STEREOTYPE THREAT AS A BARRIER TO WOMEN ENTERING STEM CAREERS

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ABSTRACT

Vocational psychology has produced a great deal of research about the development of career interest and choice. Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994) has increasingly guided much of this research, particularly research that has been concerned with career pathways for science, technology, engineering and mathematics (STEM) fields. Women and racial/ethnic minorities are largely underrepresented in STEM, increased research about the factors contributing to these disparate numbers in these domains is important as employment opportunities in STEM are on the rise. Thus far the proximal contextual affordances studied have minimally included research from social psychology regarding stereotype threat (Steele, 1997). Stereotype threat research has demonstrated that negative stereotypes about one’s social identity can influence performance (e.g., women in mathematics). The purpose of the current study was to examine the relationships among stereotype threat and academic self-efficacy for women majoring in STEM fields. As coping efficacy has been shown to mediate the impact of barriers on academic self-efficacy and interests and moderate the relationship between variables related to identity and self-efficacy, the present study examined the impact of coping efficacy on the relationship between stereotype threat and self-efficacy.
Participants were 232 undergraduate women majoring in STEM fields. Stereotype threat was measured by stigma consciousness (Pinel, 1999) and the stereotype vulnerability scale (Spencer, 1993). Coping efficacy was measured by the Coping With Barriers scale (CWB; McWhirter, 1997) and academic self-efficacy by Lent et al.’s (1987) Self-Efficacy for Academic Milestones (AM-S) index. Responses were collected online and analyzed using structural equation modeling (SEM). Results of the mediation model showed a significant negative path from stigma consciousness to academic self-efficacy. When coping efficacy is included in the model, the direct path was no longer significant, but a significant indirect effect is present, suggesting coping efficacy’s role as a mediator. Conversely, a moderation model was tested, showing that the interaction of coping efficacy and stigma consciousness was significant on academic self-efficacy. These findings offer an important addition to the proximal contextual barriers framework within SCCT. Additionally, they demonstrate that identity and environment interaction can be harmful to women’s career development in STEM.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xii</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Researching Self-Efficacy in STEM Career Development</td>
<td>2</td>
</tr>
<tr>
<td>Stereotype Threat</td>
<td>7</td>
</tr>
<tr>
<td>Linking Stereotype Threat and SCCT</td>
<td>10</td>
</tr>
<tr>
<td>Stereotype Vulnerability</td>
<td>12</td>
</tr>
<tr>
<td>Stigma Consciousness</td>
<td>13</td>
</tr>
<tr>
<td>Summary and Statement of Purpose</td>
<td>14</td>
</tr>
<tr>
<td>II. LITERATURE REVIEW</td>
<td>18</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>19</td>
</tr>
<tr>
<td>Social Cognitive Career Theory</td>
<td>23</td>
</tr>
<tr>
<td>Interest model</td>
<td>24</td>
</tr>
<tr>
<td>Choice model</td>
<td>25</td>
</tr>
<tr>
<td>Performance model</td>
<td>29</td>
</tr>
</tbody>
</table>
The Relationship of Proximal Contextual Influences ………………….. 31
Stereotype Threat…………………………………………………………….. 36
Contributing Factors …………………………………………………………… 37
  Environment ................................................................. 37
  Identity ................................................................. 39
  Performance ............................................................... 41
  Summary ................................................................. 44
Measurement of Stereotype Threat ………………………………………….. 45
  Stereotype Vulnerability .................................................. 45
  Stigma Consciousness ................................................... 47
  Stereotype Threat as a Proximal Contextual Influence………………… 48
Coping-Efficacy in Vocational Research…………………………………… 53
  Summary…………………………………………………………… 58
III. METHODOLOGY……………………………………………………………. 60
  Research Questions……………………………………………. 60
  Participants……………………………………………………… 61
  Measures……………………………………………………….. 63
    Academic Self-Efficacy ................................................. 63
    Coping Efficacy ....................................................... 64
    Stereotype Threat ..................................................... 65
      Stereotype vulnerability ........................................... 65
      Stigma consciousness ............................................. 67
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic Data</td>
<td>68</td>
</tr>
<tr>
<td>Procedure</td>
<td>69</td>
</tr>
<tr>
<td>Analyses</td>
<td>69</td>
</tr>
<tr>
<td>Summary</td>
<td>74</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>76</td>
</tr>
<tr>
<td>Stereotype Vulnerability Scale: Factor Structure</td>
<td>66</td>
</tr>
<tr>
<td>Data Cleaning</td>
<td>82</td>
</tr>
<tr>
<td>Descriptive Statistics and Correlations</td>
<td>85</td>
</tr>
<tr>
<td>Tests of Hypotheses</td>
<td>85</td>
</tr>
<tr>
<td>Exploratory Analyses</td>
<td>95</td>
</tr>
<tr>
<td>Summary</td>
<td>100</td>
</tr>
<tr>
<td>V. SUMMARY AND DISCUSSION</td>
<td>102</td>
</tr>
<tr>
<td>Overview of the Current Study</td>
<td>102</td>
</tr>
<tr>
<td>Results of the Current Study</td>
<td>104</td>
</tr>
<tr>
<td>Stereotype Vulnerability Scale development</td>
<td>104</td>
</tr>
<tr>
<td>Relationship of Coping Efficacy to Vocational Constructs</td>
<td>105</td>
</tr>
<tr>
<td>Relationship of Barrier Constructs to Vocational Constructs</td>
<td>106</td>
</tr>
<tr>
<td>Mediation Model</td>
<td>109</td>
</tr>
<tr>
<td>Moderation Model</td>
<td>111</td>
</tr>
<tr>
<td>Exploratory Analyses</td>
<td>113</td>
</tr>
<tr>
<td>Limitations</td>
<td>115</td>
</tr>
<tr>
<td>Implications</td>
<td>118</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCCT theoretical model</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Conceptual model</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Model of choice goals</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>Mediation measurement model</td>
<td>57</td>
</tr>
<tr>
<td>5</td>
<td>Moderation measurement model</td>
<td>74</td>
</tr>
<tr>
<td>6</td>
<td>Stereotype vulnerability scale (SVS)</td>
<td>79</td>
</tr>
<tr>
<td>7</td>
<td>SVS – four item version</td>
<td>80</td>
</tr>
<tr>
<td>8</td>
<td>SVS – revised version</td>
<td>82</td>
</tr>
<tr>
<td>9</td>
<td>Direct path model</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>Full mediation model</td>
<td>91</td>
</tr>
<tr>
<td>11</td>
<td>Alternative mediation model</td>
<td>92</td>
</tr>
<tr>
<td>12</td>
<td>Conditional effect of Coping With Barriers on the relationship between</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Academic Milestones Scale and Stigma Consciousness Questionnaire</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Moderation model</td>
<td>96</td>
</tr>
<tr>
<td>14</td>
<td>Curvilinear relationship of stereotype vulnerability across year in college</td>
<td>99</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1. Exploratory factor analysis ............................................................... 81
Table 2. Cases included in and excluded from the analyses ............................... 85
Table 3. Correlations between primary variables ............................................. 86
Table 4. Mean values, standard deviation, range, and alphas of primary variables .... 86
Table 5. Summary of research hypotheses and outcomes .................................. 101
CHAPTER I
INTRODUCTION

Careers in Science, Technology, Engineering, and Mathematics (STEM) fields rank among the fastest-growing nationally. The Bureau of Labor Statistics projected that from 2004 to 2014 jobs in these sectors will have grow by 22 percent (United States Department of Labor, 2007). Greater investments at the state and local levels have been made to prepare individuals for this growing job market. For example, the Department of Education’s “A Blueprint for Reform” (2010) includes several initiatives that focus on preparing students in elementary and secondary education to pursue careers in math and science. At the college level, support has grown for professional and student development in STEM fields, especially with funding through the National Science Foundation (NSF) and institutional support for STEM programs. Moreover, the jobs available offer salaries higher than the national average, having a mean annual wage for all STEM occupations of $77,880, well above the U.S. average of $43,460 (Cover, Jones, & Watson, 2011).

As with higher education generally, the problem of inconsistent access to educational opportunities appears to impact the diversity of those who pursue careers in STEM fields (National Science Board, 2012). Women and U.S. racial and ethnic minority students are underrepresented among students in STEM fields. Recently, there has been a great deal of research focusing on this underrepresentation. The Journal of Social Issues
devoted an entire issue to the problem of student success and ultimate pursuit of STEM careers (Syed & Chemers, 2011). The issue focused on personal factors such as self-efficacy and identity, social factors such as parental and family support, and institutional factors such as university support, and educational opportunities. Syed and Chemers concluded that the “complexity of the problem of underrepresentation in STEM requires a broad and deep understanding of the lives of underrepresented individuals” (p. 437). Therefore, in order to address this problem, the present study aimed to understand how social identity may impact the vocational development barriers for women in STEM majors within higher education institutions.

**Researching Self-Efficacy in STEM Career Development**

Researchers in counseling psychology initially addressed demographic disparities in STEM career entry by examining the low number of women compared to men in science-based majors. Betz and Hackett (1983) examined the role mathematics self-efficacy played in supporting retention and success in mathematics careers, finding that decisions to select science-based majors were significantly associated with students’ levels of mathematics self-efficacy. Additionally, Betz and Hackett found that men in their study reported significantly stronger math-related self-efficacy expectations. Bandura’s (1977, 1986) Theory of Social Cognition in learning experiences provided a theoretical framework to this early research with constructs such as domain-related (e.g. mathematics, science, etc.) self-efficacy and the triadic interplay of personal, environmental, and behavioral influences. Betz and Hackett’s initial utilization of Bandura’s construct of self-efficacy has remained the crux of much vocational research exploring career decision.
Later, the development of Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994) expanded and adapted Bandura’s work to include outcome expectations as contributing to interests, goals, and performance in academic domains. The SCCT model seen in Figure 1 explores factors related to an individual’s beliefs concerning their perception of how successful they may be in pursuing different vocational domains.

