes in the stereotype threat reduction mentoring condition, whereas protégés paired with female mentors in the academic control and non-academic control conditions were expected to report experiencing less stereotype threat in their STEM classes than protégés paired with male mentors in the academic control and non-academic control conditions. Results indicated no support for hypothesis 2b as no significant type of mentoring x gender match interaction was found ($F(2, 126) = 0.91$, $p = .41$, $\eta^2 = .01$).

To determine which component of the stereotype threat reduction program contributed the most to reducing feelings of stereotype threat in STEM classes, a hierarchical regression analysis was carried out with pre-mentoring feelings of stereotype threat in STEM classes entered in the first step, and coded self-affirmation, misattributions, and self-theories entered in the second step. Pre-mentoring feelings of stereotype threat in STEM classes explained a significant amount of the variance in post-mentoring feelings of stereotype threat in STEM classes in the first step of the regression analysis ($\beta = .72$, $t(126) = 9.68$, $p < .01$, $R^2 = .43$). The inclusion of coded self-affirmation, misattributions, and self-theories in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring feelings of stereotype threat in STEM classes ($\Delta R^2 = .08$, $p < .01$). Coded self-theories ($\beta = -.06$, $t(123) = -3.81$, $p < .01$) emerged as a unique predictor of post-mentoring feelings of stereotype threat in STEM classes, whereas coded self-affirmations ($\beta = -.02$, $t(123) = -1.29$, $p = .20$) and coded misattributions ($\beta = .02$, $t(123) = 1.74$, $p = .08$) did not account for unique variance in post-mentoring feelings of stereotype threat in STEM classes. Based on these findings, it appears to discussing self-theories is the key intervention component contributing to stereotype threat reduction.

Given that the amount of psychosocial support provided by mentors was found to be negatively correlated with protégés' feelings of stereotype threat in STEM classes, coded psychosocial support was added in a third step to the regression analysis discussed above to determine if the frequency of psychosocial support accounted for unique variance in stereotype threat reduction beyond that of self-affirmation, misattributions, and self-theories. The inclusion of coded psychosocial support in the third step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring feelings of stereotype threat in STEM classes (β = -.01, $t(122) = 2.21$, $p = .03$, $\Delta R^2 = .02$). Based on these findings, it appears to receiving more psychosocial support reduces feelings of stereotype threat in STEM classes.

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring feelings of stereotype threat in STEM classes was mediated by coded self-affirmation, misattributions, and self-theories. First, a hierarchical regression analysis was carried out in which pre-mentoring feelings of stereotype threat in STEM classes was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as a predictor of post-mentoring feelings of stereotype threat in STEM classes. Pre-mentoring feelings of stereotype threat in STEM classes explained a significant amount of the variance in post-mentoring feelings of stereotype threat in STEM classes in the first step of the regression analysis (β = .72, $t(126) = 9.68$, $p < .01$, $R^2 = .43$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring feelings of stereotype threat in STEM classes (β = -.41, t(125) = -4.60, p < .01, ΔR^2 = .08). The significant relationship between condition and post-mentoring feelings of stereotype threat in STEM classes meets the first step in mediation evidence. The second step for mediation was met in the previously reported regression analysis in which coded self-affirmation, misattributions, and self-theories were entered as predictors of post-mentoring feelings of stereotype threat in STEM classes, with coded self-theories emerging as the only predictor accounting for unique variance in post-mentoring feelings of stereotype threat in STEM classes. The third step for mediation was met in the previously reported regression analysis in which the dummy-coded condition variable was entered as a predictor of coded self-theories. To meet the last step for mediation, the dummy-coded condition variable and coded self-theories were simultaneously entered into a regression analysis as predictors of post-mentoring feelings of stereotype threat in STEM classes. Both the dummy-coded condition variable (β = -.32, t(124) = -3.47, p < .01) and coded self-theories (β = -.04, t(124) = -2.59, p = .01) remained significant predictors of post-mentoring feelings of stereotype threat. Although, the stereotype threat reduction condition remained a significant predictor of post-mentoring feelings of stereotype threat, the decline in its beta suggests that self-theories discussions partially mediates the effects of the stereotype threat mentoring condition on stereotype threat reduction (see Figure 8).

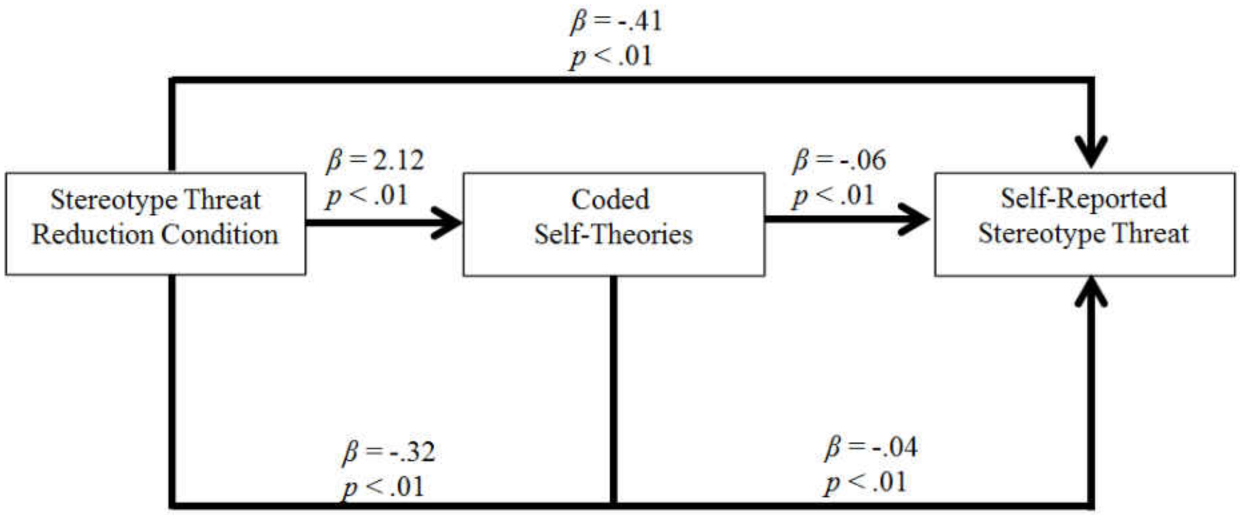


Figure 8: Protégé Stereotype Threat in STEM Classes Mediation Analysis

Hypothesis 3

The lack of variability in protégés' intentions to remain in STEM *prior* to mentoring may have limited the ability of the present study to detect differences between conditions. Results for highest intended degree on a 4-point scale (i.e., 1 = associates, 2 = bachelors, 3 = masters, 4 = doctoral degree) revealed that the majority of protégés intended to obtain a master's degree or above (M = 3.36, SD = 0.76). In terms of degree breakdown, 1 protégé sough an associate's degree, 19 sought a bachelor's degree, 40 sought a master's degree, and 66 sought a doctoral degree. Similarly, the majority of protégé intended to pursue graduate education (M = 4.27, SD = 1.03), with 57.78% responding with a 5 (*very likely*) on the 5-point Likert scale. Additionally, the majority of protégés intended to pursue a professional job in a STEM field (M = 4.72, SD = 0.58), with 77.61% responding with a 5 (*very likely*) on the 5-point Likert scale. Lastly, the majority of protégés intended to take future STEM courses (M = 4.09, SD = 1.06), with 48.89% responding with a 5 (*very likely*) on the 5-point Likert scale.

The lack of variability in protégés' intentions to remain in STEM *after* receiving mentoring may have also limited the ability of the present study to detect differences between conditions. Results for highest intended degree revealed that the majority of protégés intended to obtain a master's degree or above ($M = 3.26$, $SD = 0.80$). In terms of degree breakdown, 1 protégé sought an associate's degree, 25 sought a bachelor's degree, 42 sought a master's degree, and 60 sought a doctoral degree. Similarly, the majority of protégé intended to pursue graduate education ($M = 4.38$, $SD = 1.02$), with 66.17% responding with a 5 (*very likely*) on the 5-point Likert scale. Additionally, the majority of protégés intended to pursue a professional job in a STEM field ($M = 4.76$, $SD = 0.66$), with 84.09% responding with a 5 (*very likely*) on the 5-point Likert scale. Lastly, the majority of protégés intended to take future STEM courses ($M = 4.41$, $SD = 0.85$), with 62.41% responding with a 5 (*very likely*) on the 5-point Likert scale.

The lack of variability in protégés' intention to remain in STEM measures likely prevented the present study from finding significant effects for hypothesis 3. Hypotheses 3a and 3b were tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with pre-mentoring intentions scores used as a covariate. There were no significant main effect for type of mentoring or gender match, as well as no significant interaction between type of mentoring and gender match, for any of the intention outcomes. Refer to Table 6 for the main effect and interaction ANCOVAs for hypothesis 3.

Table 6: Analysis of Covariance for Protégés' STEM Intentions

	df	*F*	*p*	η^2
Type of Mentoring (TM) → Highest Degree Desired	2	0.57	.57	.01
Gender Match (GM) → Highest Degree Desired	1	0.50	.48	.00
TM x GM → Highest Degree Desired	2	0.99	.38	.02
Error	114			
Type of Mentoring (TM) → Intent to Obtain Graduate Education	2	1.12	.33	.02
Gender Match (GM) → Intent to Obtain Graduate Education	1	0.68	.41	.01
TM x GM → Intent to Obtain Graduate Education	2	0.82	.44	.01
Error	124			
Type of Mentoring (TM) → Intent to Obtain a STEM Job	2	1.43	.24	.02
Gender Match (GM) → Intent to Obtain a STEM Job	1	0.18	.67	.00
TM x GM → Intent to Obtain a STEM Job	2	0.11	.90	.00
Error	122			
Type of Mentoring (TM) → Intent to Take STEM Classes	2	0.47	.63	.01
Gender Match (GM) → Intent to Take STEM Classes	1	1.01	.32	.01
TM x GM → Intent to Take STEM Classes	2	0.41	.66	.01
Error	124			

Hypothesis 4

Hypothesis 4 stated that sense of belonging would mediate the effects of stereotype threat on intentions such that higher stereotype threat was expected to predict lower sense of belonging, which was expected to predict lower intentions to remain in STEM. Initial support for the relationship between sense of belonging and stereotype threat can be found in the significant negative correlation between post-mentoring sense of belonging and post-mentoring stereotype threat in STEM classes ($r(133) = -.29$, $p < .01$). To determine if sense of belonging mediates the effects of stereotype threat on intentions to remain in STEM, Baron and Kenny's (1986) mediation technique was utilized. First, a hierarchical regression analysis was carried out in which post-mentoring sense of belonging was entered as the dependent variable, and pre-mentoring sense of belonging was entered as the predictor in the first step, followed by post-mentoring feelings of stereotype threat in STEM classes in the second step. Pre-mentoring sense of belonging was entered in the first step to determine if post-mentoring feelings of stereotype threat in STEM classes uniquely predicts post-mentoring feelings of sense of belonging. As expected, pre-mentoring sense of belonging was a significant predictor of post-mentoring sense of belonging in the first step (β = .47, $t(129) = 5.88$, $p < .01$). Pre-mentoring sense of belonging remained a significant predictor of post-mentoring sense of belonging in the second step (β = .44, $t(128) = 5.71$, $p < .01$). However, post-mentoring stereotype threat in STEM classes was also a significant predictor of post-mentoring sense of belonging in the second step (β = -.19, $t(128) = -3.13$, $p < .01$).

For the next step, post-mentoring feelings of stereotype threat in STEM classes was entered as a predictor of post-mentoring intentions to remain in STEM, after pre-mentoring intentions to remain in STEM were entered first as control variables. Because the four intention items (i.e., highest intended degree, likelihood of pursuing STEM graduate education, likelihood of obtaining a professional STEM job, and likelihood of taking STEM classes in the future) were not highly correlated with each other, separate regression analyses were carried out for each intention outcome. Results indicated that post-mentoring feelings of stereotype threat in STEM classes did not significantly predict any of the intention outcomes (see Table 7). Thus, hypothesis 4 remains unsupported as no evidence was obtained for sense of belonging mediating of the effects of stereotype threat on intentions.

Table 7: Mediation Analysis for Protégés' STEM Intentions

Post-Mentoring Stereotype Threat → Post-Mentoring Intentions to Remain in STEM	*B*	*t*	*df*	*p*	R^2
DV: Highest Degree Desired					
Step 1					.47
Pre-Mentoring Highest Degree Desired	.72	10.34	119	.00	
Step 2					.48
Pre-Mentoring Highest Degree Desired	.74	10.44	118	.00	
Post-Mentoring Stereotype Threat	.10	1.32	118	.19	
DV: Graduate Education Intent					
Step 1					.42
Pre-Mentoring Graduate Education Intent	.64	9.73	129	.00	
Step 2					.42
Pre-Mentoring Graduate Education Intent	.64	9.66	128	.00	
Post-Mentoring Stereotype Threat	.00	0.04	128	.97	
DV: Intent to Obtain STEM Job					
Step 1					.48
Pre-Mentoring Intent to Obtain STEM Job	.79	10.89	127	.00	
Step 2					.49
Pre-Mentoring Intent to Obtain STEM Job	.80	10.92	126	.00	
Post-Mentoring Stereotype Threat	.06	0.96	126	.34	
DV: Intent to Take STEM Classes					
Step 1					.28
Pre-Mentoring Intent to Take STEM Classes	.43	7.11	129	.00	
Step 2					.28
Pre-Mentoring Intent to Take STEM Classes	.43	7.08	128	.00	
Post-Mentoring Stereotype Threat	-.01	-.11	128	.91	

Hypothesis 5a

Hypothesis 5a stated that protégés in the stereotype threat mentoring condition were expected to experience less stereotype threat while taking a standardized math test than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a

3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring stereotype threat on the math test scores as a covariate. There was no significant main effect for type of mentoring ($F(2, 116) = 0.49$, $p = .62$, $\eta^2 = .01$), as protégés in the stereotype threat reduction ($M = 1.56$, $SD = 0.83$) condition did not report experiencing less stereotype threat during the math test than protégés in the academic control ($M = 1.33$, $SD = 0.59$) and the non-academic control ($M = 1.32$, $SD = 0.56$) conditions. There was also no significant main effect for gender match ($F(1, 116) = 0.65$, $p = .42$, $\eta^2 = .01$, $d = .04$), as protégés paired with female mentors ($M = 1.41$, $SD = .70$) did not report experiencing less stereotype threat during the math test than protégés paired with male mentors ($M = 1.44$, $SD = .69$). Results indicated no support for hypothesis 5a; protégés in the stereotype threat reduction condition did not report experiencing less stereotype threat than protégés in the academic control and non-academic control conditions.

Hypothesis 5b

Hypothesis 5b proposed a type of mentoring x gender match interaction such that protégés paired with female mentors were expected to report experiencing less stereotype threat while taking the math test than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender was expected to have no effect on protégés' feelings of stereotype threat during the math test in the stereotype threat reduction mentoring condition. Hypothesis 5b was not supported as there was no type of mentoring x gender match interaction on protégés' feelings of stereotype threat during the math test ($F(2, 116) = 0.99$, $p = .38$, $\eta^2 = .02$).

Hypothesis 6a

Hypothesis 6a stated that protégés in the stereotype threat mentoring condition would perform better on a standardized math test than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring math test scores as a covariate. There was no significant main effect for type of mentoring ($F(2, 124) = 0.18$, $p = .84$, $\eta^2 = .00$), as protégés in the stereotype threat reduction ($M = 15.12$, $SD = 4.93$) condition did not answer more math questions correctly than protégés in the academic control ($M = 14.92$, $SD = 4.78$) and the non-academic control ($M = 14.72$, $SD = 4.53$) conditions. Similarly, protégés in the stereotype threat reduction ($M = 66.74$, $SD = 16.71$) condition did not answer a higher percentage of math questions correctly than protégés in the academic control ($M = 66.93$, $SD = 15.15$) and the non-academic control ($M = 71.79$, $SD = 12.68$) conditions ($F(2, 124) = 0.55$, $p = .58$, $\eta^2 = .01$). There was also no main effect for gender match ($F(1, 124) = 0.39$, $p = .53$, $\eta^2 = .00$, $d = .12$), as protégés paired with female mentors ($M = 14.77$, $SD = 4.48$) did not answer more math questions correctly than protégés paired with male mentors ($M = 15.39$, $SD = 5.41$). Similarly, protégés paired with female mentors ($M = 67.64$, $SD = 15.56$) did not answer a higher percentage of questions correctly compared to protégés paired with male mentors ($M = 68.65$, $SD = 14.93$; $F(1, 124) = .00$, $p = .96$, $\eta^2 = .00$, $d = .07$). Results indicated no support for hypothesis 6a; protégés in the stereotype threat reduction condition did not perform better on the math test than protégés in the academic control and non-academic control conditions.

Hypothesis 6b

Hypothesis 6b stated that protégés with female mentors would perform better on a standardized math test than protégés with male mentors in the academic control and non-academic control conditions, whereas mentor gender would have no effect on protégés' performance on a standardized math test in the stereotype threat mentoring condition. No support was found for hypothesis 6b as the type of mentoring x gender match interaction on protégés' math test performance was not significant for total correct ($F(2, 124) = 1.61$, $p = .20$, $\eta^2 = .03$) and percentage correct ($F(2, 124) = 0.16$, $p = .85$, $\eta^2 = .00$).

Hypothesis 7a

Hypothesis 7a stated that protégés in the stereotype threat mentoring condition would report less performance-avoidance goals during the math test than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring performance-avoidance goal scores during the math test as a covariate. There was no significant main effect for type of mentoring ($F(2, 116) = 1.00$, $p = .37$, $\eta^2 = .02$), as protégés in the stereotype threat reduction ($M = 3.41$, $SD = 0.81$) condition did not report less performance-avoidance goals during the math test than protégés in the academic control ($M = 3.43$, $SD = 0.78$) and the non-academic control ($M = 3.48$, $SD = 0.52$) conditions. There was also no significant main effect for gender match ($F(1, 116) = 0.31$, $p = .58$, $\eta^2 = .00$, $d = .28$), as protégés paired with female mentors ($M = 3.49$, $SD = 0.76$) did not report less performance-avoidance goals than protégés paired with male mentors ($M = 3.29$, $SD = 0.67$). There was also no type of mentoring x gender match interaction on protégés' performance-avoidance goals during the math test ($F(2, 116) = 0.08$, $p = .92$, $\eta^2 = .00$). Results indicated no support for hypothesis 7a; protégés in the stereotype threat mentoring condition did not report less performance-avoidance goals during the math test compared to protégés in the academic control and non-academic control conditions.

Hypothesis 7b

Hypothesis 7b stated that protégés in the stereotype threat mentoring condition would report less worry during the math test than protégés in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender Match: Female or Male Mentor) ANCOVA with protégés' pre-mentoring worry during the math test as a covariate. There was no significant main effect for type of mentoring ($F(2, 116) = 0.36$, $p = .70$, $\eta^2 = .01$), as protégés in the stereotype threat reduction ($M = 1.46$, $SD = 0.54$) condition did not report less worry during the math test than protégés in the academic control ($M = 1.47$, $SD = 0.59$) and the non-academic control ($M = 1.32$, $SD = 0.58$) conditions. There was also no significant main effect for gender match ($F(1, 116) = 3.48$, $p = .07$, $\eta^2 = .03$, $d = .14$), as protégés paired with female mentors ($M = 1.41$, $SD = 0.55$) did not report less worry during the math test than protégés paired with male mentors ($M = 1.49$, $SD = 0.61$) in the amount of worry experienced during the math test. There was also no type of mentoring x gender match interaction on protégés' worry during the math test ($F(2, 116) = 2.55$, $p = .08$, $\eta^2 = .04$). Results indicated no support for hypothesis 7b; protégés in the stereotype threat mentoring condition did not report less worry during the math test than protégés in the academic control and non-academic control conditions.

Hypothesis 7c

Hypothesis 7c stated that performance-avoidance goals and worry would mediate the effects of stereotype threat on performance such that higher stereotype threat was expected to predict higher performance-avoidance goals, which was expected to predict higher worry, which was expected to predict lower performance. Although the type of mentoring and the gender of their mentor did not affect protégés' performance-avoidance goals and worry during the math test, performance-avoidance goals and worry may still mediate the effects of stereotype threat on math test performance across conditions. A regression analysis was carried out following the Baron and Kenny's (1986) guidelines. First, a regression analysis was carried out in which feelings of stereotype threat during the post-mentoring math test was entered as a predictor of performance-avoidance goals during the post-mentoring math test. There was no evidence of a relationship between stereotype threat and performance-avoidance goals ($\beta = .14$, $t(122) = 1.49$, $p = .14$).

Although there is no evidence of performance-avoidance goals being a mediator of stereotype threat, worry may still mediate the effects of performance-avoidance goals on math test performance. To test this possibility, a regression analysis was carried out in which performance-avoidance goals during the post-mentoring math test was entered as a predictor of worry during the post-mentoring math test. A significant relationship was found between performance-avoidance goals during the post-mentoring math test and worry during the post-mentoring math test (β = .26, $t(122) = 3.92$, $p < .01$). Next the relationship between performance-avoidance goals during the post-mentoring math test and performance on the post-mentoring math test was examined. No relationship was found between performance-avoidance goals and math test performance (β = -.78, $t(122) = -1.34$, $p = .18$).

It may also be the case that worry mediates the effects of stereotype threat on performance directly. To test this possibility, a regression analysis was carried out in which stereotype threat during the post-mentoring math test was entered as a predictor of worry during the post-mentoring math test. A significant relationship was found between stereotype threat during the post-mentoring math test and worry during the post-mentoring math test (β = .22, $t(122) = 3.09$, $p < .01$). Next the relationship between stereotype threat during the post-mentoring math test and performance on the post-mentoring math test was examined. No relationship was found between stereotype threat during testing and math test performance (β = .17, $t(122) = 0.27$, $p = .79$).

Although performance-avoidance goals during the post-mentoring math test predicted worry during the post-mentoring math test and stereotype threat during the post-mentoring math test predicted worry during the post-mentoring math test, stereotype threat during the post-mentoring math test did not predict performance-avoidance goals during the post-mentoring math test, performance-avoidance goals during the post-mentoring math test did not predict math test performance, and stereotype threat during the post-mentoring math test did not predict math test performance. Thus, there was no evidence of a mediation chain in which higher stereotype threat resulted in higher performance-avoidance goals, which resulted in higher worry, which undermined performance on the math test. Figure 9 summarizes the math test mediation analyses. Taken together, these findings indicate that hypothesis 7c was not supported.

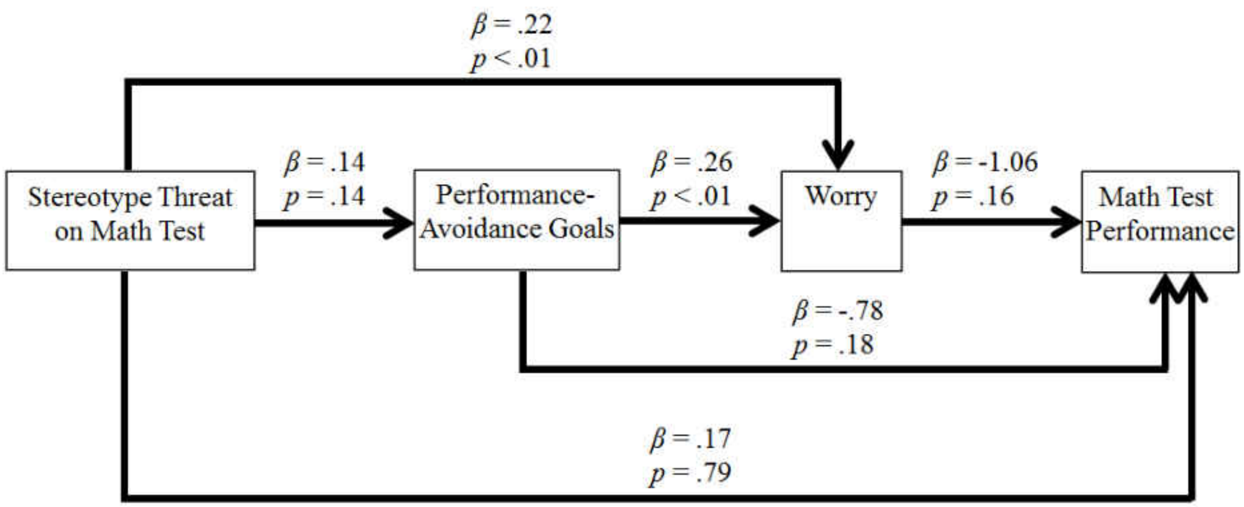


Figure 9: Protégé Math Test Mediation Analyses

Mentor Results

Research Question 1

Research question 1 sought to determine if mentors' ratings of the career development they provided, as well as the frequency of career development comments they made was related to their feelings of stereotype threat. Bivariate correlation analyses revealed that mentors' post-mentoring ratings of career development they provided was not correlated with mentors' post-mentoring feelings of stereotype threat in STEM classes ($r(100) = .03$, $p = .76$) or mentors' feelings of stereotype threat during the post-mentoring math test ($r(96) = .06$, $p = .53$). Similarly, the number of career development comments made by mentors was not correlated with mentors' post-mentoring feelings of stereotype threat in STEM classes ($r(76) = -.06$, $p = .63$) or mentors' feelings of stereotype threat during the post-mentoring math test ($r(78) = .07$, $p = .57$). Based on these findings, it appears that providing more career development was not related to feeling less stereotype threat.

Research Question 2

Research question 2 sought to determine if mentors' ratings of the psychosocial support they provided, as well as the frequency of psychosocial support comments they made was related to their feelings of stereotype threat. A bivariate correlation analysis revealed that mentors' post-mentoring ratings of the psychosocial support provided was not correlated with mentors' post-mentoring feelings of stereotype threat in STEM classes ($r(100) = -.00$, $p =.99$) or mentors' feelings of stereotype threat during the post-mentoring math test ($r(96) = -.01$, $p = .92$). Similarly, the number of psychosocial support comments made by mentors was not correlated with mentors' post-mentoring feelings of stereotype threat in STEM classes ($r(76) = -.08$, $p =.49$) or mentors' feelings of stereotype threat during the post-mentoring math test ($r(78) = .04$, $p = .70$). Based on these findings, it appears that providing more psychosocial support was not related to feeling less stereotype threat.

Hypothesis 1a

Hypothesis 1a stated that mentors in the stereotype threat reduction mentoring condition would endorse an incremental theory of intelligence more than participants in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring incremental theory scores as a covariate. A significant main effect for type of mentoring was found ($F(2, 96) = 4.45$, $p = .01$, $\eta^2 = .09$; see Figure 10). Planned comparisons revealed that mentors in the academic control ($M = 3.98$, $SD = 0.72$) and non-academic control ($M = 3.73$, $SD = 0.67$) conditions did not differ from each other ($t(100) = -1.48$, $p = .14$, $d = .36$). However, mentors in the stereotype threat reduction ($M = 4.33$, $SD = 0.62$) condition endorsed incremental theories of intelligence more than mentors in the academic control ($t(100) = -2.27$, $p = .03$, $d = .52$) and non-academic control conditions ($t(100) = -3.58$, $p < .01$, $d = .93$). A significant main effect for mentor gender was also found ($F(1, 96) = 8.47$, $p < .01$, $\eta^2 = .08$, $d = .73$; see Figure 11). Male mentors (M = 4.37, SD = 0.63) endorsed an incremental theory of intelligence more than female mentors (M = 3.89, SD = 0.69).