These beliefs are shaped by environmental and identity characteristics that are posited to predict one’s career development. Specifically, self-efficacy, outcome expectations, interests, goals, actions, and performance are determined by contextual variables. Research using the SCCT model has directly explored the relationships between college students’ racial identity, gender, and their self-efficacy for completing math and science courses as well as their intention to pursue STEM careers (e.g., Gainor & Lent, 1998; Lent, Lopez, & Bieschke, 1991; Byars-Winston & Fouad, 2008; Byars-Winston, Estrada, Howard,
Davis, & Zalapa, 2010). For diverse populations, SCCT has demonstrated predictive power for understanding interests and career choice. Self-efficacy and outcome expectations have been shown to predict interests and choice intentions. Environmental factors, such as perceived supports and barriers have been demonstrated to have an indirect impact on choice through self-efficacy (Lent et al., 2001; Byars-Winston et al., 2010).

The primary focus of SCCT research has been self-efficacy, conceptualized as one’s beliefs about one’s ability to perform certain tasks. Self-efficacy differs from a global self-confidence or assessment of a skill-set. Instead, self-efficacy is seen as a “dynamic (rather than fixed) attribute” (Lent et al., 1994; p. 83) that interacts with ability within a given domain. Self-efficacy drives much of social cognitive career theory because it underscores the necessary component of agency in completing behaviors and forming career interests. Additionally, self-efficacy has been posited to reflect one's core beliefs about one's potential to create a desired outcome (Lent et al., 1994). Because self-efficacy concerns judgments about capability, the mediating effect of self-efficacy has been studied in beliefs about careers appropriate for one’s identity. As an example, Betz and Hackett’s (1981) seminal paper posited that women are less likely to pursue traditionally male-dominated fields, believing they do not have the capabilities due to vicarious learning experiences such as sex-role stereotyping, lack of exposure to performance accomplishments, and lack of verbal persuasion or encouragement from others. Byars-Winston and Fouad (2008) demonstrated that men report higher math/science self-efficacy, more positive outcome expectancies (positive outcomes related to pursuing a math or science career), and more parental involvement. Women
perceived greater barriers to pursuing a career in math or science than did men. According to Bandura (1997) self-efficacy beliefs account for the majority of influence on interests and development of goals related to pursuing a career.

Self-efficacy has often been understood as the combined impact of content self-efficacy (pertaining to task performance) and coping efficacy. Content self-efficacy is defined as individuals’ beliefs about their ability to perform tasks within a distinct academic domain. Coping efficacy, on the other hand, is defined as one’s beliefs about their ability to manage or negotiate barriers to career progress. Lent and colleagues (2001) suggested that content efficacy and coping efficacy exert both individual and combined influences on interest, choice, and performance criteria. Empirically, coping efficacy has been assessed as one's confidence in managing perceived situational and environmental demands that have the potential to impede performance in given domain. For example, situational and environmental demands have been identified as sex and racial discrimination (Swanson, Daniels, & Tokar, 1996) or financial and educational opportunities (Swanson & Woitke, 1997). The sparse research addressing the influence of coping efficacy has shown coping efficacy is positively related to content (academic) self-efficacy, outcome expectations, interests, and goals while being negatively related to career barriers. Coping efficacy also directly predicted academic self-efficacy and interests and mediated the strength of association between career barriers and academic self-efficacy (Byars-Winston & Fouad, 2008). Recently, coping efficacy has been demonstrated to mediate relationships between systemic and personal classism, perceived social status, and career outcome expectations (Thompson & Dahling, 2012) as well as the relationship between career barriers and career outcome expectations (Perrone,
Civilette, Webb, & Fitch, 2004). According to Bandura (1997) those who have high coping efficacy may perceive potential barriers as challenges while those with low coping efficacy see the same barriers as threats to their performance.

In reviewing contextual supports and barriers, Lent, Brown, and Hackett (2000) encouraged greater understanding of coping with barriers to explore individual differences in how people respond to environmental barriers. Supports and barriers within SCCT are included under the larger concept of proximal contextual influences (Figure 1) that are important during “active phases of educational or career decisions” (Lent et al., 2001, p. 38). To date, proximal contextual influences have been defined as barriers and supports that are activated through relationships. For instance, supports may be framed as encouragement from friends or family, while barriers are framed as feeling pressured by important persons to change a discipline of study (Lent et al., 2005). Byars-Winston and colleagues (2010) have expanded contextual variables to include perceived campus climate and other-group orientation. Campus climate perceptions include classroom experience, racism and discrimination, and peer interactions (Cabrera, Nora, Terenzini, Pascarella, & Hagedorn; 1999), while other-group orientation is measured by respondents’ endorsement of items reflecting positive attitudes toward one’s in-group (i.e., ethnic identity). Byars-Winston et al.’s study of ALANA students in biology and engineering showed that perceived campus climate had a direct effect on both other-group-orientation and academic self-efficacy, which mediated perceived campus climate’s indirect effect on interests and offered partial support for a mediated indirect effect on goals. This study demonstrates the influence of environmental variables, such as perception of campus climate, on one’s confidence in succeeding academically. As
proximal contextual variables, the evidence presented that perceived campus climate and other group orientation impact academic self-efficacy is a valuable contribution to making a conceptual link to the impact of other personal and social variables that are influenced by the environment.

Thus far, the proximal contextual influences studied have focused on a limited variety of variables. The inclusion of stereotype threat in vocational literature using SCCT is sparse (Davies, Spencer, Quinn, & Grehardstein, 2002; Deemer, Thoman, Chase, & Smith, 2013). Yet the impact of stereotype threat on performance through social identity in higher education has been robust. Therefore its utility in expanding our understanding of how proximal contextual influences affect the process of implementation or abandonment of career relevant choices is paramount.

**Stereotype Threat**

Stereotype threat is defined as “the social-psychological threat that occurs when one is in a situation or doing something for which a negative stereotype about one's group applies. This predicament threatens one with being negatively stereotyped, with being judged or treated stereotypically, or with the prospect of conforming to the stereotype” (Steele, 1997, p. 614). A myriad of studies in this area has shown that stereotypes about certain groups’ (e.g., women, African-Americans) intellectual abilities (e.g., mathematics) negatively influences those students’ performance in diagnostic conditions. When the stereotype threat was lifted, by framing testing situations as non-evaluative of intelligence, stereotyped students’ performance significantly improves (Steele & Aronson, 1995; Spencer, Steele, & Quinn, 1999). Over time, stereotype threat is associated with persons with negatively stereotyped identities feeling systematic pressure
that undervalues their ability. This leads negatively stereotyped groups to disidentify with
domains such as school achievement, a phenomenon Steel (1997) terms disidentification.
This robust phenomenon has been demonstrated with multiple minority groups, including
ethnic minorities (e.g. Steele & Aronson, 1995), women (e.g. Spencer, Steele, & Quinn,
1999), girls (e.g. Ambay, Shih, Kim, & Pittinsky, 2000), students from low
socioeconomic backgrounds (Croizet & Claire, 1998), and older adults (Levy, 1996).

Cabrera, Colbeck, and Terenzini (2001) found classroom experiences for minority
individuals in STEM domains to be different than for their white counterparts, an
experience the authors cited as a “chilly climate” (p. 338). Therefore, it may be that
continued experiences that involve multiple personal, contextual, and performance-based
factors, result in disidentification and/or lower self-efficacy beliefs concerning science
and mathematics ability within STEM domains for underrepresented students.

Stereotype threat is often empirically demonstrated as producing immediate
effects, such as scoring lower on tests of mathematical ability. In addition, Woodcock,
Hernandez, Estrada, and Schultz (2012) found for African American and Latino/a
students in science majors, the experience of stereotype threat over a three-year period
was related to decreased intention to pursue a science major. This gives empirical support
to the long-term implications of stereotype threat, including domain disidentification,
defined as the “more permanent separation of the self and the domain in question in
response to chronic stereotype threat across time” (p. 635;Woodcock et al., 2012).
Therefore, stereotype threat is not just situational; rather, it is sustained through cultural
experiences and internalized through history and pervasive negative beliefs about one’s
identity or minority status. Overall, stereotype threat can serve to undermine underrepresented students’ identity and beliefs about their abilities within the classroom.

Brodish and Devine (2008) tested an integrated process model that combined mediating variables of emotionality (physiological response) with that of worry (cognitive response) for women in mathematics. Using measures adapted from achievement goal theory (Elliot & Church, 1997), Brodish and Divine measured performance-avoidance goals using items that reflected avoidance of appearing incompetent in comparison to others, for example “My goal is to avoid doing poorly on the test.” Positing that under stereotype threat conditions avoidance motivation and state test anxiety would be linked. Brodish and Devine found that women under stereotype threat conditions on a test of quantitative ability reported more worry, greater emotionality post-test, and answered fewer questions correctly than did those in non-threat conditions. As well, participants under threat endorsed performance-avoidance goals more strongly and mastery goals to a lesser extent than did those in the non-threat condition. In other words, this study illustrates an integrated process that helps to understand the mechanisms by which stereotype threat functions. From these results, stereotype threat can be assumed to affect performance through the adoption of performance-avoidance goals and increased worry concerning performance.

Stereotype threat’s mechanisms for reducing performance provide a strong link to the theorized sources of self-efficacy that are hypothesized to bolster performance which include one’s beliefs about their past performances, as well as the successive failures or successes within a task-specific domain, combined with vicarious learning, social persuasion, and physiological and affective states (i.e. situational anxiety). Research on
stereotype threat has repeatedly demonstrated that the interplay of identity, of diagnostic performance conditions that are task-relevant, and of tasks that are difficult enough to cause doubt can negatively impact performance for stereotyped individuals. Thus, consideration of this social-psychological variable and its impact on self-efficacy as it is related to the SCCT model of career development could offer an increased understanding of the mechanisms that inhibit career persistence.

**Linking Stereotype Threat and SCCT**

Presently, the use of stereotype threat as a relevant vocational development variable has been sparse. Davies et al. (2002, study 3) demonstrated with a sample of 30 men and 32 women in introductory psychology courses the impact of gender-stereotypic commercials on women’s performance and vocational interests. Women exposed to gender-stereotypic commercials indicated greater interest for careers that do not hold stereotypically sex-based assumptions concerning intellectual ability for performance. Compared to men, who showed little difference in interests across conditions, women who were exposed to the stereotypic commercials selected options for educational/vocational interest that did not risk negative stereotypes. This was also statistically different than the control group of women who selected a greater number of educational and vocational options within quantitative domains. The study is limited by its sample, although participants indicated math and their ability in mathematics was important to them, the students had not declared a major where mathematics would be of primary importance (e.g. engineering). Furthermore, the vocational interest measure was given directly upon experimental manipulation; the lasting impact of a stereotypic threatening situation cannot be extrapolated from these findings. The small sample size
makes generalizability difficult, yet the results are not nominal; rather they demonstrate an important empirical link between the activation of negative stereotypes and decreased interest in stereotypic vocational domains.

Deemer, Thoman, Chase, and Smith (2013) were the first to explore stereotype threat within the vocational framework of SCCT. Their study gathered data from 439 female undergraduate students enrolled in chemistry and physics laboratory courses. Deemer et al. built a model proposed to connect stereotype threat, self-efficacy, and intentions to pursue undergraduate research. Their results indicated that stereotype threat had a negative direct effect on science self-efficacy for women in chemistry and physics respectively ($\beta = -.16$, $p < .05$; $\beta = -.27$, $p < .01$). Science self-efficacy was still positively associated to research interests and science career choice, yet stereotype threat was negatively associated with research interests in both groups. Although, the results of this study provide an example of stereotype threat as a barrier to science career development there are several limitations to take into consideration. First, the construct validity of the measures used for the study is questionable. For example, their measure for stereotype threat consisted of three items adapted from an original four-item measure developed to capture stereotype threat in an experimentally manipulated context with racial minorities. Similarly, the measurement of self-efficacy used items from an original measure of motivation for learning in science coursework. While their confidence in learning science scale tapped one area of self-efficacy, namely “confidence”, the items were limited in scope, not meeting the measurement criteria set forth by Lent and Brown (2006) for measuring task-specific areas that are conceptually linked with other measurement instruments used in SCCT.
In order to explore the impact of stereotype threat on underrepresented students in STEM fields, the present study sought to empirically link the experience of stereotype threat to self-efficacy beliefs of underrepresented students in STEM domains. Two areas associated with the effects of stereotype threat were examined: stereotype vulnerability (Spencer, 1993; Woodcock et al., 2012) and stigma consciousness (Brown & Pinel, 2003; Pinel, 1999).

**Stereotype Vulnerability**

Stereotype vulnerability, a construct originally developed by Spencer (1993), refers to the degree to which stereotyped students report feeling threatened by negative associations with their performance in academic domains. As stereotype threat is a situational phenomenon, Spencer, Steele, and Quinn (1999) said it is “felt in situations where one can be judged by, treated in terms of, or self-fulfill negative stereotypes about one’s group. It is not, we assume, peculiar to the internal psychology of particular groups” (p. 6). Therefore, vulnerability denotes one’s perception of threat in situations where judgment concerning their academic ability in specific domains will be passed due to their gender or race/ethnicity.

Empirically, Steele, James, and Barnett (2002) found that women who were pursuing male-dominated majors compared to women who were not pursuing such majors reported that stereotype threat vulnerability as greater. Additionally, those women reporting higher stereotype threat vulnerability were also less likely to identify with their major and were more likely to report they were considering changing their major. Woodcock et al. (2012) created a revised version of Spencer’s (1993) Stereotype Vulnerability Scale (SVS-4) and studied the long-term outcome of chronic stereotype
threat with African-American and Latino/a students. Over a three-year period, Woodcock et al. found evidence of the experience of stereotype threat in their sample of undergraduate African Americans and Latino(a)s students. Analyses revealed a significant negative direct effect of stereotype threat on “scientific identity” for Latino(a)s but not for African Americans. The same significance was found for an indirect effect of stereotype threat on intention to persist in the sciences, where for Latino(a)s there was evidence of the hypothesized disidentification – or disassociating personal success from academic performance – but this was not significant for African American students. This difference in effect could be due, the authors opined, to the aggregated sample that included students from historically Black colleges and universities. There is evidence that African American students attending predominantly historically Black institutions report stronger self-efficacy, outcome expectations, technical interests, and social supports due to the presence of strong mentoring relationships and same-race mentors (Lent et al., 2005). Consequently, Woodcock et al. called for a better understanding of individual differences that may serve to buffer individuals’ experience of stereotype threat.

**Stigma Consciousness**

In order for individuals to be susceptible to the threat, their group identity must be salient and they must be aware of the negative stereotypes associated with their group. Goffman’s (1963) classic definition described stigma as a “spoiled” identity that is designated by a sign or mark that creates a devalued identity in comparison to “normals.” In understanding the social and environmental factors that lead to decreased self-efficacy in STEM domains, how conscious students are of a possible stigmatized identity will be
an important facet in understanding how their identity interacts with their academic performance and choice to continue in an academic domain.

Pinel (1999) described the expectation of stereotyping as “stigma consciousness” and developed the Stigma Consciousness Questionnaire (SCQ) to measure the level of awareness for individuals who are the target of stereotypes (e.g. women, gay men and lesbians, & racial minorities). In research with various stigmatized groups, high stigma consciousness has been associated with higher perception of discrimination and a greater awareness of instances when prejudicial behavior is personally experienced (Pinel, 1999, 2002). In differentiating the SVS-4 from the SCQ, Woodcock et al. (2012) stated, “the SVS-4 is a measure of the experience of stereotype threat, which is distinct from more dispositional measures of vulnerability to stereotype-threatening situations, such as Pinel’s measure of stigma consciousness” (p. 644). These differences are apparent in the item measurement, where stigma consciousness items are global in nature, measuring a dispositional vulnerability to stereotypes, for example “Most men have a problem viewing women as equals.” While items measuring stereotype threat vulnerability reference situational vulnerability, such as “If you do poorly on a test, people will assume it is because of your ethnicity.” Measurement of dispositional experiences as well as one’s perception of situational experience of stereotype threat will be important to determining their influence in SCCT’s framework of career decision-making.

**Summary and Statement of Purpose**

When the experience of a stigmatized identity is salient within an academic domain, this can result in stereotype threat, greater consciousness of stigma, and potentially disengagement and disidentification within an academic domain (Steele,
In order to understand this phenomenon in greater detail, the current study used the constructs of stereotype vulnerability and stigma consciousness to examine the influence of stigmatized identity on domain specific self-efficacy.

As coping efficacy has been hypothesized (Bandura, 1997; Lent et al., 2001) and demonstrated (Byars-Winston & Fouad, 2008) to have a unique contribution to understanding vocational interests, the role of coping efficacy is explored. Bandura (1986) discussed coping efficacy as an orientation to environmental barriers; someone with high coping efficacy may view social barriers as a challenge and those with low coping efficacy would see the same barrier as a threat. Lent et al. (2000) concluded that these differing perceptions lead to diverse motivations for pursuing or rejecting choice options. For the present study, one’s level of coping efficacy was tested as a mediator for self-efficacy, as coping efficacy may shape how underrepresented students respond to the social barrier and environmental demand of stereotype threat. Given the evidence that barriers can be construed differently among targets of discrimination (Masten, Obradovic, & Burt 2006; Pearson & Bieschke, 2001), the role that coping efficacy plays within relationship between stereotype threat, stigma consciousness and self-efficacy contributes to an important understanding of individual differences. Alternatively, it may be that high levels of coping efficacy result in barriers being perceived as challenges and therefore the resulting relationship between stereotype threat and self-efficacy is no longer present. As this has not been tested, an alternative competing hypothesis regarding coping efficacy as a moderator in the relationship for stigmatized individuals and coping efficacy was also tested as represented in Figure 2.
Overall, the present study bridges two important fields – self-efficacy in counseling psychology and stereotype threat in social psychology - by examining how proximal contextual factors shape domain self-efficacy for women STEM students. This dissertation addressed the need for greater understanding of individual differences in coping with barriers through the exploration of coping as a mediator that carries the effects of stereotype vulnerability and stigma consciousness to academic self-efficacy.