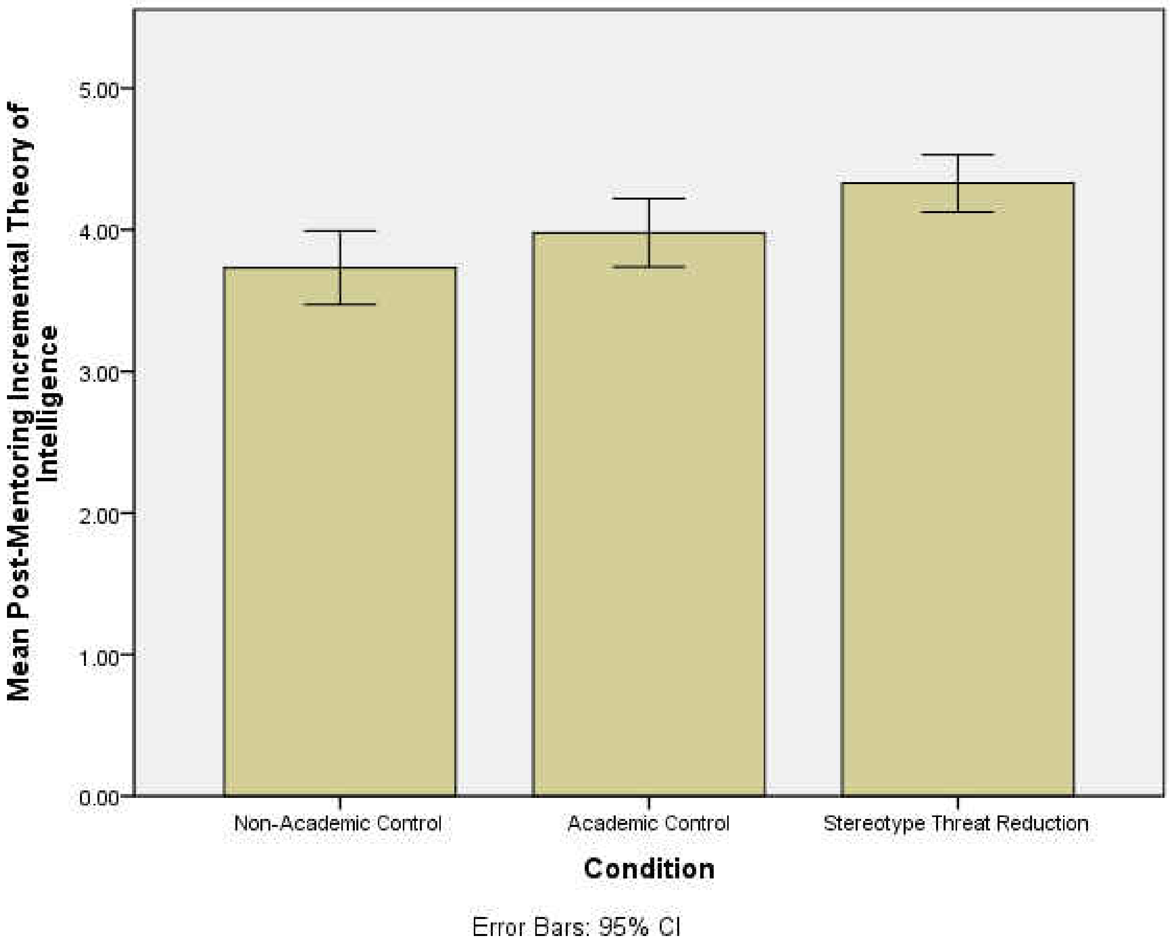


Figure 10: Mentors' Incremental Theory of Intelligence across Conditions

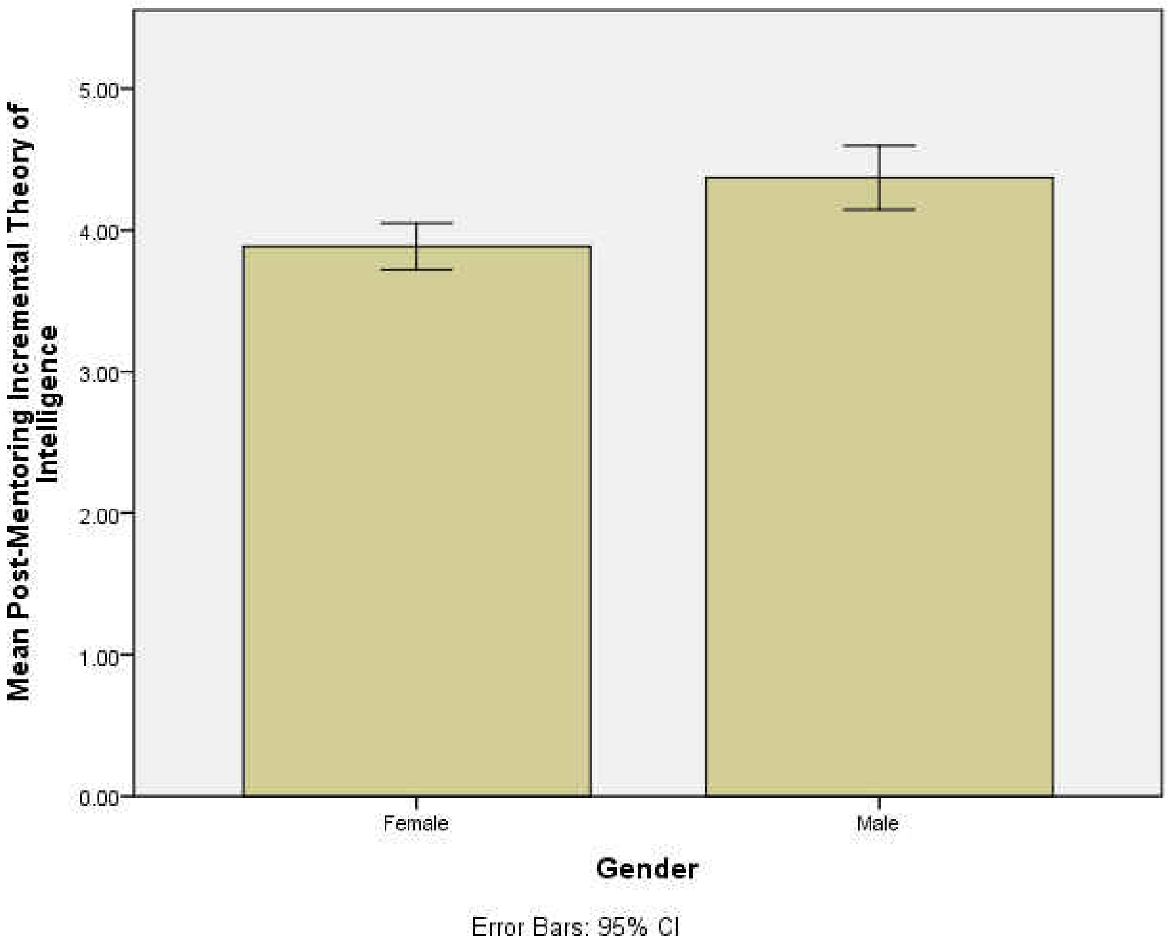


Figure 11: Mentors' Incremental Theory of Intelligence by Gender

These main effects were qualified by a significant type of mentoring x mentor gender interaction ($F(2, 96) = 3.49$, $p = .03$, $\eta^2 = .07$). Planned comparisons revealed no significant difference between female mentors in the academic control ($M = 3.74$, $SD = 0.61$) and non-academic control ($M = 3.60$, $SD = 0.63$) conditions ($t(67) = -.73$, $p = .47$, $d = .23$). However, female mentors in the stereotype threat reduction ($M = 4.27$, $SD = 0.65$) condition endorsed incremental theories of intelligence more than female mentors in the academic control ($t(67) = -2.90$, $p = .01$, $d = .84$) and non-academic control ($t(67) = -3.61$, $p < .01$, $d = 1.05$) conditions (see Figure 12). Planned comparisons revealed no significant difference between male mentors in the academic control (M = 4.38, SD = 0.73) and non-academic control (M = 4.21, SD = 0.64) conditions ($t(30)$ = -0.53, p = .60, d = .25). Unlike female mentors, male mentors in the stereotype threat reduction (M = 4.44, SD = 0.54) condition did not significantly differ from male mentors in the academic control ($t(30)$ = -0.27, p = .79, d = .09) and non-academic control conditions ($t(30)$ = -0.73, p = .47, d = .39; see Figure 13).

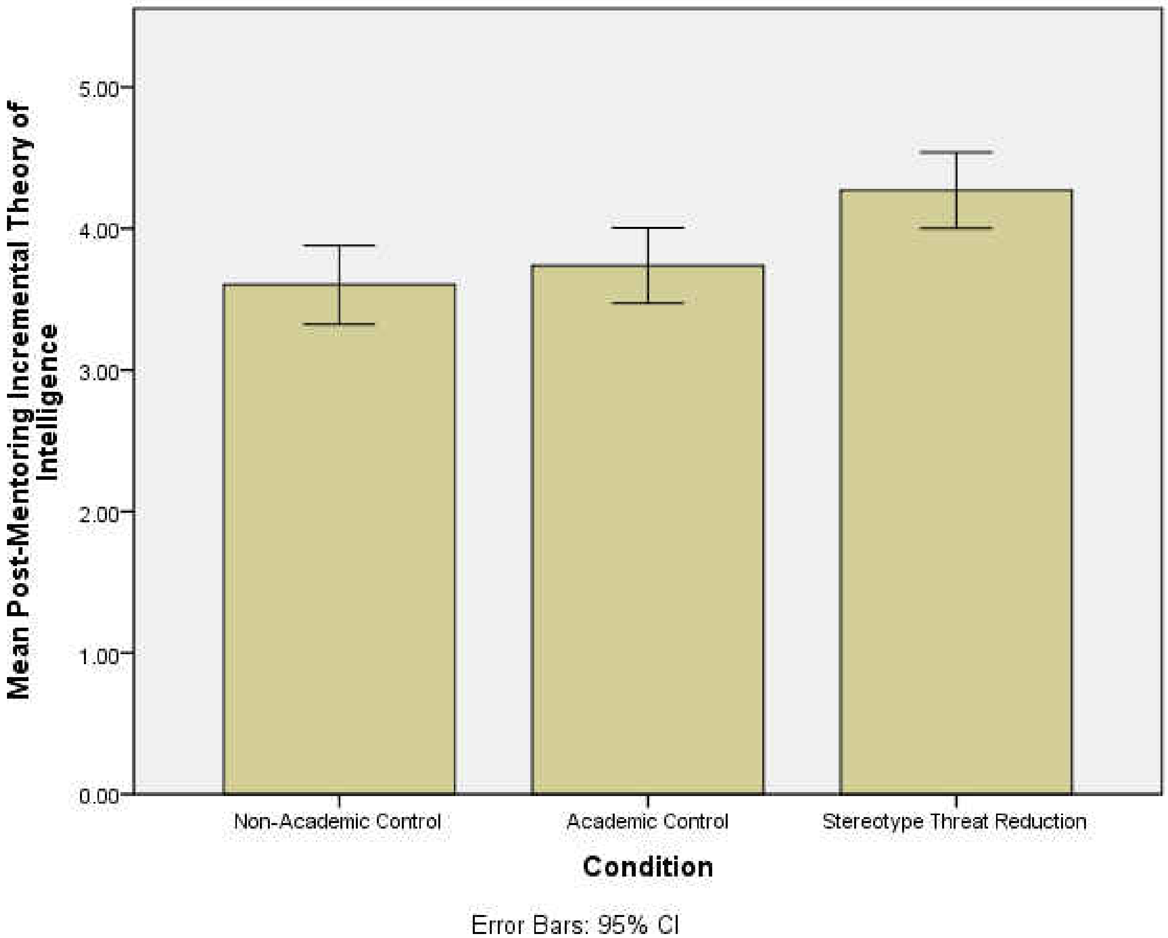


Figure 12: Female Mentors' Incremental Theory of Intelligence across Conditions

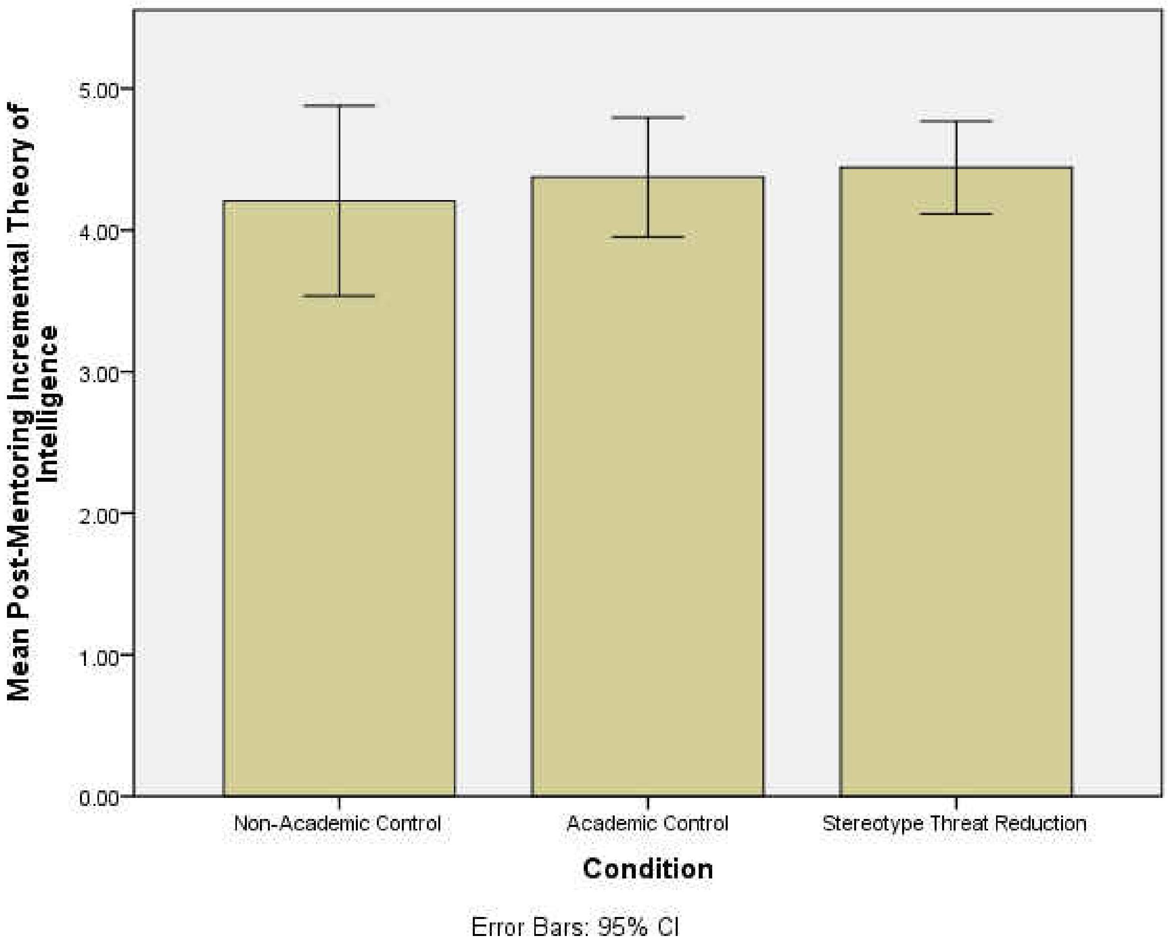


Figure 13: Male Mentors' Incremental Theory of Intelligence across Conditions

Based on these results, hypothesis 1a is supported. Mentors in the stereotype threat reduction condition endorsed an incremental theory of intelligence more than mentors in the academic control and non-academic control conditions. Additionally, female mentors in the stereotype threat reduction condition endorsed an incremental theory of intelligence more after the mentoring intervention than female mentors in the academic control and non-academic control conditions, whereas male mentors in the stereotype threat reduction condition did not significantly differ in their endorsement of an incremental theory of intelligence after the mentoring intervention from male mentors in academic control and non-academic control conditions.

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring endorsements of incremental theories of intelligence was mediated by coded self-theories (see Figure 14). First, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of incremental theories of intelligence was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as predictors of post-mentoring endorsement of incremental theories of intelligence. Pre-mentoring endorsements of incremental theories of intelligence explained a significant amount of the variance in post-mentoring endorsements of incremental theories of intelligence in the first step of the regression analysis ($\beta = .61$, $t(76) = 8.02$, $p < .01$, $R^2 = .46$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of incremental theories of intelligence ($\beta = .33$, $t(75) = 2.76$, $p < .01$, $\Delta R^2 = .05$). The significant relationship between mentoring condition and post-mentoring endorsements of incremental theories of intelligence meets the first step in mediation evidence.

To meet the second step in mediation evidence, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of incremental theories of intelligence was entered in the first step, followed by coded self-theories entered in the second step as predictors of post-mentoring endorsement of incremental theories of intelligence. The inclusion of coded self-theories in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of incremental theories of intelligence (β = .05, $t(75) = 4.69$, $p = .02$, $\Delta R^2 = .04$). The significant relationship between coded self-theories and post-mentoring endorsements of incremental theories of intelligence meets the second step in mediation evidence.

To meet the third step in mediation evidence, a regression analysis was carried out in which the dummy-coded condition variable was entered as a predictor of coded self-theories. The stereotype threat reduction mentoring condition explained a significant amount of the variance in coded self-theories (β = 1.93, $t(81) = 3.26$, $p < .01$, $R^2 = .12$). The significant relationship between mentoring condition and coded self-theories meets the third step in mediation evidence.

To meet the last step for mediation, the dummy-coded condition variable and coded self-theories were simultaneously entered into a regression analysis as predictors of post-mentoring endorsements of incremental theories of intelligence. The dummy-coded condition variable (β = .27, $t(74) = 2.09$, $p = .04$) remained a significant predictor of post-mentoring endorsements of incremental theories of intelligence. Coded self-theories (β = .03, $t(74) = 1.53$, $p = .13$), however, was not a significant predictor of post-mentoring endorsements of incremental theories of intelligence when entered simultaneously with the dummy-coded condition variable. These findings suggest that self-theories discussions did not mediate the effects of the stereotype threat reduction condition on increased endorsement of incremental theories of intelligence.

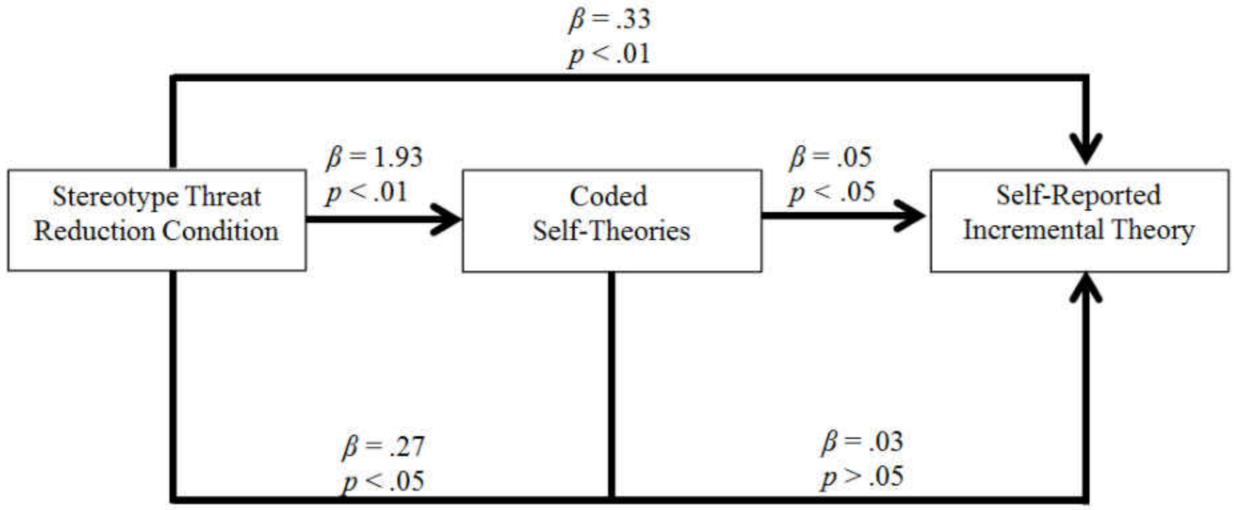


Figure 14: Mentor Incremental Theory Mediation Analysis

Hypothesis 1b

Hypothesis 1b stated that mentors in the stereotype threat reduction mentoring condition would endorse an entity of intelligence less than mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring entity theory scores as a covariate. A significant main effect was found for type of mentoring ($F(2, 96) = 7.18$, $p < .01$, $\eta^2 = .13$; see Figure 15). Planned comparisons revealed that mentors in the academic control ($M = 2.03$, $SD = 0.90$) and non-academic control ($M = 2.22$, $SD = 0.72$) conditions did not differ from each other ($t(100) = 1.05$, $p = .30$, $d = .23$). However, mentors in the stereotype threat reduction ($M = 1.55$, $SD = 0.58$) condition endorsed entity theories of intelligence less than protégés in the academic control ($t(100) = 2.79$, $p < .01$, $d = .63$) and non-academic control conditions ($t(100) = 3.65$, $p < .01$, $d = 1.02$). A significant main effect was found for mentor gender ($F(1, 96) = 4.75$, $p = .03$, $\eta^2 = .05$, d = .58; see Figure 16). Female mentors (*M* = 2.05, *SD* = 0.75) endorsed an entity theory of intelligence more than male mentors (*M* = 1.60, *SD* = 0.80). Lastly, the type of mentoring x mentor gender interaction was not significant ($F(2, 96) = 0.58$, $p = .56$, $\eta^2 = .01$). In conclusion, hypothesis 1b was supported; mentors in the stereotype threat reduction condition endorsed entity theories of intelligence less after the mentoring intervention than mentors in the academic control and non-academic control conditions.

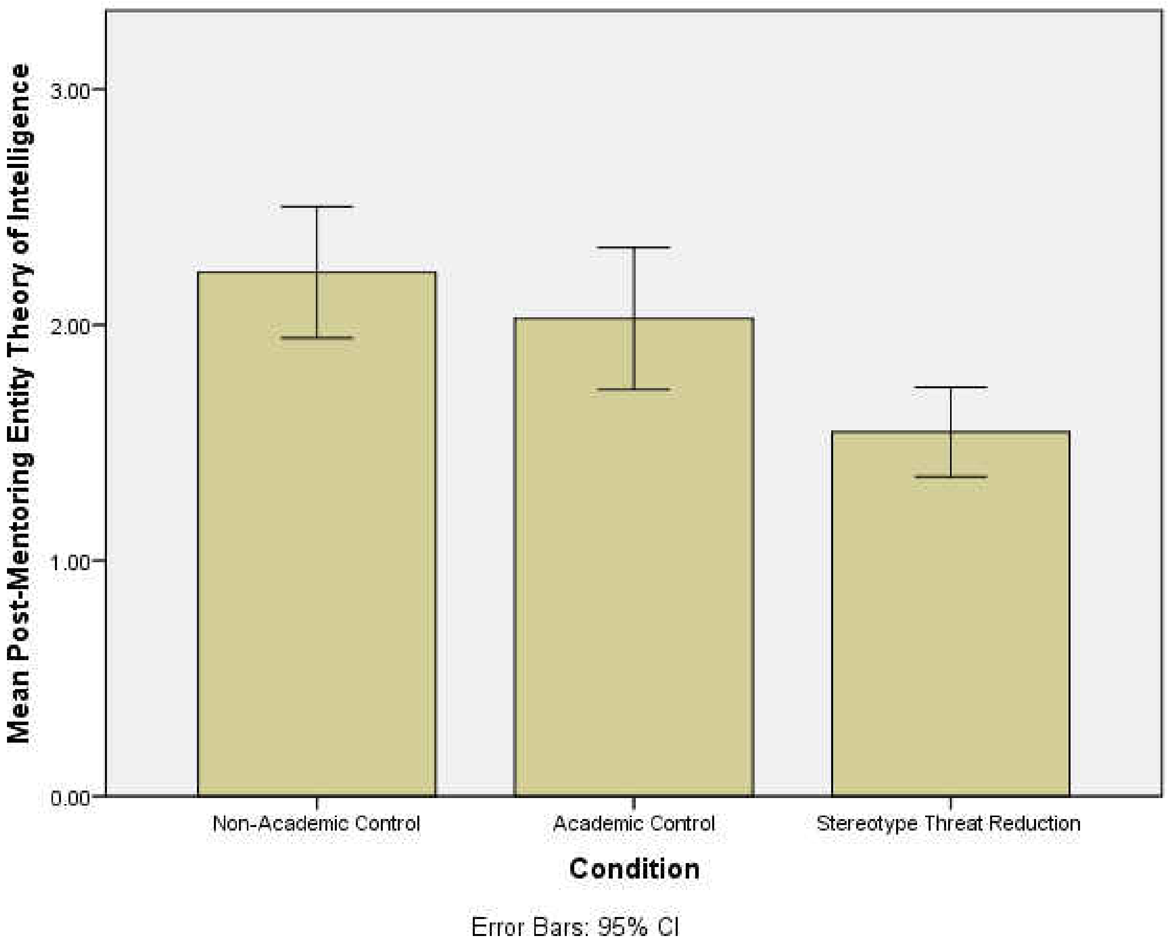


Figure 15: Mentors' Entity Theory of Intelligence across Conditions

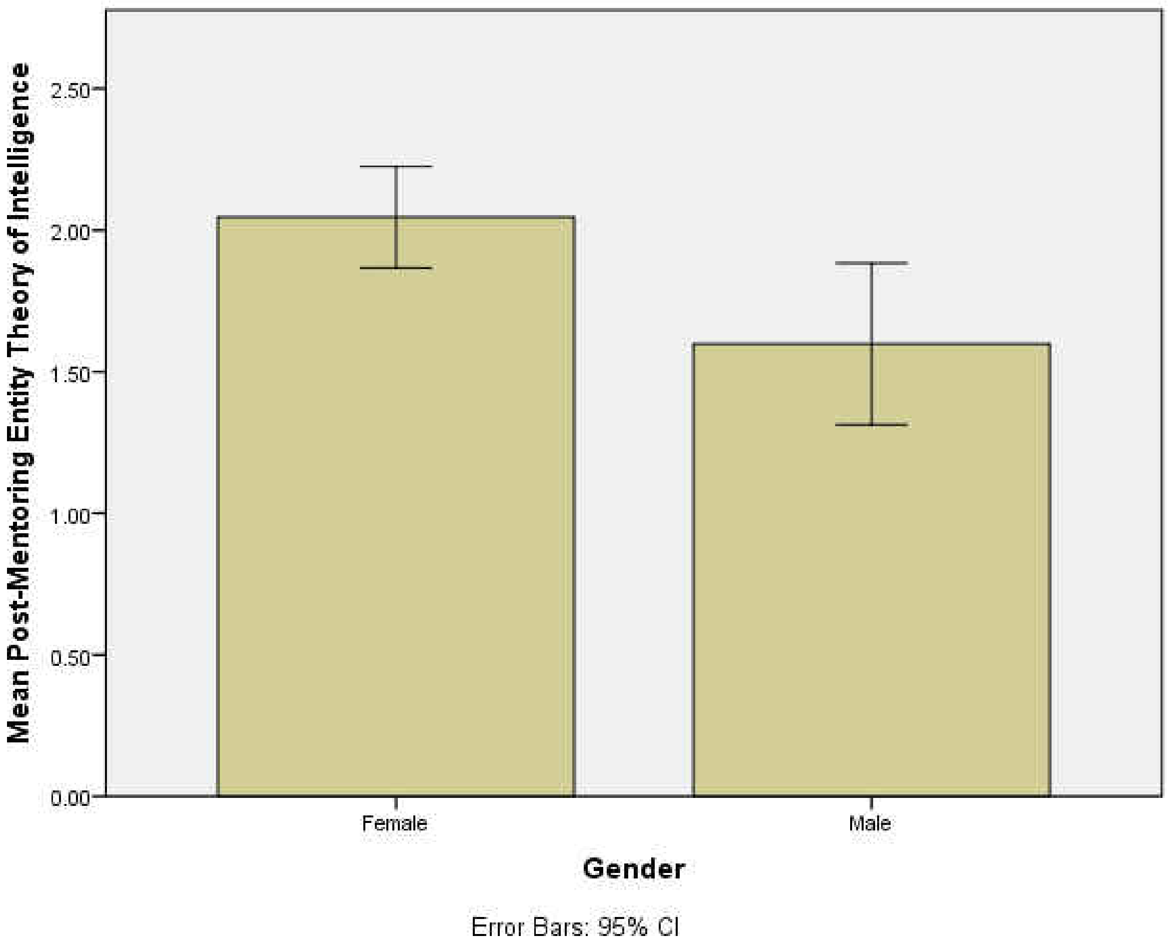


Figure 16: Mentors' Entity Theory of Intelligence by Gender

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring endorsements of entity theories of intelligence was mediated by coded self-theories. First, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of entity theories of intelligence was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as a predictor of post-mentoring endorsement of entity theories of intelligence. Pre-mentoring endorsements of entity theories of intelligence explained a significant amount of the variance in post-mentoring endorsements of entity theories of intelligence in the first step of the regression analysis (β = .57, $t(76) = 5.28$, $p < .01$, $R^2 = .27$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring endorsements of entity theories of intelligence (β = -.56, $t(75) = -3.48$, $p < .01$, $\Delta R^2 = .10$). The significant relationship between mentoring condition and post-mentoring endorsements of entity theories of intelligence meets the first step in mediation evidence.