*Figure 2. Conceptual model.*

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Mediation paths (Hypotheses 3a-b)

Moderation paths (Hypotheses 4a-b)
influence of both stigma consciousness and stereotype threat to academic self-efficacy. Understanding how these contextual barriers influence students’ confidence about performance in their academic domain may offer insight for educational and career interventions that can foster the educational and career development of women, and ultimately their persistence in STEM fields.
CHAPTER II
LITERATURE REVIEW

Disparities present in STEM fields have been addressed by multiple disciplines including sociology (Seymour & Hewitt, 1997), education (Fryer, 2006), economics (Landivar, 2013), and various sub-disciplines in psychology. Counseling psychology has made unique contributions to the study of STEM disparities, especially in the field of vocational psychology, by exploring career interest and choice for underrepresented students in STEM majors. Social Cognitive Career Theory (SCCT; Lent et al., 1994) has been the framework for the majority of this research and the exploration of self-efficacy as a determinant in career behavior has been well documented (see Betz, 2007 for a review). Vital to this area of research are studies that will contribute to a better understanding of factors that promote and inhibit career development in STEM fields. Specifically, Lent et al. (2000) called for increased study of social, cultural, and economic factors that serve as barriers to career progress. Barriers may be defined as a combination of personal perception and environmental impediments. Lent et al. (2000) stated that measures should separately assess person and environment as disposition- (e.g. low self-efficacy) and situation-specific (unsupportive environment) measures, respectively. The current study sought to address these needs by examining unique factors that inhibit women’s entry into STEM majors.
This chapter opens with an overview of the construct of self-efficacy as it relates to vocational development. Next, literature that has investigated the function of self-efficacy in making career decisions is reviewed including work within the framework of SCCT. Then, the work of SCCT is explored in regards to proximal contextual barriers. From this literature review, conclusions are made regarding the need for a more expansive understanding of inhibitive factors that lead to restriction of career decision-making. Stereotype threat is then introduced as a fitting contextual influence that may serve as a barrier to career expression. This is followed by a consideration of the role of coping efficacy, acting as an important individual difference, may contribute to understanding the interplay between barriers and content focused self-efficacy. Finally, a summary of how the current study aids understanding vocational development and academic persistence of underrepresented students in STEM fields is presented. The chapter concludes with a summary of the research proposal and the presentation of hypotheses.

**Self-Efficacy**

The construct of self-efficacy originated in Bandura’s (1986, 1997) Social Cognitive Theory, which seeks to explain human behavior through a complex interaction of cognitive and performance mechanisms influenced by one’s social context. When discussing self-efficacy in relation to personal agency, Bandura (1989) stated with regards to self-efficacy “none is more central or pervasive than people's beliefs about their capabilities to exercise control over events that affect their lives. Self-efficacy beliefs function as an important set of proximal determinants of human motivation, affect, and action” (p. 1175). Bandura identified four pathways that influence self-
efficacy beliefs: (1) vicarious learning or observation of the performances of others; (2) verbal persuasion in the form of encouragement and praise, (3) physiological states from which people partly judge their capability, strength, and vulnerability, and (4) personal performance accomplishments.

Empirically, perceived self-efficacy is the degree of confidence a person has that they can accomplish certain tasks or deal with potential situations. As Bandura demonstrated, people avoid activities that they believe exceed their perceived coping capabilities, but they undertake and perform assuredly those that they judge themselves capable of managing (Bandura, 1977). Judgments about tasks are a complex process of evaluation concerning personal ability and situational factors that are used to make decisions to either implement behaviors to accomplish a task or avoid and distance oneself from tasks that are beyond assessed capabilities.

Hackett and Betz (1981) first applied Bandura’s ideas of self-efficacy to vocational psychology in their seminal theoretical paper on the career development of women. Hackett and Betz explored the construction of self-efficacy expectations for career using the four pathways discussed above. In exploring sex differences in efficacy expectations, Hackett and Betz outlined the social and developmental aspects that may lead to restriction of career choice for women. For instance, they postulated that when considering performance accomplishments, boys and girls are cast into stereotypic behaviors from a young age, thereby facilitating acquisition of skills for different tasks, but also enhancing perceived self-efficacy with regard to task performance. The restricted range of socially acceptable behaviors does not only inhibit self-efficacy for women, additionally the lack of role models and depiction of women in media and educational
roles are also less available (vicarious learning). Further complications come from anxiety responses (which Hackett and Betz cite as a co-effect rather than cause of low self-efficacy), where women are prone to experience greater anxiety in anticipation of performing tasks that are gender-stereotyped. High anxiety responses hinder development of self-efficacy beliefs. Finally, encouragement in the form of verbal persuasion can be facilitative or inhibitive of self-efficacy beliefs about career choice. Hackett and Betz cited a National Science Foundation study that found differences in encouragement for girls and boys from parents, teachers, and peers, where girls interests were treated with “ambivalence, lack of encouragement, or suggestions that their goals were inappropriate” (Hackett & Betz, 1981; p. 332-3).

Betz and Hackett (1981) followed their theoretical paper with an empirical investigation of career-related self-efficacy and gender differences in perceived college options. Gathering information from 134 female and 101 male undergraduates, Betz and Hackett measured beliefs regarding capabilities to complete tasks associated with 10 traditionally male occupations and 10 traditionally female occupations. Controlling for ability (as measured by ACT scores) men’s overall self-efficacy was equal across traditional and non-traditional occupations. The authors found that differences between genders were due to women’s low self-efficacy expectations in regards to traditionally male occupations as compared to non-traditionally male (traditionally female) occupations. Betz and Hackett concluded that self-efficacy was a useful construct for understanding career development for both men and women. In addition, they called for greater understanding of the influence of internal and external barriers on self-efficacy and, in turn, career development.
Betz and Hackett's work was followed by several tests of their theoretical hypotheses and support for their empirical findings. Notably, Lent, Brown, and Larkin (1984 & 1986) examined college students’ career self-efficacy in the technical/scientific fields. After developing a list of 15 scientific and technical occupations, Lent et al. (1984) assessed students' self-efficacy beliefs regarding their success in the interest related fields. Comparing high and low self-efficacy subjects at a one-year follow-up, self-efficacy was shown to predict achievement. Specifically, students reporting higher self-efficacy estimates for the occupations demonstrated higher grade point averages and greater rates of completion and persistence in science and engineering majors.

In their second study, Lent et al. (1986) addressed limitations in their previous study, employing a larger sample size and adjusting self-efficacy measures to establish greater psychometric specification. Expanding the self-efficacy ratings for scientific and technical occupations, Lent et al. also developed a new measure assessing self-efficacy in terms of academic milestones that students may expect to achieve during their academic tenure in undergraduate scientific and engineering coursework. Controlling for ability using high school rank and PSAT scores, hierarchical regression analyses yielded results demonstrating self-efficacy as a significant predictor of academic performance and in predicting possible career options within science and engineering fields. In testing career self-efficacy against similar measures, Lent et al. (1986) concluded that self-efficacy was a unique construct that explained career choice.

As Bandura’s social learning theory (1977) and later social cognitive theory (1986, 1997) was expanded, the progression of empirical and theoretical development in career research followed. Self-efficacy remains an important determinant of career
choice, but other factors related to Bandura’s theory needed to be explored as well. Next, I discuss the introduction of Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 1994) and examine both the theoretical concepts and empirical proliferation. Although the current study is concerned with self-efficacy, Betz and Hackett (2006) link self-efficacy and SCCT as sharing the same theoretical and empirical foundation and state that “one could equally validly refer to self-efficacy research as work on social cognitive theory” (p. 8).

**Social Cognitive Career Theory**

Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994) utilizes the environmental factors incorporated within Bandura's (1986) social-cognitive theory model to understand career decision-making. The full model (see Figure 1) draws on the social-environment as shaping one's behavior through several mediating variables (contextual factors, self-efficacy beliefs, outcome expectations, interests, and career goals). The theory works through three processes: formation of career and academic interests, career choices, and mechanisms through which performance outcomes are achieved.

SCCT is framed in the theoretical postulates of Bandura, beginning with his notion of *triadic reciprocality*; the view that person, environment, and behavior interact bidirectionally. Lent et al. (2002) asserted that within the SCCT model, the bidirectional nature is present over time where self-efficacy promotes interests and pursuit of interests creates (in a cyclical nature) opportunities for self-efficacy development. This is illustrated in Bandura’s (1997) discussion of career development, “Social cognitive theory posits a reciprocal but asymmetric relationship between perceived efficacy and
occupational interests, with efficacy beliefs playing the stronger determinant role” (p. 424). Because self-efficacy plays a strong role in each of the models within SCCT (interest, choice, and performance) each will be discussed briefly followed by a description of research relevant to the current proposed study.

**Interest Model**

In SCCT, interests are proposed to develop as a product of one’s beliefs concerning their ability to successfully perform activities associated with an interest. For example, in academic pursuits, students are likely to enroll in coursework for which they have confidence in being successful (self-efficacy) and for which they anticipate will be beneficial for their future (outcome expectations). As interests are formed through self-efficacy and outcome expectations, people then initiate goals to persist and increase their involvement. As shown in Figure 1, consistent success forms a feedback loop, which then increases self-efficacy and outcome expectations and both directly influence interests. The model holds that career interest can be influenced by personal and contextual variables (both proximal and distal to development), underscoring the role of personal agency in the formation of career development goals. As such, change and growth in interest can be possible at any point in career development, especially considering environmental conditions which promote or inhibit self-efficacy and outcome expectations, such as perceived environment and personal experiences as under investigation in the current study.