To meet the second step in mediation evidence, a hierarchical regression analysis was carried out in which pre-mentoring endorsements of entity theories of intelligence was entered in the first step, followed by coded self-theories entered in the second step. The inclusion of coded self-theories in the second step of the regression analysis did not result in a significant increase in the amount of explained variance in post-mentoring endorsements of entity theories of intelligence (β = -.04, $t(75) = -1.34$, $p = .18$, $\Delta R^2 = .02$). Given that self-theories discussions was not significantly related to post-mentoring endorsements of entity theories of intelligence, there is no evidence that the effects of the stereotype threat reduction condition on decreased endorsement of entity theories of intelligence were mediated by self-theories discussions (see Figure 17).

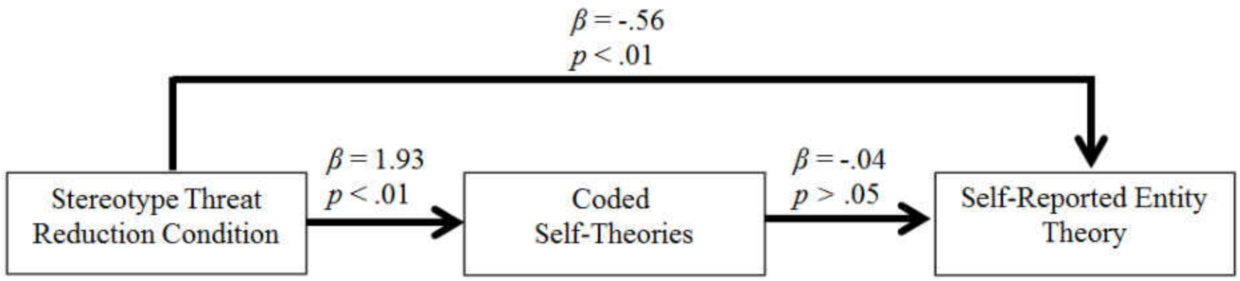


Figure 17: Mentor Entity Theory Mediation Analysis

Hypothesis 2a

Hypothesis 2a stated that female mentors in the stereotype threat mentoring condition were expected to report experiencing less stereotype threat in their STEM classes than female mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring stereotype threat in STEM classes scores as a covariate. A significant main effect for type of mentoring on feelings of stereotype threat in STEM classes was found ($F(2, 94) = 6.71$, $p < .01$, $\eta^2 = .13$; see Figure 18). Planned comparisons revealed that mentors in the academic control ($M = 2.24$, $SD = 0.67$) and non-academic control ($M = 2.29$, $SD = 0.78$) conditions did not differ from each other ($t(98) = 0.29$, $p = .77$, $d = .07$). However, mentors in the stereotype threat reduction ($M = 1.76$, $SD = 0.68$) condition reported experiencing less stereotype threat in their classes than mentors in the academic control ($t(98) = 2.98$, $p < .01$, $d = .71$) and non-academic control conditions ($t(98) = 3.00$, $p < .01$, $d = .72$). A significant main effect for mentor gender on feelings of stereotype threat in STEM classes was also found ($F(1, 94) = 9.89$, $p < .01$,

$\eta^2 = .10$, $d = .84$; see Figure 19). Female mentors ($M = 2.26$, $SD = 0.68$) reported experiencing more stereotype threat in STEM classes than male mentors ($M = 1.68$, $SD = 0.70$).

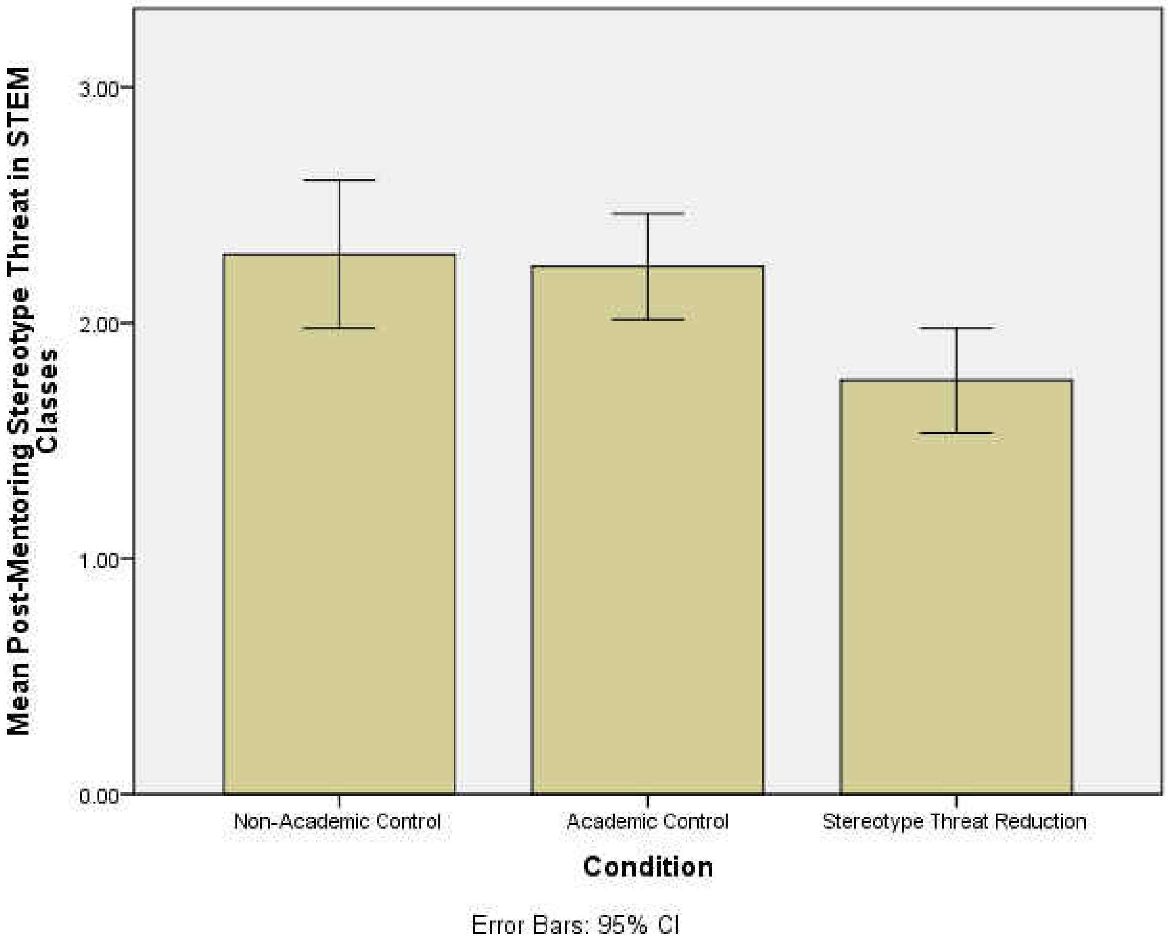


Figure 18: Mentors' Stereotype Threat in STEM Classes across Conditions

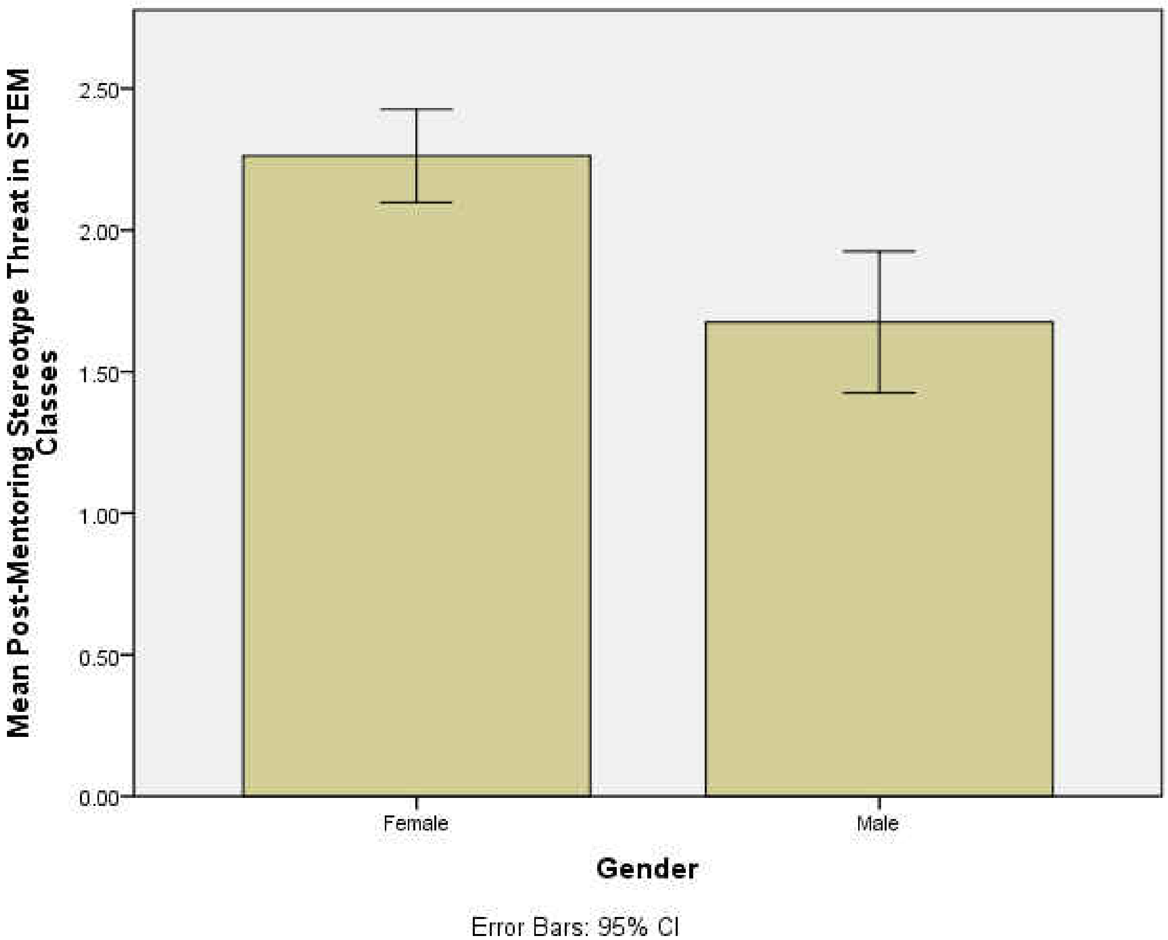


Figure 19: Mentors' Stereotype Threat in STEM Classes by Gender

Planned comparisons were carried out to determine if female mentors benefitted more from the stereotype threat reduction condition than male mentors. Female mentors in the academic control (M = 2.47, SD = 0.60) and non-academic control (M = 2.46, SD = 0.68) conditions did not differ in the amount of stereotype threat felt in STEM classes ($t(65) = .04$, $p = .97$). However, female mentors in the stereotype threat reduction condition (M = 1.92, SD = 0.64) reported experiencing less stereotype threat in their STEM classes than female mentors in the academic control ($t(65) = 2.97$, $p < .01$) and female mentors in the non-academic control ($t(65) = 2.82$, $p < .01$) conditions. Male mentors were not expected to experience stereotype threat in their

STEM classes and as a result, male mentors in the stereotype threat reduction condition were not expected to differ from male mentors in the academic control and non-academic control conditions. As expected, male mentors in the academic control (M = 1.87, SD = 0.64) and non-academic control (M = 1.74, SD = 0.90) conditions did not differ from each other in the amount of stereotype threat experienced in STEM classes ($t(30) = -0.38$, $p = .71$). Similarly, male mentors in the stereotype threat reduction (M = 1.44, SD = 0.66) condition did not differ from male mentors in the academic control ($t(30) = 1.59$, $p = .12$) and non-academic control ($t(30) = 0.87$, $p = .39$) in the amount of stereotype threat experienced in STEM classes. Taken together, these results suggest that hypothesis 2 was supported; mentors in the stereotype threat reduction condition, particularly female mentors, reported experiencing less stereotype threat in their STEM classes after the mentoring intervention than

To determine which component of the stereotype threat reduction program contributed the most to reducing feelings of stereotype threat in STEM classes, a hierarchical regression analysis was carried out with pre-mentoring feelings of stereotype threat in STEM classes entered in the first step, and coded self-affirmation, misattributions, and self-theories entered in the second step. Pre-mentoring feelings of stereotype threat in STEM classes explained a significant amount of the variance in post-mentoring feelings of stereotype threat in STEM classes in the first step of the regression analysis ($\beta = .74$, $t(74) = 6.99$, $p < .01$, $R^2 = .40$). The inclusion of coded self-affirmation, misattributions, and self-theories in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring feelings of stereotype threat in STEM classes ($\Delta R^2 = .10$, $p < .01$). Coded self-theories ($\beta = -.05$, $t(69) = -2.34$, $p = .02$) and self-affirmations ($\beta = -.04$, $t(69) = -2.02$, $p < .05$) emerged as a unique predictor of post-mentoring feelings of stereotype threat in STEM classes, whereas coded misattributions (β = -.03, $t(69) = -1.61$, $p = .11$) did not account for unique variance in post-mentoring feelings of stereotype threat in STEM classes. Based on these findings, it appears to discussing self-theories and important values are the key intervention components contributing to stereotype threat reduction.

A mediation analysis following Baron and Kenny's (1986) guidelines was carried out to determine if the effects of mentoring condition on post-mentoring feelings of stereotype threat in STEM classes was mediated by coded self-affirmation, misattributions, and self-theories. First, a hierarchical regression analysis was carried out in which pre-mentoring feelings of stereotype threat in STEM classes was entered in the first step, followed by a dummy-coded condition variable, with the stereotype threat reduction condition coded as 1 and the two control conditions coded as 2, entered in the second step as a predictor of post-mentoring feelings of stereotype threat in STEM classes. Pre-mentoring feelings of stereotype threat in STEM classes explained a significant amount of the variance in post-mentoring feelings of stereotype threat in STEM classes in the first step of the regression analysis ($\beta = .74$, $t(74) = 6.99$, $p < .01$, $R^2 = .40$). The inclusion of the dummy-coded condition variable in the second step of the regression analysis resulted in a significant increase in the amount of explained variance in post-mentoring feelings of stereotype threat in STEM classes ($\beta = -.48$, $t(73) = -3.67$, $p < .01$, $\Delta R^2 = .09$). The significant relationship between condition and post-mentoring feelings of stereotype threat in STEM classes meets the first step in mediation evidence. The second step for mediation was met in the previously reported regression analysis in which coded self-affirmation, misattributions, and self-theories were entered as predictors of post-mentoring feelings of stereotype threat in STEM classes, with coded self-theories and self-affirmations emerging as the predictors accounting for unique variance in post-mentoring feelings of stereotype threat in STEM classes.

To meet the third step for mediation, the dummy-coded condition variable was entered as a predictor of coded self-theories and self-affirmations. The stereotype threat reduction mentoring condition explained a significant amount of the variance in coded self-theories (β = 1.93, $t(81) = 3.26$, $p < .01$, $R^2 = .12$). The stereotype threat reduction mentoring condition also explained a significant amount of the variance in coded self-affirmations (β = 2.11, $t(81) = 3.11$, $p < .01$, $R^2 = .11$).The significant relationship between mentoring condition and coded self-theories and self-affirmations meets the third step in mediation evidence.

To meet the last step for mediation, the dummy-coded condition variable and coded self-theories and self-affirmations were simultaneously entered into a regression analysis as predictors of post-mentoring feelings of stereotype threat in STEM classes. The dummy-coded condition variable (β = -.35, $t(71) = -2.45$, $p = .02$) remained a significant predictor of post-mentoring feelings of stereotype threat. However, coded self-theories (β = -.03, $t(71) = -1.45$, $p = .15$) and self-affirmations (β = -.03, $t(71) = -1.24$, $p = .22$) were no longer significant predictors of post-mentoring feelings of stereotype threat. These findings suggest that self-theories and self-affirmations discussions did not mediate the effects of the stereotype threat reduction condition on decreased feelings of stereotype threat in STEM classes (see Figure 20).

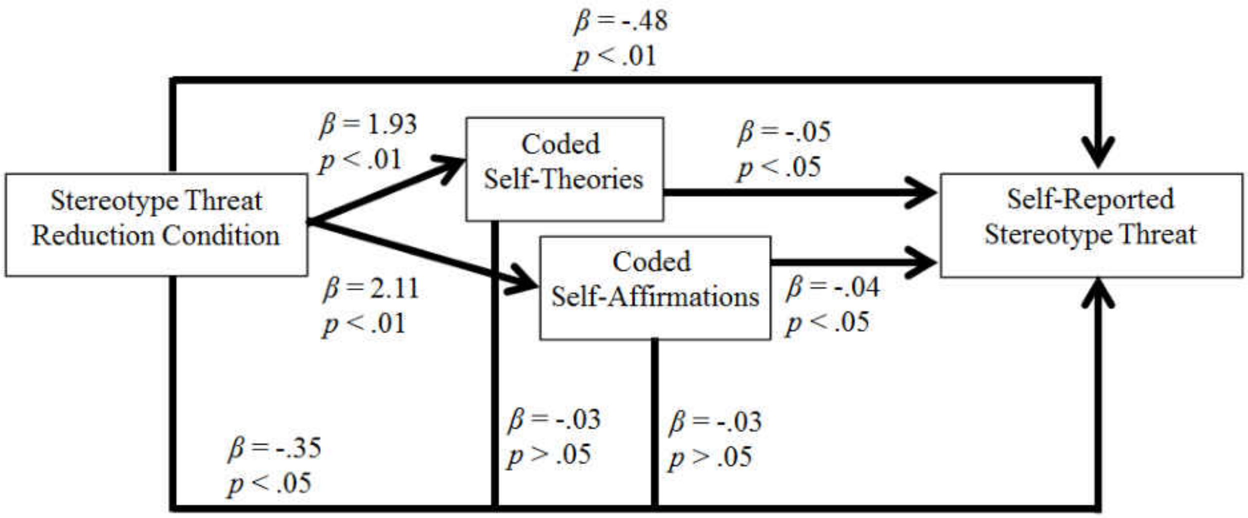


Figure 20: Mentor Stereotype Threat Mediation Analysis

Hypothesis 3

The lack of variability in mentors' intentions to remain in STEM *prior* to mentoring may have limited the ability of the present study to detect differences between conditions. Results for highest intended degree on a 4-point scale (i.e., 1 = associates, 2 = bachelors, 3 = masters, 4 = doctoral degree) revealed that the majority of mentors intended to obtain a master's degree or above (M = 3.38, SD = 0.76). In terms of degree breakdown, 18 mentors sought a bachelor's degree, 30 sought a master's degree, and 59 sought a doctoral degree. Similarly, the majority of mentors intended to pursue graduate education (M = 4.10, SD = 1.27), with 60.78% responding with a 5 (*very likely*) on the 5-point Likert scale. Additionally, the majority of protégés intended to pursue a professional job in a STEM field (M = 4.49, SD = 1.06), with 74.55% responding with a 5 (*very likely*) on the 5-point Likert scale. Lastly, the majority of mentors intended to take future STEM courses (M = 4.42, SD = 0.92), with 63.64% responding with 5 (*very likely*) on the 5-point Likert scale.

The lack of variability in mentors' intentions to remain in STEM *after* receiving mentoring may have also limited the ability of the present study to detect differences between conditions. Results for highest intended degree revealed that the majority of mentors intended to obtain a master's degree or above (M = 3.45, SD = 0.76). In terms of degree breakdown, 1 mentor sought an associate's degree, 13 sought a bachelor's degree, 25 sought a master's degree, and 60 sought a doctoral degree. Similarly, the majority of mentors intended to pursue graduate education (M = 4.03, SD = 1.33), with 55.89% responding with a 5 (*very likely*) on the 5-point Likert scale. Additionally, that the majority of mentors intended to pursue a professional job in a STEM field (M = 4.58, SD = 0.92), with 75.49% responding with a 5 (*very likely*) on the 5-point Likert scale. Lastly, the majority of mentors intended to take future STEM courses (M = 4.69, SD = 0.64), with 78.22% responding with a 5 (*very likely*) on the 5-point Likert scale.

The lack of variability in mentors' intention to remain in STEM measures likely prevented the present study from finding significant effects for hypotheses 3. Hypotheses 3a and 3b were tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Gender: Female or Male Mentor) ANCOVA with pre-mentoring intentions scores used as a covariate. There were no significant main effects for type of mentoring or gender, as well as no significant interaction between type of mentoring and gender, for any of the intention outcomes. Refer to Table 8 for the main effect and interaction ANCOVAs for hypothesis 3.

Table 8: Analysis of Covariance for Mentors' STEM Intentions

	df	*F*	*p*	η^2
Type of Mentoring (TM) → Highest Degree Desired	2	0.84	.44	.02
Gender (G) → Highest Degree Desired	1	3.69	.06	.04
TM x G → Highest Degree Desired	2	2.03	.14	.04
Error	90			
Type of Mentoring (TM) → Intent to Obtain Graduate Education	2	0.47	.63	.01
Gender (G) → Intent to Obtain Graduate Education	1	0.09	.76	.00
TM x G → Intent to Obtain Graduate Education	2	1.03	.36	.02
Error	95			
Type of Mentoring (TM) → Intent to Obtain a STEM Job	2	0.46	.63	.01
Gender (G) → Intent to Obtain a STEM Job	1	0.03	.87	.00
TM x G → Intent to Obtain a STEM Job	2	0.85	.43	.02
Error	95			
Type of Mentoring (TM) → Intent to Take STEM Classes	2	1.75	.18	.04
Gender Match (GM) → Intent to Take STEM Classes	1	0.03	.86	.00
TM x GM → Intent to Take STEM Classes	2	1.05	.35	.02
Error	94			

Hypothesis 4

Hypothesis 4 stated that sense of belonging would mediate the effects of stereotype threat on intentions such that higher stereotype threat was expected to predict lower sense of belonging, which was expected to predict lower intentions to remain in STEM. Initial support for the relationship between sense of belonging and stereotype threat can be found in the significant negative correlation between post-mentoring sense of belonging and post-mentoring stereotype threat felt in STEM classes ($r(99) = -.49$, $p < .01$). To determine if sense of belonging mediates the effects of stereotype threat on intentions to remain in STEM, Baron and Kenny's (1986) mediation technique was utilized. First, a hierarchical regression analysis was carried out in which post-mentoring sense of belonging was entered as the dependent variable, and pre-mentoring sense of belonging was entered as the predictor in the first step, followed by post-mentoring feelings of stereotype threat in STEM classes in the second step. Pre-mentoring sense of belonging was entered in the first step to determine if post-mentoring feelings of stereotype threat in STEM classes uniquely predicts post-mentoring feelings of sense of belonging. As expected, pre-mentoring sense of belonging was a significant predictor of post-mentoring sense of belonging in the first step ($\beta = .79$, $t(97) = 9.14$, $p < .01$). Pre-mentoring sense of belonging remained a significant predictor of post-mentoring sense of belonging in the second step ($\beta = .67$, $t(96) = 7.52$, $p < .01$). However, post-mentoring stereotype threat in STEM classes was also a significant predictor of post-mentoring sense of belonging in the second step ($\beta = -.19$, $t(96) = -3.44$, $p < .01$).

For the next step, post-mentoring feelings of stereotype threat in STEM classes was entered as a predictor of post-mentoring intentions to remain in STEM, after pre-mentoring intentions to remain in STEM were entered first as control variables. Because the four intention items (i.e., highest intended degree, likelihood of pursuing STEM graduate education, likelihood of obtaining a professional STEM job, and likelihood of taking STEM classes in the future) were not highly correlated with each other, separate regression analyses were carried out for each intention outcome. Results indicated that post-mentoring feelings of stereotype threat in STEM classes did not significantly predict any of the intention outcomes (see Table 9). Thus, hypothesis 4 remains unsupported as no evidence was obtained for sense of belonging mediating of the effects of stereotype threat on intentions.

Table 9: Mediation Analysis for Mentors' STEM Intentions

Post-Mentoring Stereotype Threat → Post-Mentoring Intentions to Remain in STEM	*β*	*t*	*df*	*p*	R^2
DV: Highest Degree Desired					
Step 1					.39
Pre-Mentoring Highest Degree Desired	.63	7.70	92	.00	
Step 2					.39
Pre-Mentoring Highest Degree Desired	.63	7.68	91	.00	
Post-Mentoring Stereotype Threat	-.04	-0.49	91	.62	
DV: Graduate Education Intent					
Step 1					.35
Pre-Mentoring Graduate Education Intent	.60	7.16	97	.00	
Step 2					.36
Pre-Mentoring Graduate Education Intent	.60	7.17	96	.00	
Post-Mentoring Stereotype Threat	.22	1.42	96	.16	
DV: Intent to Obtain STEM Job					
Step 1					.15
Pre-Mentoring Intent to Obtain STEM Job	.33	4.20	97	.00	
Step 2					.16
Pre-Mentoring Intent to Obtain STEM Job	.33	4.19	96	.00	
Post-Mentoring Stereotype Threat	-.08	-0.62	96	.54	
DV: Intent to Take STEM Classes					
Step 1					.16
Pre-Mentoring Intent to Take STEM Classes	.28	4.31	96	.00	
Step 2					.16
Pre-Mentoring Intent to Take STEM Classes	.28	4.29	95	.00	
Post-Mentoring Stereotype Threat	.03	0.37	95	.72	

Hypothesis 5a

Hypothesis 5a stated that female mentors in the stereotype threat reduction condition would report experiencing less stereotype threat while taking a standardized math test than female mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring stereotype threat in STEM classes scores as a covariate. There was no main effect for type of mentoring ($F(2, 93) = .76$, $p = .47$, $\eta^2 = .02$), as mentors in the stereotype threat reduction ($M = 1.25$, $SD = 0.53$) condition did not significantly differ from mentors in the academic control ($M = 1.46$, $SD = 0.72$) and non-academic control ($M = 1.33$, $SD = 0.50$) conditions in their feelings of stereotype threat during the math test. There was a significant main effort for mentor gender ($F(1, 93) = 4.96$, $p = .03$, $\eta^2 = .05$, $d = .91$), with female mentors ($M = 1.48$, $SD = 0.66$) reporting experiencing more stereotype threat during the math test than male mentors ($M = 1.04$, $SD = 0.19$). Lastly, there was no significant type of mentoring x mentor gender interaction ($F(2, 93) = .03$, $p = .97$, $\eta^2 = .00$). Based on these findings, it appears that hypothesis 5a was not supported; female mentors in the stereotype threat reduction condition did not experience less stereotype threat while taking a math test than female mentors in the academic control and non-academic control conditions.

Hypothesis 6a

Hypothesis 6a stated that female mentors in the stereotype threat mentoring condition were expected to perform better on a standardized math test than female mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring math test scores as a covariate. There was no main effect for type of mentoring ($F(2, 95) = 0.25$, $p = .78$, $\eta^2 = .01$), as mentors in the stereotype threat reduction ($M = 17.39$, $SD = 6.25$) condition did not answer more questions correctly than mentors in the academic control ($M = 17.44$, $SD = 5.24$) and the non-academic control ($M = 16.37$, $SD = 5.22$) conditions. Similarly, mentors in the stereotype threat reduction ($M = 74.14$, $SD = 13.70$) condition did not answer a significantly higher percentage of questions correctly than mentors in the academic control ($M = 70.44$, $SD = 18.51$) and the non-academic control ($M = 71.33$, $SD = 16.55$) conditions ($F(2, 95) = 0.50$, $p = .61$, $\eta^2 = .01$). A significant main effect for mentor gender was found for the total number of math questions answered correctly ($F(1, 95) = 4.40$, $p = .04$, $\eta^2 = .04$, $d = .42$), with male mentors ($M = 18.72$, $SD = 5.70$) outperforming female mentors ($M = 16.37$, $SD = 5.44$) on the math test. A near significant main effect for mentor gender was found for percentage of questions answered correctly ($F(1, 95) = 3.91$, $p = .051$, $\eta^2 = .04$, $d = .40$), with male mentors ($M = 76.38$, $SD = 15.39$) answering a higher percentage of questions correctly than female mentors ($M = 70.11$, $SD = 16.27$). No significant type of mentoring x mentor gender interaction was found for total number of math questions answered correctly ($F(2, 95) = 1.70$, $p = .19$, $\eta^2 = .03$). Similarly, no significant type of mentoring x mentor gender interaction was found for percentage of math questions answered correctly ($F(2, 95) = .09$, $p = .91$, $\eta^2 = .00$). Based on these findings, hypothesis 6a was not supported; female mentors in the stereotype threat mentoring condition did not perform better on a standardized math test than female mentors in the academic control and non-academic control conditions.

Hypothesis 7a

Hypothesis 7a stated that female mentors in the stereotype threat mentoring condition would report less performance-avoidance goals during the math test than female mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring performance-avoidance goal scores during the math test as a covariate. There was no significant main effect for type of mentoring ($F(2, 93) = .14$, $p = .87$, $\eta^2 = .00$), as mentors in the stereotype threat reduction condition ($M = 3.12$, $SD = 0.90$) did not significantly differ in their performance-avoidance goals during the math test from mentors in the academic control ($M = 3.21$, $SD = 0.77$) and non-academic control conditions ($M = 3.15$, $SD = 0.72$). There was also no significant main effect for mentor gender ($F(1, 93) = .13$, $p = .72$, $\eta^2 = .00$, $d = .37$), as female mentors ($M = 3.26$, $SD = 0.65$) did not significantly differ in their performance-avoidance goals during the math test from male mentors ($M = 2.94$, $SD = 1.03$). Lastly, there was also no significant interaction between type of mentoring and mentor gender ($F(2, 93) = .28$, $p = .76$, $\eta^2 = .01$). Based on these findings, hypothesis 7a was not supported; female mentors in the stereotype threat mentoring condition did not report experiencing less performance-avoidance goals during the math test than female mentors in the academic control and non-academic control conditions.

Hypothesis 7b

Hypothesis 7b stated that mentors in the stereotype threat mentoring condition would report less worry during the math test than mentors in the academic control and non-academic control conditions. This hypothesis was tested with a 3 (Type of Mentoring: Stereotype Threat Reduction, Academic Control, or Non-Academic Control) x 2 (Mentor Gender: Female or Male) ANCOVA with mentors' pre-mentoring worry during the math test as a covariate. There was no significant main effect for type of mentoring ($F(2, 93) = .19$, $p = .83$, $\eta^2 = .00$), as mentors in the stereotype threat reduction condition ($M = 1.41$, $SD = 0.68$) did not significantly differ in their worry during the math test from mentors in the academic control ($M = 1.39$, $SD = 0.60$) and non-academic control conditions ($M = 1.38$, $SD = 0.65$). There was also no significant main effect for mentor gender ($F(1, 93) = .48$, $p = .49$, $\eta^2 = .01$, $d = .42$), as female mentors ($M = 1.47$, $SD = 0.72$) did not significantly differ in their worry during the math test from male mentors ($M = 1.23$, $SD = 0.35$). Lastly, there was no significant interaction between type of mentoring and mentor gender ($F(2, 93) = 2.31$, $p = .11$, $\eta^2 = .05$). Based on these findings, hypothesis 7b was not supported; female mentors in the stereotype threat mentoring condition did not report experiencing less worry during the math test than female mentors in the academic control and non-academic control conditions.

Hypothesis 7c

Hypothesis 7c stated that performance-avoidance goals and worry would mediate the effects of stereotype threat on performance such that higher stereotype threat was expected to predict higher performance-avoidance goals, which was expected to predict higher worry, which was expected to predict lower performance. Although the type of mentoring and mentor gender did not affect mentors' performance-avoidance goals and worry during the math test, performance-avoidance goals and worry may still mediate the effects of stereotype threat on math test performance across conditions. A regression analysis was carried out following the Baron and Kenny's (1986) guidelines. First, a regression analysis was carried out in which feelings of stereotype threat during the post-mentoring math test was entered as a predictor of performance-avoidance goals during the post-mentoring math test. There was no evidence of a relationship between stereotype threat and performance-avoidance goals ($\beta = .17$, $t(98) = 1.24$, $p = .22$).

Although there is no evidence of performance-avoidance goals being a mediator of stereotype threat, worry may still mediate the effects of performance-avoidance goals on math test performance. To test this possibility, a regression analysis was carried out in which performance-avoidance goals during the post-mentoring math test was entered as a predictor of worry during the post-mentoring math test. A significant relationship was found between performance-avoidance goals during the post-mentoring math test and worry during the post-mentoring math test ($\beta = .32$, $t(98) = 4.32$, $p < .01$). Next the relationship between performance-avoidance goals during the post-mentoring math test and performance on the post-mentoring math test was examined. No relationship was found between performance-avoidance goals and math test performance ($\beta = -1.02$, $t(98) = -1.45$, $p = .15$).

It may also be the case that worry mediates the effects of stereotype threat on performance directly. To test this possibility, a regression analysis was carried out in which stereotype threat during the post-mentoring math test was entered as a predictor of worry during the post-mentoring math test. A significant relationship was found between stereotype threat during the post-mentoring math test and worry during the post-mentoring math test (β = .41, $t(98) = 4.04$, $p < .01$). Next the relationship between stereotype threat during the post-mentoring math test and performance on the post-mentoring math test was examined. No relationship was found between stereotype threat during testing and math test performance (β = -1.47, $t(98) = -1.56$, $p = .12$).

Although performance-avoidance goals during the post-mentoring math test predicted worry during the post-mentoring math test and stereotype threat during the post-mentoring math test predicted worry during the post-mentoring math test, stereotype threat during the post-mentoring math test did not predict performance-avoidance goals during the post-mentoring math test, performance-avoidance goals during the post-mentoring math test did not predict math test performance, and stereotype threat during the post-mentoring math test did not predict math test performance. Thus, there was no evidence of a mediation chain in which higher stereotype threat resulted in higher performance-avoidance goals, which resulted in higher worry, which undermined performance on the math test. Figure 21 summarizes the math test mediation analyses. Taken together, these findings indicate that hypothesis 7c was not supported. Please refer to Table 10 below for a summary of all the hypothesis tests described above.

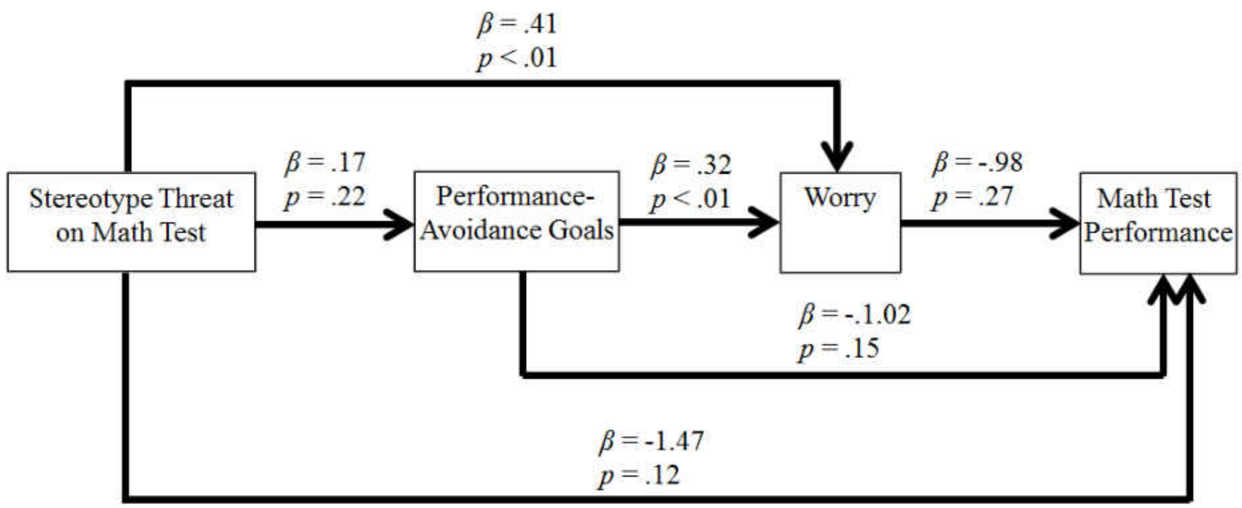


Figure 21: Mentor Math Test Mediation Analyses

Table 10: Summary of Results of Study Hypotheses

Hypothesis	Result
Hypothesis 1	
a. Participants in the stereotype threat reduction mentoring condition are expected to endorse an incremental theory of intelligence more than participants in the academic and non-academic mentoring conditions.	Supported
b. Participants in the stereotype threat reduction mentoring condition are expected to endorse an entity theory of intelligence less than participants in the academic and non-academic mentoring conditions.	Supported
Hypothesis 2	
a. Protégés and female mentors in the stereotype threat reduction mentoring condition are expected to report experiencing less stereotype threat in their STEM classes than protégés and female mentors in the academic and non-academic mentoring conditions.	Supported
b. Protégés with female mentors are expected to report experiencing less stereotype threat in their STEM classes than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender is expected to have no effect on protégés' feelings of stereotype threat in their STEM classes in the stereotype threat reduction mentoring condition.	Not Supported
Hypothesis 3	
a. Protégés and female mentors in the stereotype threat reduction mentoring condition are expected to report greater intentions to remain in their major than protégés and female mentors in the academic and non-academic mentoring conditions.	Not Supported
b. Protégés with female mentors are expected to report greater intentions to remain in STEM than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender is expected to have no effect on protégés' intentions to remain in STEM in the stereotype threat reduction mentoring condition.	Not Supported
Hypothesis 4	
Sense of belonging is expected to mediate the effects of stereotype threat on intentions such that higher stereotype threat is expected to predict lower sense of belonging, which is expected to predict lower intentions to remain in STEM.	Not Supported

Hypothesis	Result
Hypothesis 5	
a. Protégés and female mentors in the stereotype threat mentoring condition are expected to experience less stereotype threat while taking a standardized math test than protégés and female mentors in the academic and non-academic mentoring conditions.	Not Supported
b. Protégés with female mentors are expected to report experiencing less stereotype threat while taking the math test than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender is expected to have no effect on protégés' feelings of stereotype threat during the math test in the stereotype threat reduction mentoring condition.	Not Supported
Hypothesis 6	
a. Protégés and female mentors in the stereotype threat reduction mentoring condition are expected to perform better on a standardized math test than protégés and female mentors in the academic and non-academic mentoring conditions.	Not Supported
b. Protégés with female mentors are expected to perform better on a standardized math test than protégés with male mentors in the academic and non-academic mentoring conditions, whereas mentor gender is expected to have no effect on protégés' performance on a standardized math test in the stereotype threat reduction mentoring condition.	Not Supported
Hypothesis 7	
a. Protégés and female mentors in the stereotype threat mentoring intervention are expected to report less performance-avoidance goals during the test than protégés and female mentors in the academic and non-academic mentoring conditions.	Not Supported
b. Protégés and female mentors in the stereotype threat mentoring intervention are expected to report less worry during the test than protégés and female mentors in the academic and non-academic mentoring conditions.	Not Supported
c. Performance-avoidance goals and worry are expected to mediate the effects of stereotype threat on performance such that higher stereotype threat is expected to predict higher performance-avoidance goals, which is expected to predict higher worry, which is expected to predict lower performance.	Not Supported

CHAPTER FIVE: DISCUSSION

Summary of Results

The present study found that the stereotype threat reduction mentoring condition was more effective than the academic control and non-academic control conditions at reducing feelings of stereotype threat in STEM classes. Both mentors and protégés in the stereotype threat reduction condition reported feeling less stereotype threat in their STEM classes after the conclusion of the mentoring sessions than mentors and protégés in the academic control and non-academic control conditions. The frequency of self-theory comments in the mentoring sessions partially mediated the effects of the stereotype threat reduction mentoring condition on post-mentoring feelings of stereotype threat in STEM classes among protégés. The more self-theories were discussed in mentoring sessions, the less protégés reported feeling stereotype threat in their STEM courses. The frequency of self-affirmation and misattribution comments did not emerge as unique predictors of post-mentoring feelings of stereotype threat. Unlike protégés, no consistent mediator for the relationship between the stereotype threat reduction mentoring condition and post-mentoring feelings of stereotype threat in STEM classes emerged for mentors. Although type of mentoring affected protégés' feelings of stereotype threat in their STEM classes, mentor gender had no effect on protégés' feelings of stereotype threat in their STEM classes.

Additionally, the stereotype threat reduction mentoring condition was more effective than the academic control and non-academic control conditions at changing self-theories. Both mentors and protégés in the stereotype threat reduction condition reported endorsing an entity theory of intelligence less and endorsing an incremental theory of intelligence more after the conclusion of the mentoring sessions than mentors and protégés in the academic control and non-academic control conditions. Female mentors in the stereotype threat reduction condition reported endorsing an incremental theory of intelligence more after the conclusion of the mentoring session than female mentors in the academic control and non-academic control conditions, whereas male mentors in the stereotype threat reduction condition did not differ in their endorsement of an incremental theory of intelligence after the conclusion of the mentoring sessions compared to male mentors in the academic control and non-academic control conditions. The frequency of self-theory comments in the mentoring sessions partially mediated the effects of the stereotype threat reduction mentoring condition on post-mentoring endorsement of incremental and entity self-theories among protégés. The more self-theories were discussed in mentoring sessions, the more protégés endorsed an incremental self-theory and the less they endorsed an entity self-theory. Unlike protégés, no consistent mediator for the relationship between the stereotype threat reduction mentoring condition and post-mentoring endorsement of incremental and entity self-theories emerged for mentors.

Although the stereotype threat reduction condition reduced feelings of stereotype threat and increased endorsement of incremental views of intelligence, the type of mentoring protégés received and mentors provided was unrelated to intentions to remain in STEM, as well as performance on the post-mentoring math test. Mirroring the lack of difference in math test performance across conditions, protégés and mentors did not differ in their feelings of stereotype threat, performance-avoidance goals, and worry during the math test across the three mentoring conditions. Mentor gender did not have an effect on protégés intentions to remain in STEM, as well as performance on the post-mentoring math test. Mentor gender also had no effect on protégés' feelings of stereotype threat, performance-avoidance goals, and worry during the math test.

Theoretical Implications

The finding that mentoring can reduce feelings of stereotype threat in STEM classes is a key theoretical contribution of this study. Research has not thoroughly examined if mentoring reduces stereotype threat since C. Steele et al. (2002) proposed mentoring as a potential means of reducing stereotype threat. Only studies by Aronson et al. (2002) and Good et al. (2003) have examined if providing mentoring or receiving mentoring reduces stereotype threat. In Aronson et al.'s (2002) study, only a main effect for race on feelings of stereotype threat was found, with African American participants reporting feeling more stereotype threat than Caucasians across mentoring conditions in their study. African Americans in the stereotype threat reduction condition did not report feeling less stereotype threat than African Americans in the mentoring control and no-mentoring control conditions. Good et al. (2003) did not report any results regarding feelings of stereotype threat in their study. Both Aronson et al. (2002) and Good et al. (2003) inferred stereotype threat reduction by demonstrating that stereotyped individuals in the stereotype threat reduction mentoring condition performed better than stereotyped individuals in the other conditions of their respective studies. The present study adds to the literature by showing that mentors and protégé in a stereotype threat reduction mentoring condition report experiencing less stereotype threat than mentors and protégés in non-stereotype threat reduction mentoring conditions. By directly linking mentoring to stereotype threat reduction, the present study does not have to indirectly infer stereotype threat reduction by demonstrating performance differences between participants in the different mentoring conditions.

The finding that the mentoring condition utilizing techniques found to reduce stereotype threat was more effective at reducing stereotype threat than the academic, as well as the non-academic, mentoring conditions suggests that mentoring alone may not be sufficient to reduce stereotype threat. In order to reduce stereotype threat to the greatest degree, mentors must engage their protégés in discussions and activities specifically designed to reduce stereotype threat. Analysis of the relationship between the frequency of self-theories, self-affirmation, and misattribution comments and feelings of stereotype threat in STEM classes revealed that the frequency of self-theories comments was related to decreased feelings of stereotype threat in STEM classes for both mentors and protégés. Additionally, the frequency of self-affirmation comments was related to decreased feelings of stereotype threat in STEM classes for mentors but not protégés. In contrast, the frequency of misattribution comments was not related to decreased feelings of stereotype threat in STEM classes for both mentors and protégés. These findings suggest that engaging in discussions regarding the incremental nature of intelligence may be the key mechanism behind stereotype threat reduction.

The present study also contributes to research on self-theories by documenting that self-theories can change via a structured mentoring program. Mentors and protégés in the stereotype threat mentoring condition endorsed an incremental theory of intelligence to a greater extent and endorsed an entity theory of intelligence to a lesser extent after the conclusion of the mentoring sessions than mentors and protégés in the academic and non-academic mentoring conditions. These findings suggest that receiving or providing academic mentoring does not change a person's self-theories to the same extent as being in a mentoring relationship that is focused specifically on altering people's self-theories. Given that greater endorsement of an incremental theory of intelligence is positively related and that greater endorsement of an entity theory of intelligence is negatively related to outcomes such as math grades, math identification, enjoyment of math, desire to major in math, and desire to pursue a math career (Blackwell et al., 2007; Burkley et al., 2010), any mentoring intervention that increases people's endorsement of an incremental theory of intelligence and decreases people's endorsement of an entity theory of intelligence can help increase the retention of women in STEM majors.

The link between stereotype threat and self-theories is an important contribution of this study. Prior research has found that getting people to endorse an incremental theory of intelligence reduces the effects of stereotype threat (Aronson et al., 2002; Good et al., 2003, 2012). The present study found that participants in the mentoring condition designed to get people to endorse an incremental theory of intelligence reported experiencing less stereotype threat in their STEM classes. Mediation analysis revealed that the effects of the stereotype threat reduction mentoring condition on protégés' stereotype threat were mediated by the frequency of self-theory comments. The more frequently self-theories were discussed, the less stereotype threat protégés felt. Future research should establish the causal relationship between stereotype threat and self-theories. It remains unclear if stereotype threat causes people to endorse an entity theory of intelligence or if endorsing an entity theory of intelligence makes one vulnerable to experiencing stereotype threat. Similarly, it is unclear if endorsing an incremental theory of intelligence completely buffers a person against the effects of stereotype threat. Future research should endeavor to discover the casual relationships between stereotype threat and self-theories.

Another contribution of the current study is the finding that the gender of the mentor does not matter for stereotype threat reduction. Across the three mentoring conditions, protégés paired with female mentors did not report experiencing less stereotype threat in their STEM courses than protégés paired with male mentors. Additionally, male and female mentors in the stereotype threat reduction condition were equally effective at reducing their protégés' feelings of stereotype threat in STEM courses. What remains unclear is whether the lack of gender effects was due to mentoring being provided electronically. It may be the case that the gender of the mentor matters when a protégé interacts with their mentor face-to-face. Future research should determine if mentor gender plays a role in stereotype threat reduction in face-to-face mentoring relationships. Despite these limitations, the present study's finding that male and female mentors were equally effective at reducing stereotype threat extends Bages and Martinot's (2011) finding that male and female role models can be equally effective at reducing stereotype threat when endorsing an incremental view of their success. Thus, it appears that the message a role model or a mentor sends is more important than the gender of a role model or mentor when trying to reduce stereotype threat.

The present study also extends mentoring research on the effects of gender in mentoring relationship. Although some studies have found that cross-gender mentoring relationships are associated with negative outcomes such as increased risk of stereotyping, decreased satisfaction, attributions of incompetence, negative visibility, interpersonal discomfort, and rumors of sexual involvement (Eby, 2010; Noe, 1988b; Ragins, 1997), many studies have found that the gender of a mentor does not matter in mentoring relationships (Eby et al., in press; O'Brien et al., 2010). The lack of mentor gender effects in the present study on protégés' feelings of stereotype threat, as well as protégés' self-theory endorsements extends mentoring research by documenting that having a same-gender mentor does not reduce stereotype threat or change a person's self-theories.

The finding that mentors and protégés both benefit from being in a mentoring relationship is yet another contribution to mentoring research. Both mentors and protégés in the stereotype threat reduction condition reported feeling less stereotype threat, endorsing entity theories of intelligence less, and endorsing incremental theories of intelligence more after the conclusion of the mentoring sessions. These findings suggest that mentoring relationships do not only beneficial to protégés, mentors benefit as well. By documenting some benefits of mentoring for mentors, the present study answers the call for more researching to examine the mentor's perspective in mentoring relationships (Allen & Eby, 2003; Eby, 2010; Ragins, 1997).

Lastly, the present study addressed the call for more stereotype threat research in non-laboratory settings (Bergeron et al., 2006; Chung et al., 2010; Cullen et al., 2004; Jordan & Lovett, 2007; Kalokerinos, von Hippel, & Zacher, in press; McKay et al., 2002, 2003). The present study differs from the majority of stereotype threat studies by attempting to alter people's feelings of stereotype threat in a non-laboratory context (i.e., stereotype threat in STEM classes). The finding that participants in the stereotype threat reduction condition reported feeling less stereotype threat than participants in the academic and the non-academic mentoring conditions suggests that stereotype threat in non-laboratory settings can be manipulated. This also suggests that stereotype threat is not a phenomenon exclusive to laboratory settings.

Practical Implications

The finding that both mentors and protégés benefit from the program allows for the potential for a more efficient means of stereotype threat reduction. Simultaneously reducing stereotype threat among upper- and lower-level students may reduce stereotype threat in STEM environments faster than other stereotype threat reduction techniques because culture change can be enacted across all levels of students at the same time. Interventions that only target lower- or upper-level students may be less effective because the recipients of the intervention may receive conflicting messages from those who did not participate in the program.

The finding that male and female mentors are equally effective at reducing stereotype threat increases the viability of utilizing a mentoring program to reduce stereotype threat among female students majoring in STEM fields. If maximum stereotype threat reduction occurs when female protégés are paired with female mentors, the viability of utilizing a mentoring intervention to reduce stereotype threat among female STEM majors is decreased because of the limited number of available female mentors due to the underrepresentation of women in STEM fields. However, the finding that male mentors are equally effective as female mentors at reducing stereotype threat among female STEM protégés makes future mentoring programs a pragmatic option given the large number of available male mentors in STEM fields.

The finding that a three-session mentoring program can decrease feelings of stereotype threat and entity theory endorsement also highlights the viability of utilizing a mentoring program to reduce stereotype threat among female students majoring in STEM fields. The mentoring program utilized in this study was relatively short-term when compared to 6-12 months that characterizes typical formal mentoring relationships, and the 3-6 years that characterizes typical informal mentoring relationships (Kram, 1985; Ragins & Cotton, 1999). Requiring only three sessions may result in a greater number of mentors and protégés being willing to commit to a mentoring relationship compared to if commitments spanning months or years were required.

Limitations

One key limitation in the present study was the lack of variability in the intention to remain in STEM measures. The majority of mentors and protégés indicated that they were going to pursue graduate education and obtain a doctoral degree. Similarly, the majority of mentors and protégés indicated that they were going to obtain a professional STEM job and continue to take STEM courses. Because mentors and protégés uniformly scored high on the intention measures, there was insufficient variability to adequately test hypotheses 3 and 4. The stereotype threat reduction mentoring condition may be effective at increasing intentions to remain in STEM by reducing stereotype threat. However, because of the ceiling effect on the intention measures in the present study, any effect that the stereotype threat reduction mentoring condition had on intentions was not detectable. Future research can address this limitation by collecting data regarding highest degree obtained and type of employment years after the program to determine if the stereotype threat reduction mentoring condition has a more positive effect on career outcomes than the academic and non-academic conditions in the present study.

The lack of non-biological STEM students is a limitation of the present study. The majority of the mentors and protégés who participated in the present study were majoring in biology and biomedical sciences. Although female students majoring in biology likely experience stereotype threat, they likely experience less stereotype threat than female students majoring in more underrepresented STEM fields. Despite the majority of participants majoring in biology-related fields, the present study found that the stereotype threat reduction mentoring program was effective at reducing feelings of stereotype threat. It is possible that the effects of the intervention would be even stronger among people exposed to more environmental conditions found to induce stereotype threat. Future research should determine if the mentoring intervention utilized in the present study is effective at reducing stereotype threat among female STEM students in fields characterized by greater female underrepresentation such as engineering and physics.

The lack of stereotype threat effect on the math test is another limitation of the present study. It may be the case that participants in the present study did not feel threatened while taking the math test. Supporting this possibility is the finding that the majority of mentors and protégés reported feeling little-to-no stereotype threat during the math test. One possible reason for the low-levels of stereotype threat during the math test is the predominance of biology students in the present study. Biology students may be less identified with mathematics than students in other STEM fields such as engineering or physics. The lower-levels of identification may have prevented stereotype threat from occurring. It is also conceivable that taking a math test as part of a program evaluation effort for a mentoring program designed to increase student retention does not induce stereotype threat. The math test was framed as one component of the program evaluation effort. One potential unintended consequence of framing the math test as one aspect of a program evaluation effort is that participants in the present study may have felt that math performance was not as important compared to participants in other stereotype threat studies where math performance is the central focus of the studies. The lack of stereotype threat during the math test may have also been due to the lack of an explicit stereotype threat manipulation. It may be the case that female participants who were in the stereotype threat reduction condition would perform better on a math test than female participants who were in the control conditions when stereotype threat is actually present in a testing environment. Future studies can determine if the stereotype threat reduction condition buffers women from the effects of stereotype threat by placing some women in conditions that have been found to induce stereotype threat (i.e., taking a math test in a room of male math test-takers) and placing some women in conditions that have been found to reduce stereotype threat (i.e., taking a math test in a room of female math test-takers, see Inzlicht & Ben-Zeev, 2000). If the stereotype threat reduction condition buffers women from the effects of stereotype threat, women who were in the stereotype threat reduction condition should not be affected by the presence of male or female test-takers. However, women in the mentoring control conditions should underperform when taking a math test in the presence of male test-takers compared to taking a math test in the presence of female test-takers because those women are not protected from the effects of stereotype threat.