There is a large body of research supporting the joint paths of self-efficacy and outcome expectations on interests especially in mathematics and sciences (Byars-Winston & Fouad, 2008; Lent, Brown, Schmidt, et al., 2003; Navarro, Flores, &
Worthington, 2007). For example, Lent et al. (2005) built upon research supporting predictive relationships across gender and race-ethnicity in science and engineering fields. Their sample, consisting of 487 students in introductory engineering courses at two historically Black colleges and universities (HBCUs) and one primarily White institution (PWI), demonstrated that across gender and race-ethnicity, key variables in SCCT (i.e. self-efficacy, outcome expectations, and interests) showed consistent predictive utility for engineering interest regardless of person variables.

Providing increased support for these conclusions across gender and race-ethnicity, Lent et al. (2008) tested an interest model with 1208 university students majoring in computing disciplines at 21 HBCUs and 21 PWIs. The study was significant as their sample was diverse in terms of geography, university type, and student diversity. Furthermore, their model tested students at entry-level and advanced statuses. Finally, it explored a STEM area not usually assessed in the literature, computing disciplines. Their findings supported equivalent measurement for structural paths across gender, educational level, and university type. Additionally, their results reinforced support for a direct influence of social supports and barriers to self-efficacy ($R^2 = .44$) consistent with Bandura’s (1999, 2000) hypotheses and confirming previous research that added this path to the original SCCT model (path “a” Figure 1.; Lent et al., 2001; Lent et al., 2005).

**Choice Model**

The above research highlights three of the four constructs present within the choice model posited by Lent et al. (1994), self-efficacy, outcome expectations and interests. Self-efficacy and outcome expectations are expected to indirectly (through interests) and directly influence goal related behaviors (determination to engage in a
particular activity). These three constructs are considered the “building blocks” of career development (Lent et al., 2002). Also presented above are environmental and contextual influences (social supports and barriers; person inputs) that shape how individuals enact choice behavior. Lent et al. (2002) cited this aspect of the model as derived from Vondracek, Lerner, and Schulenberg’s (1986) work that called attention to “physical, cultural, material, and social features of the environment” (p. 274), which in the SCCT model are termed “contextual affordances”. Lent et al. (1994) also explained the influence of contextual affordances as related to Astin’s (1984) work that discussed a “structure of opportunity” that influences how one perceives their environment. Both play an essential role in the structure of social cognitive theory (Bandura 1997, 1986), as the emphasis is on cognitive appraisal in guiding behaviors. Within the SCCT model, contextual affordances are both at the distal (e.g. role models and support/encouragement) and proximal levels (e.g., emotional and financial support). The former is conceptualized as having a direct impact on learning experiences, which then inform self-efficacy and outcome expectations. Distal contextual affordances include factors such as career role models or supportive versus discouraging reinforcement for pursuing certain activities or interests. Proximal contextual affordances, by comparison, are influences occurring during active phases of career choice and decision. Proximal affordances have often been studied as perception of support, family status, and sociodemographic measures that Lent and Brown (2006) stated are “typically too broad to offer much precision in predicting domain-specific criteria” (p. 30). In the choice model (Figure 3) proximal contextual affordances are represented by the variables labeled “supports” and “barriers.”
Career barrier inventories developed from the work completed by Swanson and Tokar (1991) and Luzzo (1993), identified a constellation of barriers or constraints to development, such as lack of parental support and financial restrictions. In a similar vein career supports were researched to understand environmental factors that are facilitative of one’s career development within the SCCT framework. Supports have been studied in terms of parental support (McWhirter, Hackett, et al. 1998), faculty support (Hackett, Betz, Casa, & Rocha-Singh, 1992), and peer support (Ali, McWhirter, & Chronister, 2005). These studies found supports to be related to interest and pursuit of careers as well as academic success. Although the current study does not explore supportive

Figure 3. Model of choice goals

Paths 1-13 represent the 6-variable version and paths 1-6 the 4-variable version of the SCCT interest/choice models. From “Testing the choice model of social cognitive career
environments directly, Lent, Brown, and Hackett (2000) suggested understanding the relationship between barriers and supports and how individuals perceive barriers and/or utilize supports is essential in designing future career interventions.

Barriers and supports are posited to be interrelated (represented in path 13, Figure 3) and to directly influence choice goals (paths 7 & 8). In testing the choice model, Sheu et al. (2010) performed a meta-analytic path analysis across the six major Holland types. Based on the correlation matrixes of previously published studies sampled by Sheu et al., they found sufficient data to test a 6-variable model including supports and barriers for the R, I, and E themes but sufficient data were not present to test a 6-variable model for the A, S, and C themes. They organized their hypotheses to be consistent with the original 4-variable model as well as integrating tests for paths finding support in recent literature, namely self-efficacy as a mediating the relationship between contextual variables and goals (Lent, Lopez, Lopez, & Sheu, 2008; represented in the 6-variable model paths 1-13, Figure 3).

Sheu et al. (2010) collected literature spanning over 25 years with studies that incorporated the dependent variable of choice goals and at least one other variable present in the SCCT model. In all, they retained 45 independent samples comprised of college students, adults, and adolescents. Results for the 4-variable model across Artistic, Conventional, and Social themes provided support for SCCT’s interest and choice hypotheses, thus demonstrating support for self-efficacy and outcome expectations jointly
predicting interests as well as predicting choice goals directly and indirectly through interests. The results indicated that outcome expectations and interests largely mediated the effect of self-efficacy on choice goals. Indicating the strength of association of self-efficacy on choice goals is also dependent on the relationships of outcome expectations and interests with one’s self-efficacy.

Sheu et al. (2010) then tested a 6-variable model, which included paths from supports and barriers to self-efficacy, outcome expectations, and choice goals. Two models were tested to determine the role self-efficacy played in mediating the impact of contextual supports and barriers to choice goals; a full mediation model and a partial mediation model. Results across all Holland types supported Bandura’s (1999, 2000) hypothesis that self-efficacy mediates the effect of supports and barriers on choice goals. Between the two models tested, the partial mediation model (direct paths to choice goals as well as indirect through self-efficacy) yielded a better statistical fit to the data ($\Delta \chi^2 = 32.93, p < .05$). Greater examination of the strength of path coefficients across types and between full mediation and partial mediation led the authors to conclude, “much of the predictive potential of supports and barriers with respect to goals appears to be channeled through self-efficacy and outcome expectations” (p. 261).

**Performance Model**

Performance within the SCCT framework is posited to be a function of five conceptually distinct yet interrelated variables of cognitive ability, past performance, outcome expectations, self-efficacy beliefs, and goal mechanisms. The model is reciprocal, where performance attainments are predicted by past performance while also cycling back in the model (current performance then becomes past performance). Direct
paths predicting performance are posited from performance goals, past performance and ability, as well as self-efficacy. The model has been supported empirically, demonstrating evidence for the predictive utility of self-efficacy, goals, and past performance/ability on performance attainment (Brown, Lent, Telander, & Tramayne, 2011).

Relevant to the current study, Brown et al. (2008) performed a meta-analytic path analysis examining college students’ academic performance and persistence. Gathering data from a previous meta-analysis conducted by Robbins et al. (2004), Brown et al. extracted correlations from relevant measures of academic self-efficacy, academic ability (SAT/ACT scores) and academic skills (high school GPA), goals, performance (college GPA), and college retention and persistence. Results provided evidence for the predictive ability of self-efficacy in both college performance and persistence. Based on results, the authors concluded that self-efficacy beliefs are substantially related to academic goals, but did not find strong support for goals as an explanatory variable for grades earned in college. Two reasons for these results were put forward, first, it may be evidence that the motivational properties of self-efficacy and goals overlap to a degree that “goals do not provide students with unique motivational incentives that are not already provided by self-efficacy beliefs” (p. 305). The second explanation regarded how goals were measured in the data used, that being as more a global measure of intention to complete college rather than a specific task oriented goal.

The above text highlights the empirical support for SCCT’s interest, choice, and performance models in predicting career development. It is also evident that within these models self-efficacy plays a critical role in predicting one’s interest in academic fields,
choices that lead toward career development, and those behaviors that ultimately impact performance within career and academic domains. Therefore the role of self-efficacy has been illustrated to be a key variable in predicting one’s career development.

The Relationship of Proximal Contextual Influences

Proximal contextual affordances also play an important role in predicting performance. Lent, Brown and Hackett (2000) discussed the need to expand SCCT with greater attention to contextual variables. Although there has been support for the paths linking supports and barriers to self-efficacy among other variables in the interest and choice models (discussed above), Lent et al. (2000) outline three areas that would aid in theoretically and practically understanding person and contextual factors that impede career development. These consist of (1) the process through which contextual barriers become internalized, (2) aiding in development of counseling interventions aimed toward assisting individuals cope with environmentally imposed barriers, and (3) identifying areas for system wide intervention through advocacy and policy change. In order to enact the suggestions above, it is important to understand the elements of person, environment, and behavior within SCCT that demand increased attention. Thus far the literature has provided strong support for the paths across interest, choice, and performance models (see above) but the inclusion of contextual supports and barriers, although ample in the literature, has been limited in scope. I next address this area of the literature, reviewing studies that provide examples of research inclusive of contextual variables followed by a discussion of alternative contextual variables consistent with the person-environment-behavior model, namely the inclusion of stereotype threat within the SCCT model.
Lent et al. (2000) outlined areas consistent with contextual supports and barriers stating they have objective and subjective features as well as temporality (distal versus proximal). Those contextual influences considered to be objective include financial support or the quality of one’s education as opposed to subjective influences which are conceptualized as a the “person’s active phenomenological role in processing both positive and negative environmental influences” (p. 37, Lent et al., 2000). It is posited that these influences can serve to facilitate or impede interest formation and therefore inhibit or sustain choice and goal behaviors. This dissertation is interested in contextual influences proximal to active choice, goal and performance behaviors. In this manner contextual supports are understood as influencing one’s perception of their abilities (self-efficacy) in a complex and interrelated manner, influenced by person and environmental factors as well as the interaction between them. Lent et al. (2000) underscored this perspective in the following explanation of SCCT’s utilization of Bandura’s theory of triadic reciprocality:

“If environmental conditions like material wealth were the only important consideration, all poor kids would fail and all rich ones would succeed. Yet obviously life is not so simple. Career development theorists, therefore, need to consider multiple, potentially compensatory aspects of the objective environment – such as economic conditions, parental behaviors, and peer influences – as well as how individuals make sense of, and respond to, what their environment provides” (p. 37).

Vocational psychologists have used several approaches to study the support barrier framework. The following studies highlight these contributions as well as
underscore the need for greater exploration of subjective measures that understand individual differences in construal of environmental barriers both dispositional and situational.

The prototypical measurement of barriers and supports is represented in Lent, Brown et al.’s (2005) study of gender and university type (HBCU vs. PWI). Their measures consisted of two support factors; social and financial, and three barrier factors; social, instrumental, and gender. When applied to their sample of 487 students in introductory engineering courses across three universities, results indicated students who attended an HBCU reported stronger self-efficacy, outcome expectations, technical interests, social support, and educational goals than students at PWIs. Lent et al. speculated that this may be due to same-race mentoring and role models present at HBCUs. Differences in gender were not found, although, Lent et al. suggested this may be due to the first-year status of the sample, considering women in engineering may not have yet had the experiences often anticipated in male-dominated academic fields. The research supported the path from barriers to self-efficacy as well as the collective impact on goals across gender, university type and race/ethnicity. Lent et al. called for increased understanding of supports and barriers across gender, academic majors, as well as racial/ethnic groups and university resources.

Lent et al.’s (2005) observation of differences regarding African-American students’ experiences in engineering at HBCUs is given credence in Hurtado et al.’s (2009) qualitative investigation of underrepresented student experiences in science fields. Focus groups were conducted with underrepresented minority students at four institutions, purposefully sampling students who were in minority serving programs –
those programs that promote science identity and offer programmatic support for minority student success. Their findings bolster those factors implied within the supports and barriers framework of SCCT. Most salient within their findings were student experiences with social stigma. Hurtado et al. quoted one student who stated:

“...you feel a little strange when you’re the only girl in the room or you feel a little strange when you’re the Black guy in the White room, you know, and that might be a really big deterrent for people to go into these fields because they’re...we’re so human at the end of the day and we want to feel like we’re amongst a group of people that are accepting or that are already integrating people like ourselves into those groups” (p. 206).

For those students attending HBCUs, Hurtado et al. still found their interactions beyond their home institution met with stigma concerning their ability, and negative assumptions about the education they received at an HBCU. As Lent et al. (2005) posited, Hurtado et al.’s study provides evidence that environment plays a large role in the level of students’ feelings concerning science identity, which in turn influences self-efficacy and encouragement towards completion of a STEM degree.

Byars-Winston and Fouad (2008) studied the role of barriers and parental support in a sample of 227 undergraduates, finding gender differences between men and women in terms of math/science self-efficacy, greater positive outcome expectations, and men reporting more parental support than did women. In contrast, women perceived more career barriers for math/science fields than did men. This study illustrates the importance of familial support in addition to the environmental support demonstrated earlier. It also provides evidence that the barriers to women’s career development in science and
mathematics first discussed in Hackett and Betz (1981) are still salient in today’s academic environment. Women in the Byars-Winston and Fouad study reported less parental support for their interests in math and science domains and this is illustrative of the social-cognitive factor of verbal persuasion, where women’s career roles are restricted by stereotypic messages of what is an appropriate career path for women. Byars-Winston and Fouad’s study provides support for previous research that has demonstrated greater social support is indicative of greater self-efficacy in an academic domain.

As shown above, the SCCT model has robust empirical support in diverse environments, disciplines, and persons. Yet, Lent et al. (2005) commented that “it is even more useful, for practical purposes, to examine whether model fit is moderated by particular participant characteristics or environmental features” (p. 59). Although the usefulness of the theory has been demonstrated across populations, the same variables for considering environmental and contextual barriers have been used. This is restrictive toward our understanding of differing psychological experiences and their impact on career development. As Lent and Brown (2006) have argued, the existing barrier measures are too broad and could therefore be missing an important aspect of an individual’s career interest, choice, and goal behavior. Unique individual differences within the current study are tested with dispositional and situational measures of stereotype threat as well as examining the role of coping efficacy in explaining differences in academic self-efficacy.

Next, the topic of stereotype threat is discussed, outlining the basic and defining characteristics of the literature. Then, four areas of stereotype threat are discussed; environmental factors, the contribution of identity, the theoretical and empirical literature
explaining stereotype’s effect on performance, and finally how the collective experience contributes to one’s susceptibility to stereotype threat.

**Stereotype Threat**

Having established the low number of women and minority students who graduate with STEM degrees, a number of researchers (e.g., Betz & Hacket, 1981; Chemers et al., 2011; Good, Aronson, & Harder, 2008; Hurtado et al., 2009) have questioned the “pipeline” that leads to a science and technology degree. Many influences can impact student success in higher education (e.g., preparation in high school, family support, social economic status), yet identity uniquely influences students’ perception of their potential for success in pathways of higher education. Stereotype threat, first researched by Steele and Aronson (1995), explores the influence of a stereotype about one’s group on one’s performance of a task. The theory holds that when one’s social identity is made salient (i.e., women in mathematics), a number of stereotypes are accessed and, when negative, these stereotypes can diminish performance due to pressure and anxiety that one’s poor performance will confirm the culturally held stereotypes about one’s group (Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995).

Steele and Aronson’s original study (1995) examined the perceived gap in intellectual performance between White and African American students’ performance on diagnostic tests. They hypothesized that African Americans’ performance suffered as a product of the situation within which one completed an evaluative task. Giving Black and White students a series of verbal questions based on the Graduate Record Exam (GRE), one condition of students was primed with a threatening stimulus condition (e.g., this test will be diagnostic of your ability and a measure of your intellectual performance).
Alternatively, a non-diagnostic and non-diagnostic challenge condition were used, both stating that the task was to be used to assist in understanding how persons solved verbal problems and the latter stating the task was an attempt to provide a challenge to persons with high verbal ability. Steele and Aronson found that in a diagnostic condition, Black students performed significantly worse than their White counterparts and conversely that there was no significant difference in their performance in the two non-diagnostic conditions. This seminal study reported a total of four experiments, finding that stereotype threat “can impair the intellectual test performance of Black students, and that lifting it can dramatically improve their performance” (p. 808; Steele & Aronson, 1995). Since this study, numerous authors (for a review see Inzlicht & Schmader, 2012) have tested these effects on different populations; the collective literature posits numerous reasons for such environmental factors such as perceived assessment by others, stigma associated with identity or group affiliation, and factors contributing to performance such as anxiety, performance approach/avoidance motivators, and cognitive functioning. The next section discusses each in turn.

**Contributing Factors**

**Environment.** The climate within which stereotyped students exist can cause actual and perceived threats that make stereotypes more salient. The external forces at play can include teachers, parents, and peers whose influence and beliefs about stigmatized students’ ability can invoke negative stereotypes (for a review see Aronson & Steele, 2005). Steele (1997) stated that the collective experiences of social barriers, such as access to educational opportunities, socioeconomic advantages, lack of role models,
and low expectations from primary groups can lead to what he termed a “threat in the air” which leads to a ubiquitous stereotype threat in any domain of study.

The “threat in the air” can become more ostensible for those students whose minority membership is even more prominent within the classroom composition in STEM fields. This composition can induce stereotype relevant thoughts and depress performance. For example, Inzlicht, Aronson, Good, and McKay (2004) studied the prevalence of stereotyped thoughts Black students had when White students outnumbered them in a classroom. Even with as few as three persons (i.e., two White students and one Black student), Black students completed a greater number of stereotypic word associations on a test aimed to measure stereotype activation then did students in equal (one White and one Black student) or majority (two other Black students).

Environment can begin to have an effect on performance long before college age. Aronson and Good (2001) studied minority children's response to evaluative situations. They discovered that, when given a test which is termed as evaluative of abilities, sixth grade children chose to work on problems that are easier, but in non-diagnostic conditions students chose problems appropriate for their grade-level. Such evidence points to the constant struggle of minority students in achieving academic success. For those students, such as women and racial/ethnic minorities who have taken courses within STEM domains, the collective impact of environmental factors can be assumed to be relevant to the student. Students who have made it to high-level coursework at the college level can be assumed to be highly capable, as they have arguably overcome more obstacles than their White male or majority member counterparts.
This is one explanation posited by Good, Aronson, and Harder (2007) who studied the impact of stereotype threat on women in a college calculus course. Their study demonstrated both the suppressed achievement of women in mathematics and as well as answered criticisms that stereotype threat is largely a laboratory phenomenon, which diminishes its utility in “real-world” settings (Sackett, Hardison, & Cullen, 2004). Through proposing a "practice" test for students in an undergraduate calculus course, threat was examined by gender; researchers found that even in a high-level math course women were susceptible to depressed performance under stereotype threat. Notably, women’s performance was equal to that of men in the threat condition, and significantly exceeded the performance of men in the non-threat condition. Good and colleagues posited a number of explanations for these results including an "ethos of diagnosticity" (p. 25) and the ratio of men to women in the course. Given that the students’ final grades did not match the superior performance on the non-threat condition of the practice test, environmental influences should not be dismissed.