Conclusion

The purpose of the present study was to determine if a stereotype threat reduction mentoring program could reduce feelings of stereotype threat among female STEM majors. Reduced feelings of stereotype threat was expected to increase female mentors' and protégés' intentions to remain in STEM, as well as increase female mentors' and protégés' math test performance. The present study was successful at demonstrating that a stereotype threat reduction mentoring program could reduce feelings of stereotype threat in STEM classes among female STEM majors. Specially, the more self-theories were discussed in mentoring sessions, the less female protégés reported feeling stereotype threat in their STEM classes. Unfortunately, the present study was unable to demonstrate differences in math test performance and intentions to remain in STEM across the mentoring conditions.

One question that emerges is how long do the effects of the stereotype threat reduction mentoring intervention last? Previous studies examining the effectiveness of incremental self-theory interventions have documented effects lasting weeks later (Aronson et al., 2002; Heslin et al., 2005). Previous studies examining the effectiveness of self-affirmation interventions have documented performance improvements two years after the intervention (Cohen et al., 2009). Similarly, studies examining the effectiveness of misattribution interventions have documented performance improvements three years after the intervention (Walton & Cohen, 2011). It is unclear if the effects of the stereotype threat reduction mentoring intervention in the present study will last as long as the other interventions. Despite the uncertainty regarding the long-term effectiveness of the stereotype threat reduction mentoring intervention, the present study found that the stereotype threat reduction mentoring intervention reduced feelings of stereotype threat in STEM classes, reduced endorsement of entity theories of intelligence, and increased endorsement of incremental theories of intelligence to a greater degree than an academic-focused, as well as a non-academic focused, mentoring interventions.

APPENDIX A: BIOLOGICAL AND ENVIRONMENTAL EXPLANATIONS FOR GENDER DIFFERENCES IN STEM ABILITIES AND INTERESTS

Brain Lateralization

Gender differences in brain lateralization has been offered as an explanation for female underrepresentation in STEM fields. Research suggests that the right hemisphere of the brain appears to be more related to visual-spatial ability, whereas the left hemisphere appears to be more related to verbal ability (Benbow, 1988; Halpern, 2000). However, females have been found to engage in more bilateral processing (i.e., utilizing both hemispheres simultaneously) than males (Gur & Gur, 2007; Halpern, 2000; Halpern et al., 2007). Because verbal information is argued to be more important to human functioning than visual-spatial information, it is proposed to be given greater priority by the brain (Halpern, 2000). By using both hemispheres to process verbal information, females are hypothesized to have fewer cognitive resources left to process visual-spatial information. Males, however, devote their entire right hemisphere to the processing of visual-spatial information because they primarily devote their left hemisphere to the processing of verbal information. Consequently, males are proposed to have an advantage over females in solving mathematical problems because they have more cognitive resources devoted to visual-spatial processing (Halpern, 2000). Conversely, females are proposed to be disadvantaged in solving mathematical problems because they are more likely to use a verbal-based strategy instead of a visual-spatial strategy (Halpern, 2000).

Unfortunately, definitive causal statements regarding the effects of brain lateralization on female underrepresentation in STEM fields cannot be made. First, some researchers disagree on whether there are significant gender differences in brain lateralization (Bleier, 1988; Bussey & Bandura, 1999; Bryden, 1988). Second, the brain lateralization hypothesis rests on the assumption that visual-spatial processing is the optimal way to solve mathematical problems, and that visual-spatial ability is a major contributor to STEM success (Bryden, 1988; Ceci et al., 2009). Although some research suggests that visual-spatial ability is related to mathematical ability (Casey et al., 1995), it is far from a definitive claim that high visual-spatial ability causes superior mathematical performance. Third, brain lateralization studies to date have focused on mean differences in ability (Ceci et al., 2009). None have examined differences in the upper-end of the distribution of abilities, which is likely where higher-level STEM professionals are drawn from. Fourth, research has yet to link brain lateralization to differences in interests, which may be a bigger contributor to female underrepresentation in STEM fields than gender differences in ability based upon the larger gender difference in interest compared to visual-spatial ability. Lastly, researchers cannot experimentally manipulate the degree to which a brain is lateralized. Thus, the relationship between gender, brain lateralization, and visual-spatial ability has not been causally established. The correlation between males having more lateralized brains and males having better visual-spatial performance does not causally establish that males are better at visual-spatial tasks because of their lateralized brains (Halpern, 2000). It may be the case that males are more lateralized for genetic reasons and better at visual-spatial tasks for environmental reasons. Thus, the relationship between brain lateralization and visual-spatial ability may be spurious. As Halpern (2000) noted, “it does not necessarily follow that lateralization is the optimal brain organization for spatial ability because it is found more frequently in the sex that tends to have better spatial ability” (p. 223). Consequently, it remains unclear how large of a role gender differences in brain lateralization plays in female underrepresentation in STEM fields.

Sex Hormones

An alternative biologically based hypothesis focuses on the role of sex hormones. Nyborg (1983, 1988) proposes that sex hormones can explain differences in visual-spatial abilities. Estradiol is proposed to be the key hormone that influences visual-spatial ability. Nyborg argues that there is an optimal level of estradiol for superior visual-spatial ability. Because estradiol is a type of estrogen, many females are proposed to have estradiol levels that exceed the optimal range for superior visual-spatial ability. Consequently, females with relatively lower levels of estradiol are predicted to have superior visual-spatial ability. Conversely, most males are argued to have insufficient levels of estradiol for superior visual-spatial ability. Consequently, males with relatively higher levels of extradiol are predicted to have superior visual-spatial ability. This leads to the prediction that females who are more masculine compared to other females and males who are more feminine compared to other males should have superior visual-spatial ability. Initial evidence appears to support the proposition that females with low levels of estradiol and males with high levels of estradiol demonstrate superior visual-spatial ability (Halpern et al., 2005).

Periodic fluctuations in hormone levels have been used as evidence of the importance of estradiol for visual-spatial ability. For example, Hampson and Kimura (1988) found that women perform better on visual-spatial tasks during menstruation, when estradiol levels are low, compared to mid-cycle, when estradiol levels are high. A study by Moffat and Hampson (1996) demonstrated comparable effects among males. Because testosterone levels vary daily, with testosterone levels typically being higher during the morning, males should perform better on visual-spatial tasks later in the day when their testosterone levels are lower and their estrodiol levels are higher. Moffat and Hampson found this pattern of results in their study with males performing better on visual-spatial tasks later in the day compared to earlier in the day. Females demonstrated the opposite pattern of results, presumably because their estrodiol levels were lower later in the day.

Although suggestive, the link between sex hormones and female underrepresentation in STEM fields remains to be determined. First, researchers have noted numerous inconsistent findings in the literature regarding the relationship between sex hormones and visual-spatial ability (Ceci et al., 2009; Hines, 2007). Supportive studies are offset by studies of comparable quality that fail to find effects. Second, the populations studied may not be generalizable to the people who pursue STEM fields. Many studies use clinical populations and no studies have been carried out examining the upper-end of the distribution of abilities (Ceci et al., 2009). Third, similar to the limitation of the brain lateralization hypothesis, the sex hormone hypothesis is dependent on the link between visual-spatial ability and mathematical ability. Finally, although studies have been supportive of the link between sex hormones and visual-spatial performance, it is important to note that effects of hormones on visual-spatial performance tend to be small and may not be detectable in non-laboratory settings (Halpern et al., 2005). Thus, it remains unclear how much sex hormones contribute to female underrepresentation in STEM fields.

Limitations of Biological Explanations

Both biological explanations rely on gender differences in visual-spatial ability to account for female underrepresentation in STEM fields. However, alternative environmental explanations can be offered to explain gender differences in visual-spatial ability. For example, studies have found that parents allow boys to explore their environments more than girls (Bussey

& Bandura, 1999; Halpern et al., 2007; Hyde, 2007). Studies also reveal that visual-spatial ability can be developed through training (Baenninger & Newcombe, 1989; Newcombe, 2007) and playing videogames (Ceci et al., 2009; Feng, Spence, & Pratt, 2007; Newcombe, 2007; Terlecki, Newcombe, & Little, 2008). Unfortunately, schools tend to have no formal training geared towards developing visual-spatial ability (Halpern, 1997; Halpern et al., 2007; Hyde, 2007). Consequently, given the lack of formal training in schools, males may have more non-school opportunities to develop their visual-spatial ability because they are allowed to explore and interact with the external world more than females. A lifetime of differential experiences may in turn produce observable differences in brain structure (Ceci et al., 2009).

It should be noted that biological factors alone cannot account for female underrepresentation in STEM fields because biological factors depend on environmental factors in order to develop (Berenbaum & Resnick, 2007; Ceci & Williams, 2007; Ceci et al., 2009; Halpern, 2000). To account for the interaction between biological systems and environmental factors, Halpern (2000) proposes a psychobiosocial model in which biology and environments mutually influence each other. In essence, Halpern (1997, 2000; Halpern et al., 2005) argues that it is impossible to distinguish between the main effects of biology and the environment because there are no main effects. For example, a person may be born with a predisposition to have high mathematical ability but never develop those abilities because of subpar schooling (Halpern, 2000). Furthermore, studies have found that experience and exposure to certain environments affect brain structures and hormone levels (Halpern, 1997, 2000, 2007; Halpern et al., 2005). For example, exposure to stress, disease, or malnutrition can affect a person's hormone levels. Additionally, Halpern and colleagues (Halpern, 2007; Halpern et al., 2007) discuss study findings indicating that the more years cab drivers worked, the larger their right posterior hippocampus. One explanation that was offered for the change in brain structure was that the longer cab drivers worked as cab drivers, the more they developed their visual-spatial ability. In acknowledging the potential role of biological factors in creating predispositions and potential upper limits, research has identified the profound impact of environmental factors in the development of people's interests and abilities.

Cross-Cultural Studies

Cross-cultural studies also provide evidence for why a completely biological explanation cannot account for female underrepresentation in STEM fields. Studies have found larger differences between countries than any gender difference within a given country (Hyde, 2007; Lummis & Stevenson, 1990; Valian, 2007). In other words, the slight differences between males and females on math performance in a given country are offset by larger differences between members of different countries. For example, Lummis and Stevenson (1990) noted that Japanese and Taiwanese females outperform American males to a greater degree than American males outperform American females. Additionally, Guiso et al. (2008) demonstrate that gender differences in math performance disappear in countries with greater gender equality (e.g., Norway and Sweden). These findings suggest that cultural factors can exert a strong influence on people's performance that is not accounted for by biological factors.

Declining gender differences over the last couple of decades also rules out a completely biological explanation. For example, in 1966 females earned 6.1% of the doctorates in mathematical and computer science, 4.5% of the doctorates in the physical sciences, and 0.3% of the doctorates in engineering (National Science Foundation, 2008b). In 2006, females earned

25.3% of doctorates in mathematical and computer science, 27.8% of the doctorates in the physical sciences, and 20.2% of the doctorates in engineering. In terms of standardized mathematics test performance, women have gone from being underrepresented 13:1 among the top 0.01% of test takers to being underrepresented 4:1 in less than 10 years (Wai et al., 2010). If biological differences are the primary cause of female underrepresentation in STEM fields than there should have been no changes in female representation in STEM fields over the last few decades because the time period is too short for any evolutionary changes to occur (Bussey & Bandura, 1999; Ceci et al., 2009; Hyde, 2007). These recent changes in female representation in STEM fields suggest that environmental factors may play a large role in affecting female representation in STEM.

Differential Course-Taking

An early environmental explanation for female underrepresentation in STEM fields focused on differential course-taking. Differential course-taking refers to differences between males and females in the number and types of courses taken. The underlying argument of the differential course-taking hypothesis is that female underachievement and underrepresentation in STEM fields is due to females taking fewer STEM courses. By taking fewer STEM courses, females have fewer opportunities to develop their STEM abilities, which in turn results in females underperforming on standardized tests of STEM abilities. Some studies have generated support for the differential course-taking hypothesis by demonstrating that the gender gap in standardized math test performance is reduced after controlling for the number of math-related courses taken (Halpern, 2000; Kimball, 1989). Unfortunately, although sizeable reductions in the math test performance gap have been noted, controlling for the number of math courses taken does not completely eliminate the gender gap in standardized math test performance (Halpern, 2000; Kimball, 1989). In some cases, controlling for the number of math courses taken does not reduce gender gap on standardized math tests at all (Benbow & Stanley, 1980, 1983). Byrnes (2005) also notes that gender differences in mathematical and verbal testing appear before male and female students take different courses. This presents a problem for the differential course-taking hypothesis because gender differences in mathematical and verbal testing should appear after males and females begin taking different courses. Additionally, it appears that with the exception of physics courses, there are no longer any gender differences in the number of demanding STEM courses taken in high school (Ackerman et al., 2001; Ceci & Williams, 2007; Ceci et al., 2009; Chipman, 2005; Huang, Taddese, Walter, & Peng, 2000; Hyde & Kling, 2001; Hyde, 2007; Lindberg et al., 2010; Williams & Ceci, 2007). These findings seem to indicate that differential course-taking may be less of a contributor to female underrepresentation in STEM fields today than in the past.

Chilly Climates

Although males and females take roughly the same number of classes now, their experiences in classes may be drastically different. Some research suggests that many teachers have sex-typed beliefs and may communicate these beliefs both subtly and explicitly (Catsambis, 2005; Ceci et al., 2009; Eccles, 1987; Hyde, 2007; Kimball, 1989). For instance, females are ignored more than males, whereas males are encouraged more than females in math and science classes (Byrnes, 2005; Ceci et al., 2009; Halpern, 2000; Hyde, 2007; Kimball, 1989; Oakes, 1990). This differential treatment may be even more prevalent in college STEM courses, with some proposing that women experience “chilly climates” in STEM courses (Fassinger, 2008;

Fassinger & Asay, 2006; Flam, 1991; Hall & Sandler, 1982; Sandler & Hall, 1986; Seymour, 1995; Seymour & Hewitt, 1997). Chilly climates are characterized as unwelcoming environments that are hostile to women. Features of chilly climates include sexist attitudes and comments, double standards, inequitable resource allocation, and exclusion from social circles. Any one of these experiences may in and of themselves have a small effect on women in STEM fields. However, these "micro inequities" may compound and add up over time (Fassinger & Asay, 2006; Hyde & Kling, 2001). These experiences may in turn motivate women to leave STEM fields to pursue less hostile environments (Seymour, 1995; Seymour & Hewitt, 1997).

A study by Wenneras and Wold (1997) demonstrates the biases that may exist against women in STEM fields. In this study, Wenneras and Wold examined the relationship between gender and evaluations of one's scientific work. Wenneras and Wold noted that women were underrepresented in the number of research grants awarded in Sweden. To determine if this underrepresentation was due to differences in performance, Wenneras and Wold calculated the impact factor of each grant applicant's scientific publications. Presumably, if women were awarded fewer grants because they demonstrated less ability, this would be reflected in women having a lower impact factor. This was not the case; instead, grant reviewers overestimated the accomplishments of male applicants and underestimated the accomplishment of female applicants. For instance, the most productive women (i.e., 100 impact points or more) were evaluated as competent as the least productive men (i.e., less than 20 impact points) by grant reviewers. In order to receive the same competence score as an average male scientist, female scientists had to be 2.5 times more productive. It is interesting to note that Sweden was named by the U.N. as the world's leading country in terms of equal opportunities for men and women around the time of the study. Presumably, other countries with less equal opportunity would face similar or greater gender discrimination issues. Although chilly climates appear to exist in STEM fields, it is unclear if chilly climates are the primary driver of women leaving STEM fields or if it is something that makes it easier to leave STEM fields when other factors come into play (Seymour & Hewitt, 1997).

Expectations of Success and Subjective Task Values

Although differential course-taking and chilly climates have received some attention and support, Eccles's (1987, 1994) expectancy x value model remains one of the most comprehensive explanations for female underrepresentation in STEM fields. Eccles proposes that the achievement related choices people make are most strongly determined by their expectations of success and their subjective task value. Expectation of success refers to whether a person believes he or she will be successful in a particular course of action; it is conceptually similar to a person's domain specific self-efficacy (Wigfield & Eccles, 2000). Subjective task value refers to how much importance or value a person attaches to the different options he or she is aware of. The higher a person's expectations of success and the greater the degree to which a person values an option, the greater the likelihood he or she will select that particular option.

Although both expectations of success and subjective task values influences the achievement related choices people make, they may differential effects on different outcomes. For example, research has found that expectations of success are a better predictor of math performance than subjective task values, whereas subjective task values are a better predictor of intentions to pursue math and science than expectations of success (Eccles, 2007; Wigfield & Eccles, 2000). However, it is important to note that expectations of success and subjective task value are proposed to be multiplicatively related. If either expectations of success or subjective task value is zero, that particular option will not be chosen.

Gender differences in STEM-related expectations of success have been documented. Given the similarities between expectations of success and self-efficacy, research on self-efficacy is relevant for understanding female underrepresentation in STEM fields. In general, self-efficacy has been found to be related to interest in a domain and performance (Multon, Brown, & Lent, 1991; Rottinghaus, Larson, & Borgen, 2003; Stajkovic & Luthans, 1998). Given that self-efficacy is argued to be task and domain specific (Bandura, 1986, 1997), research on STEM-related self-efficacy may be more relevant for understanding female underrepresentation in STEM fields. In general, males have been found to have higher mathematics, science, and technology self-efficacy than females (Betz & Hackett, 1983; Pajares, 2005; Else-Quest et al., 2010). In the case of mathematics self-efficacy, it has been found to be positively related to mathematics test performance and the selection of math-related majors (Betz & Hackett, 1983; Pajares, 2005; Pajares & Miller, 1995).

Gender differences in subjective task value have also been documented. Subjective task value is argued to be a multi-dimensional construct consisting of intrinsic value, attainment value, and utility value (Eccles, 1994, 2007; Meece, Parsons, Kaczala, Goff, & Futterman, 1982; Wigfield & Eccles, 2000). Intrinsic value refers to the enjoyment a person gets from an activity. Attainment value refers to the degree to which success on a task is meaningful to one's sense of self. Lastly, utility value refers to the degree to which success on a task helps one obtained desired outcomes. In general, females value math less, and view math as less enjoyable, useful, and important than males (Eccles, 1994; Else-Quest et al., 2010).

A variety of factors have been proposed to influence people's expectations of success and subjective task values. Notable predictors of a person's expectations of success and subjective task values include cultural stereotypes, as well as the beliefs and behaviors of socializers such as parents and teachers (Eccles, 1987, 1994). Evidence suggests that beliefs of socializers influence children's beliefs regarding their abilities (Bleeker & Jacobs, 2004; Eccles, Jacobs, & Harold, 1990; Gunderson, Ramirez, Levine, & Beilock, 2012; Jacobs, 1991; Jacobs & Eccles, 1992; Parsons, Adler, & Kaczala, 1982). For example, Jacobs and Eccles (1992) found that children's perceptions of their own ability were more strongly influenced by their mothers' expectations of their abilities than their actual performance. Additionally, mothers' expectations were found to be partially influenced by gender stereotypes. In essence, mothers were more likely to believe that their son had higher math ability than their daughter, even when their math abilities were equivalent.

Yee and Eccles (1988) also provide evidence that parents subscribe to stereotypical beliefs regarding their children. In this study, parents were found to believe that natural talent was a more important reason for their son's math success than their daughter's math success. Conversely, parents believed that effort was a more important reason for their daughter's success than their son's success. The more parents believed that their child's math success was due to effort, the lower the parent's evaluation of their child's math talent. Conversely, the more parents believe that their child's math success was due to natural talent, the higher the parent's evaluation of their child's math talent. Other studies have obtained similar findings, revealing that the math success of females is attributed to effort, whereas failure is attributed to lack of ability. Conversely, the math success of males is attributed to ability, whereas failure is attributed to lack of effort (Gunderson et al., 2012). Additionally, Jacobs, Davis-Kean, Bleeker, Eccles, and Malanchuk (2005) found that girls' interests in mathematics declined as their fathers' views became more stereotypical.

In addition to the influence of parents, young children may be strongly influenced by their peers. In order to be accepted into same-sex peer groups children often have to conform to group norms, which often entail conformity to sex-type behaviors (Bussey & Bandura, 1999; Catsambis, 2005; Harris, 1995). Consequently, female peers may exert strong pressure to avoid pursuing STEM domains (Stake & Nickens, 2005). These findings, along with others, has led Eccles (2007) to argue that gender role stereotypes may play a large role in shaping the perceived career options of men and women.

In terms of women who end up pursuing STEM careers, one implication of Eccles's (1987, 1994) research is that efforts must be taken to ensure that women's expectations of success in STEM fields and valuing of STEM fields remains high. Presumably women who major in STEM fields start out with high expectations and value the field enough to pursue a career in it. Consequently, factors that undermine women's expectations of success in STEM fields and valuing of STEM fields must be identified and minimized/eliminated.

APPENDIX B: IRB APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Luiz F. Xavier** and Co-PI: **Barbara Fritzsche**

Date: **March 11, 2013**

Dear Researcher:

On 3/11/2013, the IRB approved the following human participant research until 3/10/2014 inclusive:

Type of Review:	UCF Initial Review Submission Form
Project Title:	The Effects of Mentoring Students in Science, Technology, Engineering, and Math Fields
Investigator:	Luiz F Xavier
IRB Number:	SBE-13-09134
Funding Agency:	
Grant Title:	
Research ID:	N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

If continuing review approval is not granted before the expiration date of 3/10/2014, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 03/11/2013 01:48:01 PM EST

Joanne Muratori

IRB Coordinator

APPENDIX C: PROTÉGÉ/MENTOR PROFILE

First Name:

Major:

Minor (if applicable):

If you have any other degrees, please list them:

Class Standing (i.e., freshman, sophomore, junior, or senior):

Three personality traits that best describe me:

1)

2)

3)

What I see myself doing 5 years after I graduate:

Activities I enjoy in my spare time:

<u>Availabilities</u>

Monday:

Tuesday:

Wednesday:

Thursday:

Friday:

Saturday:

Sunday:

APPENDIX D: DEMOGRAPHIC QUESTIONAIRE

Please answer the questions about yourself to the best of your knowledge. If you do not know the answer to the question or the question does not apply to you, please write "N/A" to indicate it is not applicable.

1) How long have you been using the Internet (in years)?
2) How many hours per day do you spend online?
3) Do you use a Mac or a PC?
4) What is your employment status? (not employed, employed full-time, employed part-time)
5) How many credit hours are you enrolled in this semester?
6) What is your UCF GPA?
7) If you took the ACT, what was your score?
8) If you took the SAT, what was your score?
    a. Critical reading?
    b. Mathematics?
    c. Writing?
9) Are you currently participating in a mentoring program? Yes or No? If yes, which program(s) _________?
10) Have you previously participated in a mentoring program? Yes or No? If yes, which program(s) _________?
11) Are you the first one in your immediate family to attend college? Yes or No
12) What is the highest education level of your mother?
13) If your mother has a college degree or above, what field is her degree in?

14) What is the highest education level of your father?

15) If your father has a college degree or above, what field is his degree in?

16) Do you know someone who is working in a science, technological, engineering, or math field? If yes, who?

17) How old are you? ______

18) What is your sex? Male or Female (circle one)

19) What is your race or ethnic background? (check "yes" or "no" next to each race or ethnic group; if you choose "Other" as your response, please specify your race or ethnic group)

Yes	No	
☐	☐	White (Non-Hispanic)
☐	☐	Black or African American (Non-Hispanic)
☐	☐	Asian
☐	☐	American Indian or Alaska Native
☐	☐	Native Hawaiian or Other Pacific Islander
☐	☐	Hispanic or Latino
☐	☐	Other: (Specify) ______________________

20) If you chose more than one race or ethnic group in the previous question, which one do you most identify with?

a. White (Non-Hispanic)
b. Black or African American (Non-Hispanic)
c. Asian
d. American Indian or Alaska Native
e. Native Hawaiian or Other Pacific Islander
f. Hispanic or Latino
g. Other: (specify)________________________

APPENDIX E: SELF-AFFIRMATION EXERCISE

Below is a list of values, some of which may be important to you, some of which may be unimportant. Please rank these values in order of their importance to you, from 1 to 15 (1 = *most important item*, 15 = *least important item*). Use each number only once.

_______Artistic skills/aesthetic appreciation

_______Sense of humor

_______Relationships with friends/family

_______Spontaneity/living life in the moment

_______Social skills

_______Athletics

_______Musical ability/appreciation

_______Creativity

_______Business/managerial skills

_______Romantic values

_______Government/Politics

_______Independence

_______Learning and gaining knowledge

_______Belonging to a social group (such as a school club)

_______Spiritual/religious values

Now that you have identified the values that are most important to you, please describe in a few sentences why your highest ranked value is important to you. Additionally, please write about a particular time your most important value had a meaningful impact on your life. Focus on your thoughts and feelings, and don’t worry about spelling, grammar, or how well written your answer is.

Please indicate your agreement with the following statements regarding your highest ranked value.

1) This value has influenced my life
2) In general, I try to live up to this value
3) This value is an important part of who I am
4) I care about this value

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

APPENDIX F: SELF-AFFIRMATION PROMPT

Having common values and interests is one of the key predictors of having a successful mentoring relationship. Consequently, this mentoring session is designed to help you get to know your protégé and to help your protégé get to know you. On the next page is a values exercise. We encourage you to complete this exercise and discuss your responses with your protégé. We also encourage you to get your protégé to discuss their responses as well. You may discover that you have a lot in common with your protégé.

APPENDIX G: MISATTRIBUTION PROMPT

Many students experience difficulty when they enter new educational situations such as transitioning from high school to college or from general education courses to courses in one's major. Although students may struggle initially, many students bounce back and succeed after they adjust to their new environment. Given the potential difficulty of this transition, some students may end up feeling that they are not capable of succeeding in college or their major. Additionally, many students mistakenly conclude that they are the only ones struggling. Learning about someone else who struggled in similar circumstances is very helpful to students because it shows that they are not alone in their struggles. We encourage you to discuss times when you had difficulty adjusting to college and/or your specific major, and how you overcame those challenges. Additionally, we encourage you to get your protégés to discuss some of the concerns they have regarding college, their classes, and/or their specific major. By getting your protégé to discuss their concerns, you can show your protégé how their concerns are shared amongst many students and are caused by the inherent difficulty of their situation, and are not caused by a lack of ability on their part.

APPENDIX H: INCREMENTAL THEORY OF INTELLIGENCE PROMPT

Research has found that a large number of students believe that their intelligence is a fixed trait. In other words, many students believe that people are born smart or dumb and that there is nothing that can be done about it. In actuality, research has found that intelligence is malleable. In other words, people can develop their intelligence through hard work and practice. For example, people are not born with an innate knowledge of how to perform calculus; they learn how to perform calculus by going to school and studying. It is important to get students to realize that they can become smarter by studying and practicing. Otherwise, students may become discouraged when they perform poorly in class. They may believe that they simply lack what it takes to succeed in school or their major. To prevent this from happening, we encourage you to discuss things that you learned to do well. It may be most helpful to discuss things that you struggled with initially but learned to master through practice, effort, and hard work. We also encourage you to get your protégé to discuss things that they learned to do well through practice, effort, and hard work.

APPENDIX I: ACDEMIC CONTROL DISCUSSION PROMPTS

Week 1 discussion prompts:

The purpose of this mentoring program is to provide students who are beginning their academic careers with insight from students who have faced similar challenges. This program is designed to help students set goals and to identify the steps they need to take in order to achieve their career goals. Each week you will be provided prompts to help stimulate conversation.

Why did you agree to be a mentor?

Why did your protégé seek to utilize this service?

What do you and your protégé hope to get out of this mentoring relationship?

What does your protégé like best and least about taking college courses? Find out some of the challenges that your protégé is facing in their classes.

What are your goals for this semester?

What are your protégé's goals for this semester?

What do you and your protégé want to accomplish in college?

How does getting a college degree fit in with your life plan and your protégé's life plan?

Week 2 discussion prompts:

What is the key lesson that you learned over the years that you wished you knew day one?

How important is it to meet regularly with an advisor?

Is it important to have a faculty mentor?

How does one go about getting a faculty mentor?

How does one get to know faculty in large classes?

Does your protégé wish to pursue graduate school? What do they need to do to be competitive for graduate school?

What does a person need to do to get faculty recommendations?

Week 3 discussion prompts:

What are the career options for one’s major?

Where can you find information regarding career options in your major?

What can you do with a degree in _____?

What are the pros and cons of getting graduate degrees (i.e., masters, doctorates)?

What does one have to do to be competitive for a graduate degree?

How can one gain relevant work experience?

How does one get an internship related to one’s field of study?

APPENDIX J: NON-ACDEMIC CONTROL DISCUSSION PROMPTS

Week 1 discussion prompts:

The purpose of this mentoring program is to provide students who are beginning their academic careers with insight from students who have faced similar challenges. This program is designed to help students come up with strategies to balance the multiple commitments they face on a regular basis. Each week you will be provided prompts to help stimulate conversation.

Why did you agree to be a mentor?

Why did your protégé seek to utilize this service?

What do you and your protégé hope to get out of this mentoring relationship?

What does your protégé like best and least about being in college? Find out some of the challenges that your protégé is facing adjusting to life in college.

What hobbies do you and your protégé have?

What are some goals that you and your protégé have for the next year?

What do you and your protégé want to accomplish in life?

What do you hope to do after college?

Week 2 discussion prompts:

What are some of the challenges that your protégé is facing in regards to adjusting to life in college?

How do you and your protégé balance your school and non-school commitments?

How do you maintain your relationships with friends and family while dealing with the challenges of school?

How does one go about making friends at a large university?

How does one get to know other students in large classes?

Where can students go to for additional social support?

Are there any student organizations that the student should become involved in?

Week 3 discussion prompts:

What do you and your protégé enjoy doing when you have free time?

What are some fun things to do around town?

How does one find out about upcoming events?

What are some healthy ways of dealing with stress?

Are there any extra-curricular activities that can help students unwind?

Should a person have a job while going to school? If yes, what kind of job should a person get?

How many hours should a person work?

APPENDIX K: SELF-THEORIES QUESTIONAIRE

This questionnaire has been designed to investigate ideas about intelligence. There are no right or wrong answers. We are interested in your ideas.

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by writing the number that corresponds to your opinion in the space next to each statement.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

1) You have a certain amount of intelligence, and you can't really do much to change it. (entity)
2) Your intelligence is something about you that you can't change very much. (entity)
3) No matter who you are, you can significantly change your intelligence level. (incremental)
4) To be honest, you can't really change how intelligent you are. (entity)
5) You can always substantially change how intelligent you are. (incremental)
6) You can learn new things, but you can't really change your basic intelligence. (entity)
7) No matter how much intelligence you have, you can always change it quite a bit. (incremental)
8) You can change even your basic intelligence level considerably. (incremental)

APPENDIX L: STEREOTYPE THREAT EXPERIENCED IN CLASS QUESTIONNAIRE

The following questions are about your feelings regarding the degree to which your gender affects other people's evaluations of your S.T.E.M. ability. Think about the classes in your major and rate from 1(*never*) to 5 (*always*) how often you feel that because of your gender:

1) Professors expect me to do poorly on tests in S.T.E.M. classes because of my gender
2) S.T.E.M. tests may be easier for people of my gender.
3) I doubt that others would think that I have less S.T.E.M. ability because of my gender.
4) Some people feel I have less S.T.E.M. ability because of my gender.
5) People of my gender rarely face unfair evaluations in S.T.E.M. classes.
6) In S.T.E.M. classes people of my gender often face biased evaluations from others.
7) My gender does not affect people's perception of my S.T.E.M. ability.
8) In S.T.E.M. classes I often feel that others look down on me because of my gender.

APPENDIX M: SENSE OF BELONGING QUESTIONNAIRE

We would like you to answer some questions about your experience with S.T.E.M. courses and in the S.T.E.M. academic community. When we mention the S.T.E.M. academic community, we are referring to the broad group of people involved in that field, including the students in a S.T.E.M. course.

We would like you to consider your membership in the S.T.E.M. community. By virtue of having taken many S.T.E.M. courses, both in high school and/or at UCF, you could consider yourself a member of the S.T.E.M. community. Given this broad definition of belonging to the S.T.E.M. community, please respond to the following statements based on how you feel about that group and your membership in it.

There are no right or wrong answers to any of these statements; we are interested in your honest reactions and opinions. Please read each statement carefully, and indicate the number that reflects your degree of agreement.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

When I am in a S.T.E.M. setting,

1) I feel that I belong to the S.T.E.M community.
2) I consider myself a member of the S.T.E.M. world.
3) I feel like I am part of the S.T.E.M. community.

4) I feel a connection with the S.T.E.M. community.

5) I feel accepted.

6) I feel respected.

7) I feel disregarded. (reverse code)

8) I feel valued.

9) I feel neglected. (reverse code)

10) I feel appreciated.

11) I feel excluded. (reverse code)

12) I feel insignificant. (reverse code)

13) I feel at ease.

14) I feel anxious. (reverse code)

15) I feel comfortable.

16) I feel tense. (reverse code)

17) I feel nervous. (reverse code)

18) I feel content.

19) I feel calm.

20) I feel inadequate. (reverse code)

21) I wish I could fade into the background and not be noticed. (reverse code)

22) I try to say as little as possible. (reverse code)

23) I enjoy being an active participant.

24) I wish I were invisible. (reverse code)

25) I trust the testing materials to be unbiased.

26) I have trust that I do not have to constantly prove myself.

27) I trust my instructors to be committed to helping me learn.

28) Even when I do poorly, I trust my instructors to have faith in my potential.

APPENDIX N: STEREOTYPE THREAT DURING TESTING QUESTIONNAIRE

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by writing the number that corresponds to your opinion in the space next to each statement.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

1) I worry that my ability to perform well on math tests is affected by my gender.
2) I worry that if I perform poorly on this test, the experimenter will attribute my poor performance to my gender.
3) I worry that, because I know the negative stereotype about women and math, my anxiety about confirming that stereotype will negatively influence how I perform on math tests.

APPENDIX O: PERFORMANCE-AVOIDANCE GOALS DURING TESTING QUESTIONNAIRE

We are interested in your thoughts and feelings about completing the upcoming test. Using the scale provided, please rate your agreement with the following statements.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

Performance-Avoidance Goals

1) My goal is to avoid doing poorly on this test.
2) My fear of doing poorly on this test will motivates me.
3) I just want to avoid doing poorly on this test.
4) I'm worried about the possibility of doing poorly on this test.
5) I'm concerned that I may not do well on this test.
6) I'm concerned that I may not get many problems correct.

APPENDIX P: WORRY DURING TESTING QUESTIONNAIRE

To the left of each of the following statements, indicate your feelings, attitudes, or thoughts as they are *right now* in relation to this examination. Use the following numerical scale:

5 = The condition is very strong; the statement describes my present condition very well.

4 = The condition is strong.

3 = The condition is moderate.

2 = The condition is barely noticeable.

1 = The statement does not describe my present condition.

1) _____ I feel regretful.

2) _____ I am afraid that I should have studied more for this test.

3) _____ I feel that others will be disappointed in me.

4) _____ I feel I may not do as well on this test as I could.

5) ____ I do not feel very confident about my performance on this test.

APPENDIX Q: MATH TEST

1) If 3n <500, which of the following is the greatest possible value of n?
   a) 2
   b) 4
   c) 5
   d) 6
   e) 7

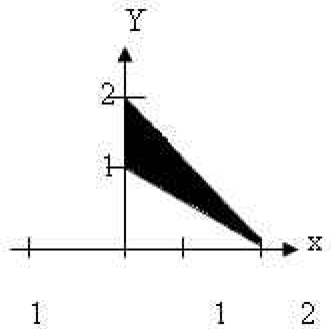
2) In deciding the asking price for a piece of property, a real estate broker determines that the market value of the lot is 1/7 the market value of the building on it. If the total value of the property is set at $140,000, then what is the total value of the lot?
   a) $10,000
   b) $17,500
   c) $20,000
   d) $120,000
   e) $122,500

3) Company A manufactures paper plates at a rate of 1,000K per hour, while company B manufactures plates at a rate of 1,000L per hour. If both companies work simultaneously, how many hours will it take them to manufacture 100,000 plates?
   a) 100/(K+L)
   b) 1/(K+L)
   c) K+L/100
   d) 100 (K+L)
   e) 1000 (K+L)

4) John has 4 ties, 12 shirts, and 3 belts. If each day he wears exactly one tie, one shirt and one belt, what is the maximum number of days he can go without repeating a particular combination?
   a) 12
   b) 21
   c) 84
   d) 108
   e) 144

5) If y = 2x-1, what is the value of x in terms of y?
   a) (y/2) –
   b) (y/2) – (1/2)
   c) (y/2) + (1/2)
   d) (y/2) + 1
   e) y + ½

6) In the figure below what is the area of the shaded region?



a) 1
b) 2
c) $2\sqrt{2}$
d) 3
e) 4

7) If a = 2, b = 4, and c = 5, then [(a+b)/c] – [c/(a-b)] =
a) 1
b) 37/10
c) 0
d) -11/30
e) -1

8) Which of the following is the greatest?
a) .00003/.0007
b) .008/.005
c) .007/.0008
d) .006/.0005
e) .01/.008

9) If (p-q)/p = 2/7, then q/p =
a) 2/5
b) 5/7
c) 1
d) 7/5
e) 7/2

10) If integer x were divided by 7, the quotient would be 12 with a remainder of 1. Therefore, x =
a) 91
b) 90
c) 88
d) 85
e) 83

11) If y is not 0 and 2x + y = 12, then which of the following is NOT a possible value of x?
a) 12
b) 10
c) 8
d) 6
e) 4

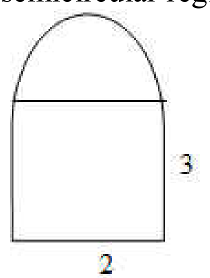
12) Two tanks, X and Y, are filled to capacity with jet fuel. Tank X holds 600 gallons more than tank Y. If 100 gallons of fuel were to be pumped from each tank, tank X would then contain 3 times as much fuel as tank Y. What is the total number of gallons of fuel in the two full tanks?
a) 1,400
b) 1,200
c) 1,000
d) 900
e) 800

13) If 4x + 3y = 8 and x/2 = 1/4, what is the value of y?
a) 4/3
b) 2
c) 7/3
d) 3
e) 10/3

14) Two people were hired to mow a lawn for a total of $45. They completed the job with one person working for 1 hour and 20 minutes and the other working 40 minutes. If they split the $45 in proportion to the amount of time each spent working on the job, how much did the person who worked longer receive?
a) $33.75
b) $30.00
c) $27.50
d) $25.00
e) $22.50

15) [102 (108 +108)] / 104
a) 2(104)
b) 2(106)
c) 108
d) 2(108)
e) 1010

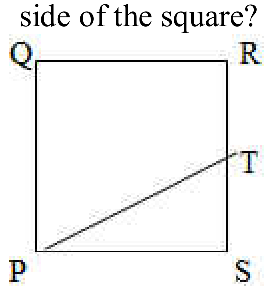
16) A rectangular window with dimensions 2 meters by 3 meters is to be enlarged by cutting out a semicircular region in the wall as shown above. What is the area, in square meters, of this semicircular region?



a) $\pi/4$
b) $\pi/2$
c) π
d) 2π
e) 4π

17) If n = 15 x 28 x 26, which of the following is NOT an integer?
a) n/15
b) n/21
c) n/32
d) n/35
e) n/39

18) In the square PQRS below, T is the midpoint of side RS. If PT = $8\sqrt{5}$, what is the length of a side of the square?



a) 16
b) $6\sqrt{5}$
c) $4\sqrt{5}$
d) 8
e) $2\sqrt{6}$

19) If q is not 0 and k = qr/2 – s, then what is r in terms of k, q, and s?
   a) (2k + s) /q
   b) (2sk)/q
   c) [2(k-s)]/q
   d) [(2k) + (sq)]/q
   e) [2(k + s)]/q

20) |3| + |-4| + |3-4|
   a) 14
   b) 8
   c) 7
   d) 2
   e) 0

21) A computer can perform 30 identical tasks in 6 hours. At that rate, what is the minimum number of computers that should be assigned to complete 80 of the tasks within 3 hours?
   a) 6
   b) 7
   c) 8
   d) 12
   e) 16

22) Which of the following is 850 percent greater than 8×10^3?
   a) 8.5×10^3
   b) 6.4×10^4
   c) 6.8×10^4
   d) 7.6×10^4
   e) 1.6×10^5

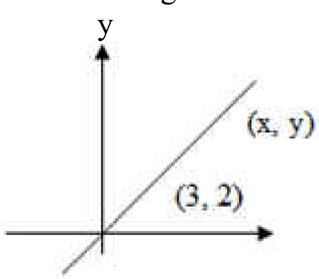
23) $\frac{9^2 - 6^2}{3} =$
   a) 1
   b) 15/9
   c) 5
   d) 8
   e) 15

24) What is 0.423658 rounded to the nearest thousandth?
   a) 0.42
   b) 0.423
   c) 0.424
   d) 0.4236
   e) 0.4237

25) If 3(x + 2) = x - 4, then x =
a) -5
b) -3
c) 1
d) 3
e) 5

26) If $x^2 + 2xy + y^2 = 9$, then $(x + y)^4$ =
a) 3
b) 18
c) 27
d) 36
e) 81

27) In the rectangular coordinate system below, if x = 4.8, then y =

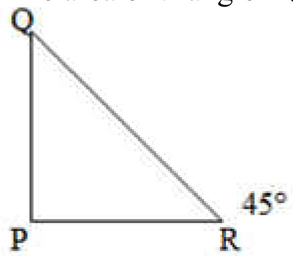


a) 3.0
b) 3.2
c) 3.4
d) 3.6
e) 3.8

28) If the sum of two numbers is 14 and their difference is 2, what is the product of the two numbers?
a) 24
b) 28
c) 40
d) 45
e) 48

29) A secretary typed 6 letters, each of which had either 1 or 2 pages. If the secretary typed 10 pages in all, how many of the letters had 2 pages?
a) 1
b) 2
c) 3
d) 4
e) 5

30) The area of triangle PQR is 32, what is the length of PR?



a) 2
b) 7
c) 8
d) 16
e) 32

31) If 3/x + 4/3x = 1/3, then x =

a) 7
b) 9
c) 11
d) 13
e) 15

32) $\dfrac{4/9 + 4/9 + 4/9 + 4/9 + 4/9 + 4/9}{6}$

a) 2/27
b) 4/9
c) 2/3
d) 8/3
e) 6

APPENDIX R: ACADEMIC CAREER DEVELOPMENT

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements regarding your relationship with your mentor.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

1) My mentor reduced unnecessary risks that could threaten the possibility that I would advance through my program of study.
2) My mentor helped me review assignments/tasks or meet deadlines that otherwise would have been difficult to complete.
3) My mentor offered to help me meet with other students.
4) My mentor gave me ideas for increasing contact with school administrators and faculty.
5) My mentor gave me ideas for activities to prepare me for an internship or job.
6) My mentor gave me ideas for activities that will present opportunities for me to learn new skills.
7) My mentor provided me with practical tips on how to accomplish academic objectives.
8) My mentor offered to introduce me to others who can provide me with academic opportunities.
9) My mentor helped me develop interpersonal communication, leadership, or team skills through feedback.

10) My mentor helped me to develop study skills.

11) My mentor offered to recommend to faculty, staff, employees, etc., for desired opportunities.

12) My mentor gave suggestions on how to better manage my time in order to complete my academic tasks successfully.

13) My mentor provided suggestions for how to better manage my finances.

14) My mentor suggested different places where I could apply for a job.

15) My mentor provided tips for taking exams successfully.

16) My mentor provided information about which courses to take.

17) My mentor provided information about which professors are good.

18) My mentor took time to look up academic or job-related information for me.

19) My mentor taught me about school policies.

20) My mentor provided me with information about the area around the university.

21) My mentor suggested places to live near or on campus.

APPENDIX S: PSYCHOSOCIAL SUPPORT

Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements regarding your relationship with your mentor.

5 = strongly agree

4 = agree

3 = neither disagree or agree

2 = disagree

1 = strongly disagree

1) My mentor shared the history of his/her academic career with me.
2) My mentor encouraged me to prepare for academic advancement.
3) My mentor encouraged me to try new ways of behaving in school.
4) My mentor demonstrated good listening skills in our conversations.
5) My mentor discussed my questions and concerns regarding feelings of competence.
6) My mentor discussed my questions and concerns regarding commitment to academic advancement.
7) My mentor discussed my questions and concerns regarding relationships with peers.
8) My mentor discussed my questions and concerns regarding relationships with faculty.
9) My mentor discussed my questions and concerns regarding work/family conflicts.
10) My mentor shared personal experiences as a different perspective to my problems.
11) My mentor encouraged me to talk openly about anxiety and fears that detract from my school work.
12) My mentor conveyed empathy for the concerns and feelings I discussed with him/her.

13) My mentor kept my feelings and doubts in strict confidence.

14) My mentor conveyed feelings of respect for me as an individual.

REFERENCES

Abrams, D., Eller, A., & Bryant, J. (2006). An age apart: The effects of intergenerational contact and stereotype threat on performance and intergroup bias. *Psychology and Aging, 21*, 691-702. doi: 10.1037/0882-7974.21.4.691

Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interest, and knowledge. *Intelligence, 22*, 227-257. doi: 10.1016/S0160-2896(96)90016-1

Ackerman, P. L., Bowen, K. R., Beier, M. E., & Kanfer, R. (2001). Determinants of individual differences and gender differences in knowledge. *Journal of Educational Psychology, 93*, 797-825. doi: 10.1037/0022-0663.93.4.797

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin, 121,* 219-245. doi: 10.1037/0033-2909.121.2.219

Allen, T. D., Day, R., & Lentz, E. (2005). The role of interpersonal comfort in mentoring relationships. *Journal of Career Development, 31*, 155-169. doi: 10.1007/s10871-004-2224-3

Allen, T. D., & Eby, L. T. (2003). Relationship effectiveness for mentors: Factors associated with learning and quality. *Journal of Management, 29*, 469-486. doi: 10.1016/S0149-2063(03)00021-7

Allen, T. D., & Eby, L. T. (2004). Factors related to mentor reports of mentoring functions provided: Gender and relational characteristics. *Sex Roles, 50*, 129-139. doi: 10.1023/B:SERS.0000011078.48570.25

Allen, T. D., Eby, L. T., O'Brien, K. E., & Lentz, E. (2008). The state of mentoring research: A qualitative review of current research methods and future research implications. *Journal of Vocational Behavior, 79*, 343-357. doi: 10.1016/j.jvb.2007.08.004

Allen, T. D., Eby, L. T., Poteet, M. L., Lentz, E., & Lima, L. (2004). Career benefits associated with mentoring for protégés: A meta-analysis. *Journal of Applied Psychology, 89,* 127-136. doi: 10.1037/0021-9010.89.1.127

Allen, T. D., Poteet, M. L., & Burroughs, S. M. (1997). The mentor's perspective: A qualitative inquiry and future research agenda. *Journal of Vocational Behavior, 51*, 70-89. doi: 10.1006/jvbe.1997.1596

Ambady, N., Shih, M., Kim, A., & Pittinsky, T. L. (2001). Stereotype susceptibility in children: Effects of identity activation on quantitative performance. *Psychological Science, 12*, 385-390. doi: 10.1111/1467-9280.00371

Appel, M., Kronberger, N., & Aronson, J. (2011). Stereotype threat impairs ability building: Effects on test preparation among women in science and technology. *European Journal of Social Psychology, 41*, 904-913. doi: 10.1002/ejsp.835

Aronson, E. (1999). The power of self-persuasion. *American Psychologist, 54*, 875-884. doi: 10.1037/h0088188

Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology, 38*, 113-125. doi: 10.1006/jesp.2001.1491

Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When white men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology, 35*, 29-46. doi: 10.1006/jesp.1998.1371

Aronson, J., Quinn, D. M., & Spencer, S. J. (1998). Stereotype threat and the academic underperformance of minorities and women. In J. K. Swim & C. Stangor (Eds.), *Prejudice: The target's perspective* (pp. 83-103). San Diego, CA: Academic Press.

Bages, C., & Martinot, D. (2011). What is the best model for girls and boys faced with a standardized mathematics evaluation situation: A hardworking role model or a gifted role model? *British Journal of Social Psychology, 50*, 536-543. doi: 10.1111/j.2044-8309.2010.02017.x

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Baenninger, M., & Newcombe, N. (1989). The role of experience in spatial test performance: A meta-analysis. *Sex Roles, 20*, 327-344. doi: 10.1007/BF00287729

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychosocial research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182. doi: 10.1037/0022-3514.51.6.1173

Beaton, A., Tougas, F., Rinfret, N., Huard, N., & Delisle, M.-N, (2007). Strength in numbers? Women and mathematics. *European Journal of Psychology of Education, 22*, 291-306. doi: 10.1007/BF03173427

Beggs, J. M., & Doolittle, D. C. (1993). Perceptions now and then of occupational sex typing: A replication of Shinar's 1975 study. *Journal of Applied Social Psychology, 23*, 1435-1453. doi: 10.1111/j.1559-1816.1993.tb01042.x

Beilock, S. L. (2008). Math performance in stressful situations. *Current Directions in Psychological Science, 17*, 339-343. doi: 10.1111/j.1467-8721.2008.00602.x

Bell, A. M., Spencer, S. J., Iserman, E., & Logel, C. E. R. (2003). Stereotype threat and women's performance in engineering. *Journal of Engineering Education, 92*, 307-312.

Benbow, C. P. (1988). Sex differences in mathematical reasoning ability among the intellectually talented: Their characterization, consequences, and possible causes. *Behavioral and Brain Sciences, 11,* 169–232. doi: 10.1017/S0140525X00078365

Benbow, C. P., Lubinski, D., Shea, D. L., & Eftekhari-Sanjani, H. (2000). Sex differences in mathematical reasoning ability at age 13: Their status 20 years later. *Psychological Science, 11*, 474-480. doi: 10.1111/1467-9280.00291

Benbow, C. P., & Stanley, J. C. (1980). Sex differences in mathematical ability: Fact or artifact? *Science, 210*, 1262-1264. doi: 10.1126/science.7434028

Benbow, C. P., & Stanley, J. C. (1983). Sex differences in mathematical reasoning ability: More facts. *Science, 222,* 1029-1031. doi: 10.1126/science.6648516

Ben-Zeev, A., Scharnetzki, L., Chan, L. K., & Dennehy, T. C. (2012). Hypermasculinity in the media: When men "walk into the fog" to avoid affective communication. *Psychology of Popular Media Culture, 1*, 53-61. doi: 10.1037/a0027099

Ben-Zeev, T., Fein, S., & Inzlict, M. (2005). Arousal and stereotype threat. *Journal of Experimental Social Psychology, 41*, 174-181. doi: 10.1016/j.jesp.2003.11.007

Berenbaum, S. A., & Resnick, S. (2007). The seeds of career choices: Prenatal sex hormone effects on psychological sex differences. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence* (pp. 147-157). Washington, DC: American Psychological Association. doi: 10.1037/11546-012

Bergeron, D. M., Block, C. J., & Echtenkamp, B. A. (2006). Disabling the able: Stereotype threat and women's work performance. *Human Performance, 19*, 133-158. doi:10.1207/s15327043hup1902_3

Betz, N. E. (2005). Women's career development. In Steven D. Brown & Robert W. Lent (Eds.), *Career development and counseling: Putting theory and research to work* (pp. 253-277). Hoboken: New Jersey: John Wiley & Sons, Inc.

Betz, N. E., & Hackett, G. (1983). The relationship of mathematics self-efficacy expectations to the selection of science-based college majors. *Journal of Vocational Behavior, 23*, 329-345. doi: 10.1016/0001-8791(83)90046-5

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*, 246-263. doi: 10.1111/j.1467-8624.2007.00995.x

Blake-Beard, S., Bayne, M. L., Crosby, F. J., & Muller, C. B. (2011). Matching by race and gender in mentoring relationships: Keeping our eyes on the prize. *Journal of Social Issues, 67*, 622-643. doi: 10.1111/j.1540-4560.2011.01717.x

Blascovich, J., Spencer, S. J., Quinn, D., & Steele, C. (2001). African Americans and high blood pressure: The role of stereotype threat. *Psychological Science, 12,* 225-229. doi: 10.1111/1467-9280.00340

Bleeker, M. M. & Jacobs, J. E. (2004). Achievement in math and science: Do mother's beliefs matter 12 years later? *Journal of Educational Psychology, 96*, 97-109. doi: 10.1037/0022-0663.96.1.97

Bleier, R. (1988). The plasticity of the human brain and human potential. *Behavioral and Brain Sciences, 11*, 184-185.

Bosson, J. K., Haymovitz, E. L., & Pinel, E. C. (2004). When saying and doing diverge: The effects of stereotype threat on self-reported versus non-verbal anxiety. *Journal of Experimental Social Psychology, 40*, 247-255. doi: 10.1016/S0022-1031(03)00099-4

Brodish, A. B. (2007). *Stereotype threat and achievement goals: An integrative perspective* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database.

Brodish, A. B., & Devine, P. G. (2009). The role of performance-avoidance goals and worry in mediating the relationship between stereotype threat and performance. *Journal of Experimental Social Psychology, 45*, 180-185. doi: 10.1016/j.jesp.2008.08.005

Brown, R. P., & Josephs, R. A. (1999). A burden of proof: Stereotype relevance and gender differences in math performance. *Journal of Personality and Social Psychology, 76*, 246-257. doi: 10.1037/0022-3514.76.2.246

Brown, R. P., & Pinel, E. C. (2003). Stigma on my mind: Individual differences in the experience of stereotype threat. *Journal of Experimental Social Psychology, 39*, 626-633. doi: 10.1016/S0022-1031(03)00039-8

Bryden, M. P. (1988). Cerebral organization and mathematical ability. *Behavioral and Brain Sciences, 11*, 186-187.

Burkley, M., Parker, J., Stermer, S. P., & Burkley, E. (2010). Trait beliefs that make women vulnerable to math disengagement. *Personality and Individual Differences, 48*, 234-238. doi: 10.1016/j.paid.2009.09.002

Bussey, K., & Bandura, A. (1999). Social cognitive theory of gender development and differentiation. *Psychological Review, 106*, 676-713. doi: 10.1037/0033-295X.106.4.676

Byrnes, J. P. (2005). Gender differences in math: Cognitive processes in an expanded framework. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 73-98). Cambridge, United Kingdom: Cambridge University Press.

Cadinu, M., Maass, A., Frigerio, S., Impagliazzo, L., & Latinotti, S. (2003). Stereotype threat: The effect of expectancy on performance. *European Journal of Social Psychology, 33*, 267-285. doi: 10.1002/ejsp.145

Cadinu, M., Maass, A., Lombardo, M., & Frigerio, S. (2006). Stereotype threat: The moderating role of locus of control. *European Journal of Social Psychology, 36,* 183-197. doi: 10.1002/ejsp.303

Cadinu, M., Maass, A. Rosabianca, A., & Kiesner, J. (2005). Why do women underperform under stereotype threat? Evidence for the role of negative thinking. *Psychological Science, 16*, 572-578. doi: 10.1111/j.0956-7976.2005.01577.x

Carr, P. B., & Steele, C. M. (2009). Stereotype threat and inflexible perseverance in problem solving. *Journal of Experimental Social Psychology, 45*, 853-859. doi: 10.1016/j.jesp.2009.03.003

Casey, M. B., Nuttall, R., Pezaris, E., & Benbow, C. P. (1995). The influence of spatial ability on gender differences in mathematics college entrance test scores across diverse samples. *Developmental Psychology, 31*, 697-705. doi: 10.1037/0012-1649.31.4.697

Catsambis, S. (2005). The gender gap in mathematics: Merely a step function? In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 220-245). Cambridge, United Kingdom: Cambridge University Press.