Overall, evidence supports that environment can shape how minority members view themselves in the context of others. Within the academic environment, this poses deleterious implications where students can feel threatened due to their social identity. Collective ideas within social settings can create cultural expectations that may be deemed as stereotypical in nature. Such stereotypes may then be transferred from parents, teachers, and peer groups to students, negatively impacting minority students’ ideas about their own success and ability in the academic environment.

**Identity.** One’s social identity is of paramount importance in understanding stereotype threat’s impact on the individual. As discussed earlier, personal identity is
made salient by social environments, which may serve to evoke stereotypic thoughts about oneself. Stereotype threat can only be activated, however when an individual is identified with the group (Schmader, 2002). When thoughts about one’s personal worth are negative, due to stereotypes concerning minority performance within academic domains or women’s performance in mathematics, the student may not only perform poorly for fear of confirming the stereotype, but may disengage from the academic domain all together. Steele (1997) suggested that results from stereotype experiments show self-rejecting concepts. This is evident, he posited, in the example of African-American participants (when given a choice) choosing not to list their race at the end of a diagnostic test. Additionally, in this same study (Steele & Aronson, 1995), African-American participants rejected stereotypical interests attributed to their race (e.g., rap music, basketball) more frequently when stereotype threat was invoked than when it was not invoked. Taken together, Steele suggested this behavior is in line with earlier theorists’ notions about internalization of negative attitudes resulting in group rejection and self-hating beliefs (Steele, 1997). Steele proposed a self-preservation response which he termed “disidentification” or a detachment of self-esteem from outcomes.

In the domain of education and interests, Gunderson, Ramirez, Levine and Beilock (2012) reviewed the existing literature on the impact of parents and teachers’ gender related stereotypes regarding girls and math. They concluded that often girls and young women follow the attributions of ability that are believed by their parents. For instance, when girls succeed at math this is due to effort, but their failure is attributed to ability. Boys, by contrast, succeed at math due to their ability but fail due to lack of effort. Gunderson et al. posited several theoretical constructs for transmission of these
beliefs including direct teaching, differential treatment, and modeling. These demonstrate sufficient overlap with the argument first made by Hackett and Betz (1981) regarding women’s career development in math-related domains. Specifically, both sets of authors opined that development of stereotypes regarding gender negatively impact girls’ development. These stereotypes are internalized through socialization of gender-biased norms through encouragement of activities in line with traditional gender-related behaviors (e.g., playing house or nurturing baby dolls) while discouraging behaviors that do not fit these stereotypes (e.g., building model airplanes). Further, girls are provided with differential treatment or verbal persuasion for pursuit of math and science interests and these are reinforced by vicarious learning or modeling. This process of stereotype attribution to women can lead to an internalized belief about ability based on gender-identity. Bonnot and Croizet (2007) found that women who endorsed stereotypical beliefs about women’s ability showed lower math self-concept.

Overall, socialization regarding gender and how women attribute these gender stereotypes to their identity can greatly influence their perception of their ability. The above findings support the notion that stereotyped individuals who have greater awareness or internalization of stereotypes regarding their social identity (e.g., gender) are less likely to persist towards completing a degree than those who have context relevant identities, such as a scientist (Eccles & Barber, 1999). To date, the direct impact of beliefs and experiences regarding gender stereotypes and vocational development has not been studied.

**Performance.** As noted, there are multiple explanations regarding how academic performance can be thwarted by negative stereotypes about one’s race/ethnicity or gender
and stereotypic beliefs about these identities. Several mediators have been studied to further understanding of how stereotype threat negatively impacts performance; these include anxiety, worry, reduced working memory capacity, and impaired self-regulatory behaviors (for a review see Aronson & McGlone, 2009). Specific examples of these mediators are discussed below.

Anxiety and the correlated physiological arousal associated with increased activity in the sympathetic nervous system including increased heart rate, systolic blood pressure, sweating and the release of adrenaline (epinephrine) during emotional arousal of fear or anger have been shown to either enhance or diminish performance on tasks dependent upon their level of difficulty (Bolles, 1967; Wright, Murray, Storey, & Williams, 1997). The theory holds that higher anxiety and more difficult task has diminishing returns. O'Brien and Crandall (2003) tested women's math performance in threat-induced tests finding that for women under threat, their performance was better on easier math tests compared to those in a control condition, but impaired on more difficult tests. They concluded that this is due in part to the impact of arousal due to anxiety surrounding confirming negative stereotypes about women and mathematical ability. The arousal concerning the induced stereotype (manipulated through an introduction to test materials informing participants that the tests had been shown to either produce gender differences or not produce gender differences) increased performance on an easy test but significantly reduced performance compared to a control group on the difficult test. Men who took part in in the study showed no differences by test or condition. Anxiety has also been demonstrated to be present in self-report (Osborne, 2001), nonverbal behaviors (Bosson, Haymovitz, & Pinel, 2004), and has been found to function to induce
performance avoidance goals (Elliot & Church, 1997; Elliot, McGregor, & Gable, 1999; Smith, 2004; Brodish & Devine, 2008).

Schmader, Johns, and Forbes (2008) posited an integrative set of mechanisms are responsible for the impairments associated with stereotype threat, including an increased physiological stress response, greater conscious monitoring of performance, and activation towards regulating negative thoughts and feelings. Taken together, these mediating effects can serve to diminish working memory capacity and therefore diminish test performance due to cognitive deficits. Other researchers have confirmed Schmader et al.'s (2008) model, whereby the process of being faced with a threatening situation of confirming a negative stereotype causes increased negative task-related thoughts (Cadinu, Maass, Rosabianca, & Kiesner, 2005) and greater task-related thoughts and worries (Beilock, Rydell, & McConnell, 2007). Mrazek, Chin, Schmader, Hartson, Smallwood, and Schooler (2011) studied the notion of mind-wandering (which they defined as a task-unrelated thought) and found that participants who were faced with a stereotype threat experienced more "off-task thoughts" when given a quantitative exam compared to a control condition, showing a reduction in sustained attention during performance.

As a construct related to anxiety, worry involves both the physiological responses present within anxiety with the addition of negative cognitions (Davey, Hampton, Farrell, & Davidson, 1992). Incorporating these closely related responses to stereotype threat, Brodish and Devine (2008) tested an integrated process model which combined the mediating variable of emotionality, a physiological response, with that of worry, a cognitive response, for women in mathematics, positing that their study would theoretically link the roles of avoidance motivation and state test anxiety under stereotype
threat conditions. Working from a model proposed by Ryan and Ryan (2005), Brodish and Devine hypothesized worry, defined as "cognitive reactions such as self-criticism and concerns about the consequences of failure," (p. 59; Ryan & Ryan, 2005) would act as a mediator in a stereotype condition to affect a student’s performance goals (Elliot & Harackiewicz, 1996). The model posits that students under threat who identify with the domain (e.g., math ability) and are a member of a stereotyped group (e.g., women, African Americans) will have anxiety about confirming such stereotypes, which directly impacts performance avoidant goals and depresses mathematical performance. Testing this model, Brodish and Devine found that women completing a test described as testing mathematical ability or quantitative ability and informed that quantitative ability may explain gender differences in standardized testing performance reported more worry, greater emotionality post-test, and answered fewer questions correctly than those in non-threat conditions where tests were framed as a test of “working memory capacity.” As well, participants under threat endorsed performance-avoidance goals more strongly and mastery goals to a lesser extent than those in the non-threat condition.

**Summary.** Collectively, the above factors contribute to the situational threat created by negative stereotypes about an identified group. These explanations converge across a broad area, which can be categorized as social identity threat (Aronson & McGlone, 2005). Social identity threat refers to an individuals identification with a collective group for which there exists a negative stereotype. The influence of this threat can be explained at both macrosocial and microsocial levels (Kesibir & Snyder, 2009). This sociological perspective acknowledges the influence of social structures (macro) and how they impact the individual in cultural and historical contexts of a society (micro).
Therefore stereotype threat is not just situational; rather, it is sustained through cultural experiences and internalized through history and pervasive negative beliefs about one’s identity or minority status.

Overall, when stereotype threat is evoked for women and minorities in the classroom, beliefs about their abilities are challenged and can result in diminished performance. Given the complex personal and environmental obstacles regarding identity, it is understandable why there is a consistent underrepresentation of women and racial/ethnic minority students in STEM fields.

**Measurement of Stereotype Threat**

As the above studies demonstrate, the methodology commonly used to measure stereotype threat is experimental inducement of differential levels of threatening diagnostic situations. This is useful in understanding the immediate effects of stereotype threat and providing causal evidence of the phenomenon in performance situations, but it creates difficulty for measurement in survey research, as proposed in the current dissertation. There are, however, two measures that have been used within similar research contexts that provide psychometrically valid assessment of the degree to which individuals feel threatened due to stereotypes concerning their academic performance. These constructs and their usefulness in experimental assessment of stereotype threat are discussed next.