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

Ceci, S. J., & Williams, W. M. (2007). Are me moving closer and closer apart? Shard evidence leads to conflicting views. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 213-236). Washington, DC: American Psychological Association.

Ceci, S. J., Williams, W. M., & Barnett, S. M. (2009). Women's underrepresentation in science: Sociocultural and biological considerations. *Psychological Bulletin, 135*, 218-261. doi: 10.1037/a0014412

Chao, G. T., Waltz, P. M., & Gardner, P. D. (1992). Formal and informal mentorship: A comparison on mentoring functions and contrast with nonmentored counterparts. *Personnel Psychology, 45*, 619-636. doi: 10.1111/j.1744-6570.1992.tb00863.x

Chasteen, A. L., Bhattacharyya, S. B., Horhotta, M., Tam, R., & Hasher, L. (2005). How feelings of stereotype threat influence older adults' memory performance, *Experimental Aging Research, 31*, 235-260. doi:10.1080/03610730590948177

Chasteen, A. L., Kang, S. K., & Remedios, J. D. (2011). Aging and stereotype threat: Development, process, and interventions. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 202-216). New York, NY: Oxford University Press.

Cheryan, S., Plaut, V. C., Davies, P. G., & Steele, C. M. (2009). Ambient belonging: How stereotypical cues impact gender participation in computer science. *Journal of Personality and Social Psychology, 97*, 1045-1060. doi:10.1037/a0016239

Chipman, S. F. (2005). Research on the women and mathematics issue: A personal case history. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 1-24). Cambridge, United Kingdom: Cambridge University Press.

Chung, B. G., Ehrhart, M. G., Ehrhart K. H., Hattrup, K., & Solamon, J. (2010). Stereotype threat, state anxiety, and specific self-efficacy as predictors of promotion exam performance. *Group and Organization Management, 35*, 77-107. doi:10.1177/1059601109354839

Cohen, G. L., Aronson, J., & Steele, C. M. (2000). When beliefs yield to evidence: Reducing biased evaluation by affirming the self. *Personality and Social Psychology Bulletin, 26,* 1151-1164. doi: 10.1177/01461672002611011

Cohen, G. L., Garcia, J., Apfel, N., & Master, A. (2006). Reducing the racial achievement gap: A social-psychological intervention, *Science, 313*, 1307-1310. doi: 10.1126/science.1128317

Cohen, G. L., Garcia, J., Purdie-Vaughns, V., Apfel, N., & Brzustoski, P. (2009). Recursive processes in self-affirmation: Intervening to close the minority achievement gap, *Science, 324*, 400-403. doi: 10.1126/science.1170769

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. San Diego, CA: Academic Press. doi: 10.1111/1467-8721.ep10768783

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112,* 155-159. doi: 10.1037/0033-2909.112.1.155

Cohen, L. L., & Swim, J. K. (1995). The differential impact of gender ratios on women and men: Tokenism, self-confidence, and expectations. *Personality and Social Psychology Bulletin, 21*, 876-884. doi: 10.1177/0146167295219001

College Board (2009). Table 2: *Mean SAT Scores of College-Bound Seniors, 1972–2009*. Retrieved from http://professionals.collegeboard.com/profdownload/cbs-2009-Table-2_Mean-SAT-Scores-of-College-Bound-Seniors-1972_2009.pdf

Committee on Equal Opportunities in Science and Engineering. (2000). *2000 Biennial Report to the United States Congress*. Retrieved from http://www.nsf.gov/pubs/2001/ceose2000rpt/congress.pdf

Creswell, J. D., Welch, W. T., Taylor, S. E., Sherman, D. K., Gruenewald, T. L., & Mann, T. (2005). Affirmation of personal values buffers neuroendocrine and psychological stress responses. *Psychological Science, 16,* 846-851. doi: 10.1111/j.1467-9280.2005.01624.x

Crisp, R. J., Bache, L. M., & Maitner, A. T. (2009). Dynamics of social comparison in counter-stereotypic domains: Stereotype boost, not stereotype threat, for women engineering majors. *Social Influence, 4*, 171-184. doi: 10.1080/15534510802607953

Croizet, J.-C., & Claire, T. (1998). Extending the concept of stereotype threat to social class: The intellectual underperformance of students from low socioeconomic backgrounds. *Personality and Social Psychology Bulletin, 24,* 588-594. doi: 10.1177/0146167298246003

Croizet, J.-C., Desert, M., Dutrevis, M., & Leyens, J.-P. (2001). Stereotype threat, social class, gender, and academic under-achievement: When our reputation catches up to us and takes over. *Social Psychology of Education, 4*, 295-310. doi. 10.1023/A:1011336821053

Croizet, J.-C., Despres, G., Gauzins, M.-E., Huguet, P. Leyens, J.-P., & Meot, A. (2004). Stereotype threat undermines intellectual performance by triggering a disruptive mental load. *Personality and Social Psychology Bulletin, 30*, 721-731. doi. 10.1177/0146167204263961

Croizet, J.-C., & Millet, M. (2011). Social class and test performance: From stereotype threat to symbolic violence and vice versa. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 188-201). New York, NY: Oxford University Press.

Cullen, M. J., Hardison, C. M., & Sackett, P. R. (2004). Using SAT–grade and ability–job performance relationships to test predictions derived from stereotype threat theory. *Journal of Applied Psychology, 89*, 220-230. doi:10.1037/0021-9010.89.2.220

Dar-Nimrod, I., & Heine, S. J. (2006). Exposure to scientific theories affects women's math performance. *Science, 314*, 415. doi: 10.1126/science.1131100

Davies, P. G., & Spencer, S. J. (2005). The gender-gap artifact: Women's underperformance in quantitative domains through the lens of stereotype threat. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 172-188). Cambridge, United Kingdom: Cambridge University Press.

Davies, P. G., Spencer, S. J., Quinn, D. M., & Gerhardstein, R. (2002). Consuming images: How television commercials that elicit stereotype threat can restrain women academically and professionally. *Personality and Social Psychology Bulletin, 28*, 1615-1628. doi:10.1177/014616702237644

Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: Identity safety moderates the effects of stereotype threat on women's leadership aspirations. *Journal of Personality and Social Psychology, 88*, 276-287. doi:10.1037/0022-3514.88.2.276

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41,* 1040–1048. doi. 10.1037/0003-066X.41.10.1040

Dweck, C. S. (1999). *Self-theories*. Philadelphia, Pennsylvania: Taylor & Francis Group.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*, 256-273. doi. 10.1037/0033-295X.95.2.256

Dweck, C. S., & Molden, D. C. (2005) Self-theories: Their impact on competence motivation and acquisition. In A. J. Elliot & C. S. Dweck (Eds), *Handbook of competence and motivation* (pp. 122-140). New York: Guildford Press.

Dwyer, C. A., & Johnson (1997). Grades, accomplishments, and correlates. In W. W. Willingham & N. S. Cole (Eds.), *Gender and fair assessment* (pp. 127-156). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Eby, L. T. (2010). Mentoring. In S. Zedeck (Series Ed.), *APA Handbook of Industrial and Organizational Psychology: Vol. 2. Selecting and developing members for the organization* (pp. 505-525). Washington, DC: American Psychological Association. doi. 10.1037/12170-017

Eby, L. T., Allen, T. D., Evans, S. C., Ng, T., & DuBois, D. L. (2008). Does mentoring matter? A multidisciplinary meta-analysis comparing mentored and non-mentored individuals. *Journal of Vocational Behavior, 72*, 254-267. doi: 10.1016/j.jvb.2007.04.005

Eby, L. T. d. T., Allen, T. D., Hoffman, B. J., Baranik, L. E., Sauer, J. B., Baldwin, S., … Evans, S. C. (2013). An interdisciplinary meta-analysis of the potential antecedents, correlates, and consequences of protégé perceptions of mentoring. *Psychological Bulletin, 139*, 441-476. doi: 10.1037/a0029279

Eccles, J. S. (1987). Gender roles and women's achievement-related decisions. *Psychology of Women Quarterly, 11*, 135-172. doi: 10.1111/j.1471-6402.1987.tb00781.x

Eccles, J. S. (1994). Understanding women's educational and occupational choices. *Psychology of Women Quarterly, 18,* 585-609. doi: 10.1111/j.1540-4560.2011.01718.x

Eccles, J. S., Jacobs, J. E., & Harold, R. D. (1990). Gender role stereotypes, expectancy effects, and parents' socialization of gender differences. *Journal of Social Issues, 46*, 183-201. doi: 10.1111/j.1540-4560.1990.tb01929.x

Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist, 34*, 169-189. doi: 10.1207/s15326985ep3403_3

Elliot, A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology, 72*, 218-232. doi: 10.1207/s15326985ep3403_3

Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A meditational analysis. *Journal of Personality and Social Psychology, 70*, 461-475. doi: 10.1037/0022-3514.70.3.461

Elliot, A. J., & McGregor, H. A. (1999). Test anxiety and the hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology, 76*, 628-644. doi. 10.1037/0022-3514.76.4.628

Elliot, A. J., & McGregor, H. A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology, 80*, 501-519. doi: 10.1037/0022-3514.80.3.501

Elliot, A. J., & Murayama, K. (2008). On the measurement of achievement goals: Critique, illustration, and application. *Journal of Educational Psychology, 100*, 613-628. doi: 10.1037/0022-0663.100.3.613

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin, 136,* 103-127. doi: 10.1037/a0018053

Ensher, E. A., Heun, C., & Blanchard, A. (2003). Online mentoring and computer-mediated communication: New directions in research. *Journal of Vocational Behavior, 63*, 264-288. doi: 10.1016/S0001-8791(03)00044-7

Fassinger, R. E. (2008). Workplace diversity and public policy: Challenges and opportunities for psychology. *American Psychologist, 63*, 252-268. doi: 10.1037/0003-066X.63.4.252

Fassinger, R. E., & Asay, P. A. (2006). Career counseling for women in science, technology, engineering, and mathematics (STEM) fields. In W. Bruce Walsh & Mary J. Heppner (Eds.), *Handbook of career counseling for women.* Mahwah: New Jersey: Lawrence Erlbaum Associates.

Feng, J., Spence, I., & Pratt, J. (2007). Playing an action video game reduces gender differences in spatial cognition. *Psychological Science, 18,* 850–855. doi: 10.1111/j.1467-9280.2007.01990.x

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford, CA: Stanford University Press.

Flam, F. (1991). Still a "chilly climate" for women? *Science, 252*, 1604-1606.

Frantz, C. M., Cuddy, A. J. C., Burnett, M., Ray, H., & Hart, A. (2004). A threat in the computer: The race implicit association test as a stereotype threat experience. *Personality and Social Psychology Bulletin, 30*, 1611-1624. doi: 10.1177/0146167204266650

Frome, P. M., Alfred, C. J., Eccles, J. E., & Barber, B. L. (2006). Why don't they want a male-dominated job? An investigation of young women who changed their occupational aspirations. *Educational Research and Evaluation, 12*, 359-372. doi: 10.1080/13803610600765786

Gonzales, P. M., Blanton, H., & Williams, K. J. (2002). The effects of stereotype threat and double-minority status on the test performance of Latino women. *Personality and Social Psychology Bulletin, 28,* 659-670. doi: 10.1177/0146167202288010

Good, C., Aronson, J., & Harder, J. A. (2008). Problems in the pipeline: Stereotype threat and women's achievement in high-level math courses. *Journal of Applied Developmental Psychology, 29*, 17-28. doi: 10.1016/j.appdev.2007.10.004

Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Applied Developmental Psychology, 24*, 645-662. doi: 10.1016/j.appdev.2003.09.002

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. Journal of Personality and Social Psychology, 102, 700-717. doi: 10.1037/a0026659

Good, J. J., Woodzicka, J. A., & Wingfield, L. C. (2010). The effects of gender stereotypic and counter-stereotypic textbook images on science performance. *The Journal of Social Psychology, 150*, 132-147. doi: 10.1080/00224540903366552

Greenhaus, J. H. (2003). Career dynamics. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of Psychology: Vol. 12. Industrial and Organizational Psychology* (pp. 519-540). Hoboken, New Jersey: John Wiley & Sons, Inc.

Gresky, D. M., Ten Eyck, L. L., Lord, C. G., & McIntyre, R. B. (2005). Effects of salient multiple identities on women's performance under mathematics stereotype threat. *Sex Roles, 53*, 703-716. doi: 10.1007/s11199-005-7735-2

Guiso, L., Monte, F., Sapienza, P., & Zingales, L. (2008). Culture, gender, and math, *Science, 320*, 1164-1165.

Gunderson, E. A., Ramirez, G., Levine, S. C., & Beilock, S. L. (2012). The role of parents and teachers in the development of gender-related math attitudes. *Sex Roles, 66*, 153-166. doi: 10.1007/s11199-011-9996-2

Gupta, V. K., & Bhawe, N. M. (2007). The influence of proactive personality and stereotype threat on women's entrepreneurial intentions. *Journal of Leadership and Organizational Science*, *13*, 73-85. doi: 10.1177/10717919070130040901

Gupta, V. K., Turban, D. B., & Bhawe, N. M. (2008). The effect of gender stereotype activation on entrepreneurial intentions. *Journal of Applied Psychology, 93*, 1053-1061. doi: 10.1037/0021-9010.93.5.1053

Gur, R. C., & Gur, R. E. (2007). Neural substrates for sex differences in cognition. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 189-198). Washington, DC: American Psychological Association. doi: 10.1037/11546-015

Hall, R. M., & Sandler, B. R. (1982). *The classroom climate: A chilly one for women?* Washington, DC: Association of American Colleges, Project on the Status and Education of Women.

Halpern, D. F. (1997). Sex differences in intelligence: Implications for education. *American Psychologist, 52*, 1091-1102. doi:10.1037/0003-066X.52.10.1091

Halpern, D. F. (2000). *Sex differences in cognitive abilities*. Mahwah, New Jersey: Lawrence Erlbaum Associates Inc.

Halpern, D. F. (2007). Science, sex, and good sense: Why women are underrepresented in some areas of science and math. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more* *women in science? Top researchers debate the evidence.* (pp. 121-130). Washington, DC: American Psychological Association. doi: 10.1037/11546-010

Halpern, D. F., Wai, J., & Saw, A. (2005). A psychobiosocial model: Why females are sometimes greater than and sometimes less than males in math achievement. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 48-72). Cambridge, United Kingdom: Cambridge University Press.

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., & Gernsbacher (2007). The science of sex differences in science and mathematics. *Psychological Science in the Public Interest, 8*, 1-51. doi: 10.1111/j.1529-1006.2007.00032.x

Hampson, E., & Kimura, D. (1988). Reciprocal effects of hormonal fluctuations on human motor and perceptual-spatial skills. *Behavioral Neuroscience, 102*, 456-495. doi: 10.1037/0735-7044.102.3.456

Harackiewicz, J. M., Barron, K. E., Pintrich, P. R., Elliot, A. J., & Thrash, T. M. (2002). Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology, 94*, 638-645. doi: 10.1037/0022-0663.94.3.638

Harris, J. R. (1995). Where is the child's environment? A group socialization theory of development. *Psychological Review, 102,* 458-489. doi: 10.1037/0033-295X.102.3.458

Harrison, L. A., Stevens, C. M., Monty, A. N., & Coakley, C. A. (2006). The consequences of stereotype threat on the academic performance of white and non-white lower income college students. *Social Psychology of Education, 9*, 341-357. doi: 10.1007/s11218-005-5456-6

Hedges, L. V., & Friedman, L. (1993a). Computing gender difference effects in tails of distributions: The consequences of differences in tail size, effect size, and variance ratio. *Review of Educational Research, 63*, 110-112. doi: 10.2307/1170563

Hedges, L. V., & Friedman, L. (1993b). Gender differences in variability in intellectual abilities: A reanalysis of Feingold's results. *Review of Educational Research, 63*, 94-105. doi: 10.2307/1170561

Hedges, L. V., & Nowell, A. (1995). Sex differences in mental test scores, variability, and numbers of high-scoring individuals. *Science, 269,* 41-45. doi: 10.1126/science.7604277

Heslin, P. A., Latham, G. P., & Vanderwalle, D. (2005). The effect of implicit person theory on performance appraisals. *Journal of Applied Psychology, 90*, 842-856. doi: 10.1037/0021-9010.90.5.842

Hess, T. M., Auman, C. Colcombe, S. J., & Rahhal, T. A. (2003). The impact of stereotype threat on age differences in memory performance. *Journal of Gerontology: Psychological Sciences, 58*, 3-11. doi: 10.1093/geronb/58.1.P3

Hines, M. (2007). Do sex differences in cognition cause the shortage of women in science? In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 101-112). Washington, DC: American Psychological Association. doi: 10.1037/11546-008

Holden, C. (1989). Wanted: 675,000 future scientists and engineers. *Science, 244*, 1536-1537.

Holland, J. L. (1996). Exploring careers with a typology. What we have learned and some new directions. *American Psychologist, 51*, 397-406. doi: 10.1037/0003-066X.51.4.397

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments*. Odessa, FL: Psychological Assessment Resources.

Huguet, P., & Regner I. (2009). Counter-stereotypic beliefs in math do not protect school girls from stereotype threat. *Journal of Experimental Social Psychology, 45*, 1024-1027. doi: 10.1016/j.jesp.2009.04.029

Huang, G., Taddese, N., Walter, E., & Peng, S. S. (2000). Entry and persistence of women and minorities in college science and engineering education (NCES 2000–601). Washington, DC: U.S. Department of Education. Retrieved from http://nces.ed.gov/pubs2000/2000601.pdf

Hyde, J. S. (2007). Women in science: Gender similarities in abilities and sociocultural forces. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 131-145). Washington, DC: American Psychological Association. doi: 10.1037/11546-011

Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin, 107*, 139-155. doi: 10.1037/0033-2909.107.2.139

Hyde, J. S., & Kling, K. C. (2001). Women, motivation, and achievement. *Psychology of Women Quarterly, 25*, 364-378. doi: 10.1111/1471-6402.00035

Hyde, J. S., & Linn, M. C. (1988). Gender differences in verbal ability: A meta-analysis. *Psychological Bulletin, 104*, 53-69. doi: 0.1037/0033-2909.104.1.53

Hyde, J. S., Lindberg, S. M., Linn, M. C., Ellis, A. B., & Williams, C. C. (2008). Gender similarities characterize math performance. *Science, 321,* 494-495.

Inzlicht, M., Aronson, J., Good, C., & McKay, L. (2006). A particular resiliency to threatening environments. *Journal of Experimental Social Psychology, 42*, 323-336. doi: 10.1016/j.jesp.2005.05.005

Inzlicht, M., & Ben-Zeev, T. (2000). A threatening intellectual environment: Why females are susceptible to experiencing problem-solving deficits in the presence of males. *Psychological Science, 11*, 365-371. doi:10.1111/1467-9280.00272

Inzlicht, M., & Ben-Zeev, T. (2003). Do high-achieving female students underperform in private? The implications of threatening environments on intellectual processing. *Journal of Educational Psychology, 95*, 796-805. doi:10.1037/0022-0663.95.4.796

Inzlicht, M., & Schmader, T. (2011). Introduction. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 3-14). New York, NY: Oxford University Press.

Jacobi, M. (1991). Mentoring and undergraduate academic success: A literature review. *Review of Educational Research, 61*, 505-532. doi: 10.2307/1170575

Jacobs, J. E. (1991). Influence of gender stereotypes on parent and child mathematics attitudes. *Journal of Educational Psychology, 83*, 518-527. doi: 10.1037/0022-0663.83.4.518

Jacobs, J. E., Davis-Kean, P., Bleeker, M., Eccles, J. C., & Malanchuk, O. (2005). "I can, but I don't want to": The impact of parents, interests, and activities on gender differences in math. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 246-263). Cambridge, United Kingdom: Cambridge University Press.

Jacobs, J. E., & Eccles, J. S. (1992). The impact of mothers' gender-role stereotypic beliefs on mothers' and children's ability perceptions. *Journal of Personality and Social Psychology, 63*, 932-944. doi: 10.1037/0022-3514.63.6.932

Jamieson, J. P., Mendes, W. B., Blackstock, E., & Schmader, T. (2010). Turning the knots in your stomach into bows: Reappraising arousal improves performance on the GRE. *Journal of Experimental Social Psychology, 46*, 208-212. doi: 10.1016/j.jesp.2009.08.015

Johns, M. Inzlicht, M., & Schmader, T. (2008). Stereotype threat and executive resource depletion: Examining the influence of emotion regulation. *Journal of Experimental Psychology: General, 137*, 691-705. doi: 10.1037/a0013834

Johns, M., Schmader, T. & Martens, A. (2005). Knowing is half the battle: Teaching stereotype threat as a means of improving women's math performance, *Psychological Science, 16*, 175-179. doi: 10.1111/j.0956-7976.2005.00799.x

Jordan, A. H. & Lovett, B. J. (2007). Stereotype threat and test performance: A primer for school psychologists. *Journal of School Psychology, 45*, 45-59. doi: 10.1016/j.jsp.2006.09.003

Kalokerinos, E. K., von Hippel, C., & Zacher, H. (in press). Is stereotype threat a useful construct for organizational psychology research and practice? *Industrial and Organizational Psychology: Perspectives on Science and Practice*.

Kammeyer-Mueller, J. D., & Judge, T. A. (2008). A quantitative review of mentoring research: Test of a model. *Journal of Vocational Behavior, 72*, 269-283. doi: 10.1016/j.jvb.2007.09.006

Keller, J. (2002). Blatant stereotype threat and women's math performance: Self-handicapping as a strategic means to cope with obtrusive negative performance expectations. *Sex Roles, 47*, 193-198. doi: 10.1023/A:1021003307511

Keller, J. (2007a). When negative stereotypic expectancies turn into challenge or threat: The moderating role of regulatory focus. *Swiss Journal of Psychology, 66*, 163-168. doi: 10.1024/1421-0185.66.3.163

Keller, J. (2007b). Stereotype threat in classroom settings: The interactive effect of domain identification, task difficulty and stereotype threat on female students' maths performance. *British Journal of Educational Psychology, 77*, 323-338. doi: 10.1348/000709906X113662

Keller, J., & Bless, J. (2008). When positive and negative expectancies disrupt performance: Regulatory focus as a catalyst. *European Journal of Social Psychology, 38*, 187-212. doi: 10.1002/ejsp.452

Keller, J., & Dauenheimer, D. (2003). Stereotype threat in the classroom: Dejection mediates the disrupting threat effect on women's math performance. *Personality and Social Psychology Bulletin, 29*, 371-381. doi: 10.1177/0146167202250218

Keller, J., & Molix, L. (2008). When women can’t do math: The interplay of self-construal, group identification, and stereotypic performance standards. *Journal of Experimental Social Psychology, 44*, 437-444. doi: 10.1016/j.jesp.2007.01.007

Kendall, D. L. (2007). *Does choice matter? The impact of allowing protégés to select their own mentors* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database.

Kiefer, A. K., & Sekaquaptewa, D. (2007). Implicit stereotypes and women's math performance: How implicit gender-math stereotypes influence women's susceptibility to stereotype threat. *Journal of Experimental Social Psychology, 43*, 825-832. doi: 10.1016/j.jesp.2006.08.004

Kimball, M. M. (1989). A new perspective on women's math achievement. *Psychological Bulletin, 105*, 198-214. doi: 10.1037/0033-2909.105.2.198

Klein, O., Pohl, S. & Ndagijimana, C. (2007). The influence of integroup comparisons on Africans' intelligence test performance in a selection context. *The Journal of Psychology, 14*, 453-467. doi: 10.3200/JRLP.141.5.453-468

Koch, S. C., Muller, S. M., & Sieverding, M. (2008). Women and computers. Effects of stereotype threat on attribution of failure. *Computers & Education, 5*1, 1795-1803. doi: 10.1016/j.compedu.2008.05.007

Koenig, A. M., & Eagly, A. H. (2005). Stereotype threat in men on a test of social sensitivity. *Sex Roles, 52,* 489-496. doi: 10.1007/s11199-005-3714-x

Kram, K. E. (1985). *Mentoring at work: Developmental relationships in organizational life.* Glenview, IL: Scott Foresman.

Kray, K. J., Galinsky, A. D., & Thompson, L. (2002). Reversing the gender gap in negotiations: An exploration of stereotype regeneration. *Organizational Behavior and Human Decision Processes, 87*, 386-409. doi. 10.1006/obhd.2001.2979

Kray, L. J., Thompson, L. & Galinsky, A. (2001). Battle of the sexes: Gender stereotype confirmation and reactance in negotiations. *Journal of Personality and Social Psychology, 80*, 942-958. doi: 10.1037/0022-3514.80.6.942

Lankau, M. J., Riordan, C. M., & Thomas, C. H. (2005). The effects of similarity and liking in formal relationships between mentors and protégés. *Journal of Vocational Behavior, 67*, 252-265. doi: 10.1016/j.jvb.2004.08.012

Lesko, A. C., & Corpus, J. H. (2006). Discounting the difficult: How high math-identified women respond to stereotype threat. *Sex Roles, 54*, 113-125. doi: 10.1007/s11199-005-8873-2

Leyens, J.-P., Desert, M. Croizet, J.-C., & Darcis, C. (2000). Stereotype threat: Are lower status and history of stigmatization preconditions of stereotype threat? *Personality and Social Psychology Bulletin, 26*, 1189-1199. doi: 10.1177/0146167200262002

Liebert, R. M., *&* Morris, L. W. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. *Psychological Reports, 20*, 975-978. doi: 10.2466/pr0.1967.20.3.975

Linn, M. C., & Petersen, A. C. (1985). Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development, 56*, 1479-1498. doi: 10.2307/1130467

Lindberg, S. M., Hyde, J. S., Petersen, J. L., & Linn, M. C. (2010). New trends in gender and mathematics performance: A meta-analysis. *Psychological Bulletin, 136*, 1123-1135. doi: 10.1037/a0021276

Lippa, R. (1998). Gender-related individual differences and the structure of vocational interests: The importance of the people-things dimension. *Journal of Personality and Social Psychology, 74*, 996-1009. doi: 10.1037/0022-3514.74.4.996

Logel, C., Peach, J., & Spencer, S. J. (2011). Threatening gender and race: Different manifestations of stereotype threat. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 159-172). New York, NY: Oxford University Press.

Logel, C. Walton, G. M., Spencer, S. J., Iserman, E. C. Hippel, W. V. & Bell, A. E. (2009). Interacting with sexist men triggers social identity threat among female engineers. *Journal of Personality and Social Psychology, 96,* 1089-1103. doi:10.1037/a0015703

Lubinski, D. (2004). Introduction to the special section on cognitive abilities: 100 years after Spearman's (1904) "'general intelligence,' objectively determined and measured". *Journal of Personality and Social Psychology, 86*, 96-111. doi: 10.1037/0022-3514.86.1.96

Lubinski, D., & Benbow, C. P. (2006). Study of mathematically precocious youth after 35 years uncovering antecedents for the development of math-science expertise. *Perspectives on Psychological Science, 1*, 316-345. doi: 10.1111/j.1745-6916.2006.00019.x

Lubinski, D. S., & Benbow, C. P. (2007). Sex differences in personal attributes for the development of science expertise. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 79-100). Washington, DC: American Psychological Association. doi: 10.1037/11546-007

Lubinski, D., Benbow, C. P., Webbs, R. M., & Bleske-Rechek, A. (2006). Tracking exceptional human capital over two decades. *Psychological Science, 17*, 194-199. doi: 10.1111/j.1467-9280.2006.01685.x

Lubinski, D., Webb, R. M., Morelock, M. J., & Benbow, C. P. (2001). Top 1 in 10,000: A 10-year follow-up of the profoundly gifted. *Journal of Applied Psychology, 86,* 718-729. doi: 10.1037/0021-9010.86.4.718

Lummis, M., & Stevenson, H. W. (1990). Gender differences in beliefs and achievement: A cross-cultural study. *Developmental Psychology, 26*, 254-263. doi: 10.1037/0012-1649.26.2.254

Maass, A., & Cadinu, M. (2003). Stereotype threat: When minority members underperform. *European Review of Social Psychology, 14*, 243-275.

Major, B., & O'Brien, L. T. (2005). The social psychology of stigma. *Annual Review of Psychology, 56*, 393-421. doi: 10.1146/annurev.psych.56.091103.070137

Major, B., & Schmader, T. (1998). Coping with stigma through psychological disengagement. In J. K. Swim & C. Stangor (Eds.), *Prejudice: The target's perspective* (pp. 83-103). San Diego, CA: Academic Press.

Major, B., Spencer, S., Schmader, T., Wolfe, C., & Crocker, J. (1998). Coping with negative stereotypes about intellectual performance: The role of psychological disengagement. *Personality and Social Psychology Bulletin, 24*, 34-50. doi: 10.1177/0146167298241003

Martens, A., Johns, M., Greenberg, J., & Schimel, J. (2006). Combating stereotype threat: The effect of self-affirmation on women's intellectual performance. *Journal of Experimental Social Psychology, 42*, 236-243. doi: 10.1016/j.jesp.2005.04.010

Marx, D. M. (2011). Differentiating theories: A comparison of stereotype threat and stereotype priming effects. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 124-140). New York, NY: Oxford University Press.

Marx, D. M., & Goff, P. A. (2005). Clearing the air: The effect of experimenter race on target's test performance and subjective experience. *British Journal of Social Psychology, 44*, 645-657. doi: 10.1348/014466604X17948

Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin, 28*, 1183-1193. doi: 10.1177/01461672022812004

Marx, D. M., Stapel, D. A., & Muller, D. (2005). We can do it: The interplay of constructual orientation and social comparison under threat. *Journal of Personality and Social Psychology, 88*, 432-466. doi: 10.1037/0022-3514.88.3.432

McGlone, M. S., & Aronson, J. (2006). Stereotype threat, identity salience, and spatial reasoning. *Journal of Applied Developmental Psychology, 27*, 486-491. doi: 10.1016/j.appdev.2006.06.003

McGlone, M. S., & Aronson, J. (2007). Forewarning and forearming stereotype-threatened students. *Communication Education, 56*, 119-133. doi: 10.1080/03634520601158681

McGlone, M. S., Aronson, J., & Kobrynowicz, D. (2006). Stereotype threat and the gender gap in political knowledge. *Psychology of Women Quarterly, 30*, 392-398. doi: 10.1111/j.1471-6402.2006.00314.x

McIntyre, R. B., Lord, C. G., Gresky, D. M., Ten Eyck, L. L., Jay Frye, G. D., & Bond, C. F. (2005). A social impact trend in the effects of role models on alleviating women's mathematics stereotype threat. *Current Research in Social Psychology, 10*, 116-136.

McIntyre, R. B., Paulson, R. M., & Lord, C. G. (2003). Alleviating women's mathematics stereotype threat through salience of group achievements. *Journal of Experimental Social Psychology, 39*, 83-90. doi: 10.1016/S0022-1031(02)00513-9

McIntyre, R. B., Paulson, R. M., Taylor, C. A., Morin, A. L., & Lord, C. G. (2011). Effects of role model deservingness on overcoming performance deficits induced by stereotype threat. *European Journal of Social Psychology, 41*, 301-311.

McKay, P. F., Doverspike, D., Bowen-Hilton, D., & Martin, Q. D. (2002). Stereotype threat effects on the Raven Progressive Matrices scores of African Americans. *Journal of Applied Social Psychology, 32*, 767-787.

McKay, P. F., Doverspike, D., Bowen-Hilton, D., & McKay, Q. D. (2003). The effects of demographic variables and stereotype threat on black/white differences in cognitive ability test performance. *Journal of Business and Psychology, 18*, 1-14. doi: 10.1023/A:1025062703113

Meece, J. L., Parsons, J. E., Kaczala, C. M., Goff, S. B., & Futterman, R. (1982). Sex differences in math achievement: Toward a model of academic choice. *Psychological Bulletin, 91*, 324-348. doi: 10.1037/0033-2909.91.2.324

MentorNet (2006). *Evaluation findings for participants in MentorNet's industry one‑on‑one e‑mentoring program, 2003‑06 executive summary.* Retrieved from http://www.mentornet.net/documents/files/evaluation/Eval.0306.Report.pdf

MentorNet (2007). *Success sustained by study: A documentation of MentorNet's growth and a summary of research findings*. Retrieved from http://www.mentornet.net/documents/files/evaluation/1996-2007SuccessSustainedByStudyReport.pdf

Middleton, M. J., & Midgley, C. (1997). Avoiding the demonstration of lack of ability: An underexplored aspect of goal theory. *Journal of Educational Psychology, 89*, 710-718. doi: 10.1037/0022-0663.89.4.710

Miyake, A., Kost-Smith, L. E., Finkelstein, N. D., Pollock, S. J., Cohen, G. L., & Ito, T. A. (2010). Reducing the gender achievement gap in college science: A classroom study of values affirmation. *Science, 330*, 1234-1237. doi: 10.1126/science.1195996

Moffat, S. D., & Hampson, E. (1996). A curvilinear relationship between testosterone and spatial cognition in humans: Possible influence of hand preference. *Psychoneuroendocrinolgy, 21*, 323–337. doi: 10.1016/0306-4530(95)00051-8

Morris, L. W., Davis, M. A., & Hutchings, C. H. (1981). Cognitive and emotional components of anxiety: Literature review and a revised worry-emotionality scale. *Journal of Educational Psychology, 73*, 541-555. doi: 10.1037/0022-0663.73.4.541

Morris, L. W., & Liebert, R. M. (1970). The relationship of cognitive and emotional components of test anxiety to physiological arousal and academic performance. *Journal of Consulting and Clinical Psychology, 35*, 332-337. doi. 10.1037/h0030132

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38,* 30-38. doi: 10.1037/0022-0167.38.1.30

Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: How situational cues affect women in math, science, and engineering settings. *Psychological Science, 18*, 879-885. doi: 10.1111/j.1467-9280.2007.01995.x

Nadler, J. T. & Clark, M. H. (2011). Stereotype threat: A meta-analysis comparing African Americans to Hispanic Americans. *Journal of Applied Social Psychology, 41*, 872-890. doi: 10.1111/j.1559-1816.2011.00739.x

National Science Board (2003). *The science and engineering workforce: Realizing America's Potential* (NSB Publication No. 03–69). Retrieved from http://www.nsf.gov/nsb/documents/2003/nsb0369/nsb0369.pdf

National Science Foundation (2008a). *Employed scientists and engineers, by occupation, highest degree level, and sex: 2006*. Retrieved from http://www.nsf.gov/statistics/wmpd/pdf/tabh-5.pdf

National Science Foundation. (2008b). *S & E Degrees: 1966-2006*. Retrieved from http://www.nsf.gov/statistics/nsf08321/pdf/nsf08321.pdf

Neuville, E., & Croizet, J.-C. (2007). Can salience of gender identity impair math performance among 7-8 year old girls? The moderating role of task difficulty. *European Journal of Psychology of Education, 22*, 307-316. doi: 10.1007/BF03173428

Newcombe, N. S. (2007). Taking science seriously: Straight thinking about spatial sex differences. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 69-77). Washington, DC: American Psychological Association. doi: 10.1037/11546-006

Nguyen, H.-H. D., & Ryan, A. M. (2008). Does stereotype threat affect test performance of minorities and women? A meta-analysis of experimental evidence. *Journal of Applied Psychology, 91*, 1314-1334. doi: 10.1037/a0012702

Noe, R. A. (1988a). An investigation of the determinants of successful assigned mentoring relationships. *Personnel Psychology, 41*, 457-479. doi: 10.1111/j.1744-6570.1988.tb00638.x

Noe, R. A. (1988b). Women and mentoring: A review and research agenda. *Academy of Management Review, 13*, 65-78. doi: 10.2307/258355

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math = male, me = female, therefore math ≠ me. *Journal of Personality and Social Psychology, 83*, 44-59. doi: 10.1037/0022-3514.83.1.44

Nosek, B. A., Smyth, F. L., Hansen, J. J., Devos, T., Lindner, N. M., Ranganath, K. A.,…Banaji, M. R. (2007). Pervasiveness and correlates of implicit attitudes and stereotypes. *European Review of Social Psychology, 18*, 36-88. doi: 10.1080/10463280701489053

Nuttall, R. L., Casey, M. B., & Pezaris, E. (2005). Spatial ability as a mediator of gender differences on mathematics tests: A biological–environmental framework. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 121-142). Cambridge, United Kingdom: Cambridge University Press.

Nyborg, H. (1983). Spatial ability in men and women: Review and new theory. *Advances in Behaviour Research and Therapy, 5*, 89–140. doi: 10.1016/0146-6402(83)90019-X

Nyborg, H. (1988). Mathematics, sex hormones, and brain function. *Behavioral and Brain Science, 11*, 206-207.

O'Brien, K. E., Biga, A., Kessler, S. R., & Allen, T. D. (2010). A meta-analytic investigation of gender differences in mentoring. *Journal of Management, 36,* 537-554. doi: 10.1177/0149206308318619

O'Brien, L. T., & Crandall, C. S. (2003). Stereotype threat and arousal: Effects on women's math performance. *Personality and Social Psychology Bulletin, 29*, 782-789. doi: 10.1177/0146167203029006010

O*NET (2011). *Summary report*. Retrieved from http://www.onetonline.org/

Oakes, J. (1990). Opportunities, achievement, and choice: Women and minority students in science and mathematics. *Review of Research in Education, 16*, 153-222.

Osborne, J. W., & Jones, B. D. (2011). Identification with academics and motivation to achieve in school: How the structure of the self influences academic outcomes. *Education Psychology Review, 23*, 131-158. doi: 10.1007/s10648-011-9151-1

Osborne, J. W., & Walker, C. (2006). Stereotype threat, identification with academics, and withdrawal from school: Why the most successful students of colour might be most likely to withdraw. *Educational Psychology, 26*, 563-577. doi: 10.1080/01443410500342518

Oswald, D. L., & Harvey, R. D. (2000). Hostile environments, stereotype threat, and math performance among undergraduate women. *Current Psychology, 19*, 338-356. doi: 10.1007/s12144-000-1025-5

Pajares, F. (2005). Gender differences in mathematics self-efficacy beliefs. In A. M. Gallagher & J. C. Kaufman, (Eds.), *Gender differences in mathematics: An integrated psychological approach* (pp. 294-315). Cambridge, United Kingdom: Cambridge University Press.

Pajares, F., & Miller, M. D. (1995). Mathematics self-efficacy and mathematics performances: The need for specificity of assessment. *Journal of Counseling Psychology, 42*, 190-198. doi: 10.1037/0022-0167.42.2.190

Park, G., Lubinski, D., & Benbow, C. P. (2008). Ability differences among people who have commensurate degrees matter for scientific creativity. *Psychological Science, 19*, 957-961. doi: 10.1111/j.1467-9280.2008.02182.x

Parsons, J. E., Adler, T. F., & Kaczala, C. M. (1982). Socialization of achievement attitudes and beliefs: Parental influences. *Child Development, 53*, 310-321. doi: 10.2307/1128973

Payne, S. C., Youngcourt, S. S., & Beaubien, J. M. (2007). A meta-analytic examination of the goal orientation nomological net. *Journal of Applied Psychology, 92*, 128-150. doi: 10.1037/0021-9010.92.1.128

Peterson, C., & Barrett, L. C. (1987). Explanatory style and academic performance among university freshmen. *Journal of Personality and Social Psychology, 53*, 603-607. doi: 10.1037/0022-3514.53.3.603

Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing link between interests and occupations? *Journal of Vocational Behavior, 21,* 259-287. doi. 10.1016/0001-8791(82)90036-7

Quinn, D. M., & Spencer, S. J. (2001). The interference of stereotype threat with women's generation of mathematical problem-solving strategies. *Journal of Social Issues, 57*, 55-71. doi: 10.1111/0022-4537.00201

Ragins, B. R. (1997). Diversified mentoring relationships in organizations: A power perspective. *Academy of Management Review, 22*, 482-521. doi: 10.2307/259331

Ragins, B. R., & Cotton, J. C. (1991). Easier said than done: Gender differences in perceived barriers in getting a mentor. *Academy of Management Journal, 34*, 939-951. doi: 10.2307/256398

Ragins, B. R., & Cotton, J. L. (1996). Jumping the hurdles: barriers to mentoring for women in organizations. *Leadership and Organization Development Journal, 17,* 37-41. doi: 10.1108/01437739610116984

Ragins, B. R., & Cotton, J. L. (1999). Mentor functions and outcomes: A comparison of men and women in formal and informal mentoring relationships. *Journal of Applied Psychology, 84*, 529-550. doi: 10.1037/0021-9010.84.4.529

Rawsthorne, L. J., & Elliot, A. J. (1999). Achievement goals and intrinsic motivation: A meta-analytic review. *Personality and Social Psychology Review, 3*, 326-344. doi: 10.1207/s15327957pspr0304_3

Roberson, L., Deitch, E. A., Brief, A. P., & Block, C. J. (2003). Stereotype threat and feedback seeking in the workplace. *Journal of Vocational Behavior, 62*, 176-188. doi:10.1016/S0001-8791(02)00056-8

Rottinghaus, P. J., Larson, L. M., & Borgen, F. H. (2003). The relation of self-efficacy and interests: A meta-analysis of 60 samples. *Journal of Vocational Behavior, 62,* 221-236. doi: 10.1016/S0001-8791(02)00039-8

Ryan, K. E., & Ryan, A. M. (2005). Psychological processes underlying stereotype threat and standardized math test performance. *Educational Psychologist, 40,* 53-63. doi: 10.1207/s15326985ep4001_4

Rydell, R. J., & Boucher, K. L. (2010). Capitalizing on multiple social identities to prevent stereotype threat: The moderating role of self-esteem. *Personality and Social Psychology Bulletin, 36*, 239-250. doi: 10.1177/0146167209355062

Rydell, R. J., McConnell, A. R., & Beilock, S. L. (2009). Multiple social identities and stereotype threat: Imbalance, accessibility, and working memory. *Journal of Personality and Social Psychology, 96*, 949-966. doi: 10.1037/a0014846

Sackett, P. R. (2003). Stereotype threat in applied selection settings: A commentary. *Human Performance, 16*, 295-309. doi: 10.1207/S15327043HUP1603_6

Sackett, P. R., Hardison, C. M., & Cullen, M. J. (2004). On interpreting stereotype threat as accounting for African American-White differences on cognitive tests. *American Psychologist, 59*, 7-13. doi: 10.1037/h0087868

Sackett, P. R., & Ryan, A. M. (2011). Concerns about generalizing stereotype threat research findings to operational high-stakes testing. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 249-263). New York, NY: Oxford University Press.

Sackett, R. R., Schmitt, N., Ellingson, J. E., & Kabin, M. B. (2001). High-stakes testing in employment, credentialing, and higher education: Prospects in a post-affirmative-action world. *American Psychologist, 56*, 302-318. doi: 10.1037/0003-066X.56.4.302

Sandler, B., & Hall, R. (1986). *The campus climate revisited: Chilly for women faculty, administrators, and graduate students.* Washington, DC: Association of American Colleges, Project on the Status and Education of Women.

Scandura, T. A. (1992). Mentorship and career mobility: An empirical investigation. *Journal of Organizational Behavior, 13*, 167-174. doi: 10.1002/job.4030130206

Scandura, T. A., & Ragins, B. R. (1993). The effects of sex and gender role orientation on mentorship in male-dominated occupations. *Journal of Vocational Behavior, 43,* 251-265. doi: 10.1006/jvbe.1993.1046

Scandura, T. A., & Williams, E. A. (2001). An investigation of the moderating effects of gender on the relationships between mentorship initiation and protégé perceptions of mentoring functions. *Journal of Vocational Behavior, 59,* 342-363. doi: 10.1006/jvbe.2001.1809

Schimel, J., Arndt, J., Banko, K. M., & Cook, A. (2004). Not all self-affirmations were created equal: The cognitive and social benefits of affirming the intrinsic (vs. extrinsic) self. *Social Cognition, 22*, 75-99. doi: 10.1521/soco.22.1.75.30984

Schmader, T. (2002). Gender identification moderates stereotype threat effects on women's math performance. *Journal of Experimental Social Psychology, 38*, 194-201. doi: 10.1006/jesp.2001.1500

Schmader, T. & Beilock, S. (2011). An integration of processes that underlie stereotype threat. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 34-50). New York, NY: Oxford University Press. doi:10.1093/acprof:oso/9780199732449.003.0003

Schmader, T., & Croft, A. (2011). How stereotypes stifle performance potential. *Social and Personality Psychology Compass, 5*, 792-806. doi: 10.1111/j.1751-9004.2011.00390.x

Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology, 85*, 440-452. doi: 10.1037/0022-3514.85.3.440

Schmader, T., Johns, M., & Forbes, C. (2008). An integrated process model of stereotype threat effects on performance. *Psychological Review, 115*, 336-356. doi:10.1037/0033-295X.115.2.336

Sekaquaptewa, D., & Thompson, M. (2003). Solo status, stereotype threat, and performance expectancies: Their effects on women's performance. *Journal of Experimental Social Psychology, 39*, 68-74. doi: 10.1016/S0022-1031(02)00508-5

Seymour, E. (1995). The loss of women from science, mathematics, and engineering undergraduate majors: An exploratory account. *Science Education, 79*, 437-473.

Seymour, E., & Hewitt, N.M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Boulder, CO: Westview Press.

Shapiro, J. R., & Neuberg, S. L. (2007). From stereotype threat to stereotype threats: Implications of a multi-threat framework for causes, moderators, mediators, consequences, and interventions. *Personality and Social Psychology Review, 11*, 107-130. doi:10.1177/1088868306294790

Shapiro, J. R., & Williams, A. M. (2012). The role of stereotype threats in undermining girls' and women's performance and interest in STEM fields. *Sex Roles, 66*, 175-183. doi: 10.1007/s11199-011-0051-0

Shea, D. L., Lubinski, D., & Benbow, C. P. (2001). Importance of assessing spatial ability in intellectually talented young adolescents: A 20-year longitudinal study. *Journal of Educational Psychology, 93*, 604-614. doi: 10.1037/0022-0663.93.3.604

Sherman, D. K., & Cohen, G. L. (2006). The psychology of self-defense: Self-affirmation theory. In Mark P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 38, pp. 183-242). San Diego, CA: Academic Press.

Sherman, D. K., Cohen, G. L., Nelson, L. D., Nussbaum, A. D., Bunyan, D. P., & Garcia, J. (2009). Affirmed yet unaware: Exploring the role of awareness in the process of self-affirmation. *Journal of Personality and Social Psychology, 97*, 745-764. doi: 10.1037/a0015451

Sherman, D. A. K., Nelson, L. D., & Steele, C. M. (2000). Do messages about health risks threaten the self? Increasing the acceptance of threatening health messages via self-affirmation. *Personality and Social Psychology Bulletin, 26,* 1046-1058. doi: 10.1177/01461672002611003

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science, 10*, 80-83. doi: 10.1111/1467-9280.00111

Shih, M., Pittinsky, T. L., & Trahan, A. (2006). Domain-specific effects of stereotypes on performance. *Self and Identity, 5*, 1-14. doi: 10.1080/15298860500338534

Shinar, E. H. (1975). Sexual stereotypes of occupations. *Journal of Vocational Behavior, 7*, 99-111. doi. 10.1016/0001-8791(75)90037-8

Smith, J. L. (2004). Understanding the process of stereotype threat: A review of mediational variables and new performance goal directions. *Educational Psychology Review, 16*, 177-206. doi: 10.1023/B:EDPR.0000034020.20317.89

Smith, J. L. (2006). The interplay among stereotypes, performance-avoidance goals, and women's math performance expectations. *Sex Roles, 54*, 287-296. doi: 10.1007/s11199-006-9345-z

Smith, J. L., & White, P. H. (2002). An examination of implicitly activated, explicitly activated, and nullified stereotypes on mathematical performance: It's not just a woman's issue. *Sex Roles, 47*, 179-191. doi: 10.1023/A:1021051223441

Smith-Jentsch, K. A., Scielzo, S. A., Yarbrough, C. S., & Rosopa, P. J. (2008). A comparison of face-to-face and electronic peer-mentoring: Interactions with mentor gender. *Journal of Vocational Behavior, 72,* 193-206. doi: 10.1016/j.jvb.2007.11.004

Spencer, B., & Castano, E. (2007). Social class is dead. Long live social class! Stereotype threat among low socioeconomic status individuals. *Social Justice Research, 20*, 418-432. doi: 10.1007/s11211-007-0047-7

Spencer, S. J. (1993). *The effect of stereotype vulnerability on women's math performance* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database.

Spencer, S. J. Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance, *Journal of Experimental Social Psychology, 35*, 4-28. doi:10.1006/jesp.1998.1373

Spielberger, C. D., Gorsuch, R. R., & Lushene, R. (1970). *The State–Trait Anxiety Inventory (STAI) test manual.* Palo Alto, CA: Consulting Psychologists Press. doi: 10.1037/h0020743

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. *Psychological Bulletin, 124*, 240-261. doi: 10.1037/0033-2909.124.2.240

Stake, J. E., & Nickens, S. D. (2005). Adolescent girls' and boys' science peer relationships and perceptions of the possible self as scientist. *Sex Roles, 52*, 1-12. doi: 10.1007/s11199-005-1189-4

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 21, pp. 261–302). New York: Academic Press.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*, 613-629. doi:10.1037//0003-066X.52.6.613

Steele, C. M. (2010). *Whistling Vivaldi and other clues to how stereotypes affect us*. New York, New York: W. W. Norton and Company Inc.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*, 797-811. doi:10.1037//0022-3514.69.5.797

Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 34, pp. 379–440). New York: Academic Press. doi:10.1016/S0065-2601(02)80009-0

Steele, J. R., & Ambady, N. (2006). “Math is Hard!” The effect of gender priming on women's attitudes. *Journal of Experimental Social Psychology, 42*, 428-436. doi: 10.1016/j.jesp.2005.06.003

Steele, J., James, J. B., & Barnett, R. C. (2002). Learning in a man's world: Examining the perceptions of undergraduate women in male-dominated academic areas. *Psychology of Women Quarterly, 26*, 46-50. doi: 10.1111/1471-6402.00042

Stone, J. Lynch, C. I. Sjomeling, M., & Darley, J. M. (1999). Stereotype threat effects on black and white athletic performance. *Journal of Personality and Social Psychology, 77,* 1213-1227. doi: 10.1037/0022-3514.77.6.1213

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology, 100*, 255-270. doi: 10.1037/a0021385

Strand, S., Deary, I. J., & Smith, P. (2006). Sex differences in cognitive abilities test scores: A UK national picture. *British Journal of Educational Psychology, 76*, 463-480. doi: 10.1348/000709905X50906

Strenta, A. C., Elliot, R., Adair, R., Matier, M., & Scott, J. (1994). Choosing and leaving science in highly selective institutions. *Research in Higher Education, 35*, 513-547.

Su, R., Rounds, J., & Armstrong, P. I. (2009). Men and things, women and people: A meta-analysis of sex differences in interests. *Psychological Bulletin, 135*, 859-884. doi: 10.1037/a0017364

Terlecki, M. S., Newcombe, N. S., & Little, M. (2007). Durable and generalized effects of spatial experience on mental rotation: Gender differences in growth patterns. *Applied Cognitive Psychology, 22,* 996-1013. doi: 10.1002/acp.1420

Underhill, C. M. (2006). The effectiveness of mentoring programs in corporate settings: A meta-analytical review of the literature. *Journal of Vocational Behavior, 68*, 292-307. doi: 10.1016/j.jvb.2005.05.003

U.S. Census Bureau. (2000). *Census 2000*. Retrieved from http://censtats.census.gov/data/US/01000.pdf

Valian, V. (2007). Women at the top in science – and elsewhere. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 27-37). Washington, DC: American Psychological Association. doi: 10.1037/11546-002

VandeWalle, D. (1997). Development and validation of a work domain goal orientation instrument. *Educational and Psychological Measurement, 57*, 995-1015. doi: 10.1177/0013164497057006009

Voyer, D., Voyer, S., & Bryden, M. P. (1995). Magnitude of sex differences in spatial abilities: A meta-analysis and consideration of critical variables. *Psychological Bulletin, 117*, 250-270. doi: 10.1037/0033-2909.117.2.250

Wai, J., Cacchio, M., Putallaz, M., & Makel, M. C. (2010). Sex differences in the right tail of cognitive abilities: A 30 year examination. *Intelligence, 38*, 412-423. doi: 10.1016/j.intell.2010.04.006

Wai, J., Lubinski, D., & Benbow, C. P. (2005). Creativity and occupational accomplishments among intellectually precocious youths: An age 13 to age 33 longitudinal study. *Journal of Educational Psychology, 97*, 484-492. doi: 10.1037/0022-0663.97.3.484

Wai, J. Lubinski, D., & Benbow, C. P. (2009). Spatial ability for STEM domains: Aligning over 50 years of cumulative psychological knowledge solidifies its importance. *Journal of Educational Psychology, 101*, 817-835. doi: 10.1037/a0016127

Walton, G. M., & Carr, P. B. (2011). Social belonging and the motivation and intellectual achievement of negatively stereotyped students. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (pp. 89-106). New York, NY: Oxford University Press.

Walton, G. M. & Cohen, G. L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology, 92*, 82-96. doi: 10.1037/0022-3514.92.1.82

Walton, G. M. & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science, 331*, 1447-1451. doi: 10.1126/science.1198364

Webb, R. M., Lubinksi, D., & Benbow, C. P. (2002). Mathematically facile adolescents with math-science aspirations: New perspectives on their educational and vocational development. *Journal of Educational Psychology, 94*, 785-794. doi: 10.1037/0022-0663.94.4.785

Webb, R. M., Lubinski, D., & Benbow, C. P. (2007). Spatial ability: A neglected dimension in talent searches for intellectually precocious youth. *Journal of Educational Psychology, 99*, 397-420. doi: 10.1037/0022-0663.99.2.397

Wenneras, C. & Wold, A. (1997). Nepotism and sexism in peer-review. *Nature, 387,* 341-343.

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin, 127*, 797-826. doi: 10.1037/0033-2909.127.6.797

Widnall, S. E. (1988). AAAS presidential lecture: Voices from the pipeline. *Science, 241,* 1740-1745.

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation. *Contemporary Educational Psychology, 25*, 68-81. doi: 10.1006/ceps.1999.1015

Williams, W. M., & Ceci, S. J. (2007). Introduction: Striving for perspective in the debate on women in science. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science? Top researchers debate the evidence.* (pp. 3-23). Washington, DC: American Psychological Association. doi: 10.1037/11546-001

Willingham, W. W., Cole, N. S., Lewis, C., & Leung, S. W. (1997). Test performance. In W. W. Willingham & N. S. Cole (Eds.), *Gender and fair assessment* (pp. 55-126) Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Wout, D., Danso, H. Jackson, J., & Spencer, S. (2008). The many faces of stereotype threat: Group- and self-threat. *Journal of Experimental Social Psychology, 44*, 792-799. doi: 10.1016/j.jesp.2007.07.005

Yee, D. K., & Eccles, J. S. (1988). Parent perceptions and attributions for children's math achievement. *Sex Roles, 19*, 317-333. doi: 10.1007/BF00289840

Yerkes, R. M., & Dodson, J. D. (1908). The relationship of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology of Psychology, 18*, 459–482.

Yeung, N. C. J. & von Hippel, C. (2008). Stereotype threat increases the likelihood that female drivers in a simulator run over jaywalkers. *Accident Analysis & Prevention, 40*, 667-674. doi: 10.1016/j.aap.2007.09.003