**Stereotype vulnerability.** First developed by Spencer (1993), the concept of stereotype vulnerability measures situational responses to conditions where members of stigmatized groups can be vulnerable to devaluation based on intellectual performance. Across five studies evaluating math performance among equally prepared men and
women college students, Spencer demonstrated stereotype vulnerability as a useful predictor of performance. In situations where performance on a math test was characterized as being gender relevant, Spencer found women reported higher stereotype vulnerability and performed significantly lower on the test compared to women in the condition that framed the test as gender neutral. Overall, when women in the experiments scored lower on stereotype vulnerability, their performance on a math test increased.

Steele, James, and Barnett (2002) used stereotype vulnerability to measure the degree to which women in male-dominant academic areas reported greater perceptions of discrimination and stereotype threat than did women in female-dominant academic areas and men in female-dominant academic areas. Their results indicated that women in math, science, and engineering reported higher scores on stereotype vulnerability than did comparison groups. This result was related to higher levels of perceived sex discrimination, greater expectations of discrimination for future careers, and these women reported being more likely to think about changing their major. Although women experiencing stereotype threat and perceiving present and future discrimination were more likely to think about leaving, they were no less identified with their respective major than those in comparison groups, including men in female-dominant academic majors. These results support those derived from the experimental measurement of stereotype threat shown in the above studies and offer further evidence of the “chilly climate” encountered by women in STEM majors.

Further validation of the SVS was done by Woodcock, Hernandez, Estrada, and Schultz (2013) who used the SVS to assess the experience of stereotype threat with African American and Latino(a) undergraduate students in the sciences over a three year
period. Initially, they adapted the scale’s wording to match ethnicity rather than gender and then evaluated the scale structure using confirmatory factor analytic (CFA) procedures. They found redundancy in their initial measurement of the scale and therefore removed four of the eight total items, leaving a revised version of the scale that fit their data and formed a reliable self-report measure of experiences of stereotype threat.

Results using the four-item stereotype vulnerability scale (SVS-4) indicated across three academic years, African American and Latino(a) students endorsed experiencing stereotype threat during their pursuit of a degree in the sciences. In their sample, Woodcock et al. reported African American students reported significantly higher levels of stereotype vulnerability than did Latino(a) students. Their study expands the construct validity of the SVS while extending its usefulness with another stereotyped group of students. Furthermore, Woodcock et al. used cross-sectional methods to assess the longitudinal impact of stereotype threat over time, demonstrating the SVS-4 to be a robust measurement of the experience of stereotype threat across time.

**Stigma consciousness.** Although the prevalence of stereotypes is well documented (Crocker & Major, 1989), the targets of these stereotypes do not uniformly interpret the experience of belonging to a stereotyped group. Similarly, the impact of stereotype threat can vary from person to person. Pinel (1999) conceptualized this individual difference as stigma consciousness, defined as one’s expectation of judgment based on one’s group membership. Stigma consciousness is differentiated from stereotype threat on the basis of behavior. Where stereotype threat represents the fear that one may confirm a stereotype through acting in a stereotypical way, high levels of stigma consciousness represent the anticipation that others will stereotype one regardless of
one’s behavior. Although distinct, Pinel (1999) asserted that these two constructs covary in explaining performance.

Pinel and her research team demonstrated empirically this individual difference in self-consciousness in stereotyped identity. For instance, in a series of studies completed by Pinel (1999), persons who scored higher in stigma consciousness consistently were found to perceive greater levels of discrimination and were able to provide a greater number of examples of when they were treated in a prejudicial manner. Brown and Pinel (2003) combined the experimental manipulation typified within the study of stereotype threat with measurement of stigma consciousness, and provided evidence that stigma consciousness serves to moderate the relationship between stereotype threat and performance. Their results provide validity for the measurement of stigma consciousness as a useful covariate in determining the impact that stereotype threatening situations may have on women and minority students in STEM majors.

**Stereotype Threat as a Proximal Contextual Influence**

There is considerable overlap between the posited relationships of chronic stereotype threat and SCCT’s understanding of a self-system where thought, motivation, and behavior interact in a complex process that guides and develops responses to situation-specific circumstances. Stereotype threat parallels mechanisms of Bandura’s triadic model of causality for self-efficacy, which includes personal attributes (internal cognitive and affective states), external environmental factors, and overt behaviors. For instance, stereotype threat’s impact on performance is due to an integrative set of mechanisms, including an increased physiological stress response, greater conscious monitoring of performance, and activation towards regulating negative thoughts and
feelings (Schmader, Johns, and Forbes; 2008). In a similar interaction, self-efficacy is sustained through vicarious learning, social persuasion, physiological and affective states, and past performance (Bandura, 1997). Lopez, Lent, Brown, and Gore (1997) studied these mechanisms as predictive of self-efficacy and goals for mathematics. Their sample of 296 high school students were measured on their objective math ability (Stanford math test scores), perceived sources of efficacy information, outcome expectations, course-specific self-efficacy, interests in mathematics and science activities, and math course grades. Results indicated that ability and self-efficacy were the best predictors of performance. Consistent with social-cognitive theory, ability was an important factor in determining performance while self-efficacy determined the degree to which ability contributed to performance (Bandura, 1986).

Lent, Brown, et al. (1996) explored persons’ sources of self-efficacy through qualitative interviews, discovering that the primary factor influencing self-efficacy was personal performance accomplishments. As the SCCT model demonstrates a cyclical structure from self-efficacy to goals to performance feeding back into self-efficacy via learning experiences (when accounting for ability), the suppression of performance caused by stereotype threat can be theorized to greatly diminish self-efficacy and consequently academic goal behavior. Repeated vulnerability to stereotype threat and perceived discrimination could then be linked to underrepresented students difficulty in persistence within STEM majors.

As discussed in Chapter 1, research on stereotype threat and vocational outcomes is sparse. Often, stereotype threat is a laboratory phenomenon, evoked through subtle or explicit priming of stereotypes for a targeted group. Valid measurement of stereotype
threat as a longstanding experience for women and racial/ethnic minorities in STEM majors is critical for understanding stereotype threat’s impact on self-efficacy in career development.

To date, only one study has explicitly linked stereotype threat to the vocational theory of SCCT. Deemer, Thoman, Chase, and Smith (2013) studied stereotype threat as a contextual barrier for women in chemistry and physics laboratory courses. Positing that the laboratory environment is most similar to future work experience, Deemer et al. believed this would be an area closely related to future career choice. They sampled 439 women using measures that tested science career intent, research interest, science self-efficacy, and stereotype threat. Their results indicated that stereotype threat had a direct effect on science self-efficacy and influenced research intent indirectly through science self-efficacy for both chemistry and physics samples. Within-group tests of their model indicated that only the physics model had a significant total indirect effect on science career intentions via stereotype threat ($\beta = -.06, p = .022$). Overall, Deemer et al. concluded that stereotype threat is a useful predictor of science self-efficacy and that self-efficacy is a strong mediator of threatening situations regarding performance.

Although these results offer support for the proposed relationships within this dissertation, there are several important limitations to this study that should be addressed. First, Deemer et al.’s study is restricted by their constrained sample. While physics and chemistry labs fall generally into STEM curriculum, students within these classes were not asked if they planned to major in a physics or chemistry field where women are traditionally underrepresented. Therefore, their outcome measure of science career intent (dichotomously scored) may not be a good indicator to measure the impact of stereotype
threat on women in STEM. For example, science career choice measured distally by career intent and proximally by research interest, could have little application for premedical students who may not view research involvement and science careers as applicable to their future, but nonetheless need to complete a physics or chemistry requirement.

Second, their measurement of the proposed constructs raises some concerns. To measure stereotype threat, Deemer et al. adapted three questions altering gender from race-specific wording, using Marx and Goff’s (2005) four questions for stereotype threat regarding race. In the original study, Marx and Goff measured stereotype threat between conditions of Black and White students administered a test of verbal ability by either a White or Black proctor. Having the comparison group allowed conclusions to be drawn regarding the meaningfulness of the stereotype threat scale. Deemer et al. have no such comparison group, therefore it is difficult to assess whether their adapted measure of stereotype threat has construct validity. Furthermore, Deemer et al. reported needing to log transform the distribution of stereotype threat scores due to extreme positive skew in their results. The scale ranges from (1) strongly disagree to (7) strongly agree in response to items such as “I worry that my ability to perform well in my science lab class is affected by my gender.” Results reported from their sample indicated a mean score of 2.06 (SD = 1.42) for both groups on the stereotype threat scale. Transformations to data indicating low endorsement of the items on stereotype threat could fall into the fallacy of making low quality data behave as though it was normally distributed and meaningful in interpreting the phenomenon of stereotype threat.
Finally, the measurement of science self-efficacy was taken from five items from a subscale of the Science Motivation Questionnaire (Glynn & Koballa, 2006). Since the original scale was constructed, it has been revised twice (Glynn, Taasoobshirazi, & Brickman, 2009 and Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011) based on exploratory factor analyses and further information concerning content validity. It is not clear if the five items chosen were from the early scale or from subsequent revisions. Furthermore, the total scale, while based on social cognitive theory concerning motivation, does not follow the qualifications put forward by Betz and Hackett (2006) for the measurement of self-efficacy in career literature. As the original scale seeks broadly to understand students motivation to learn science, Glynn et al. (2011) suggested adapting the scale in future use to be domain specific rather than “I am sure I can understand science” the statement would read, “I am sure I can understand biology.” Compared to those scales traditionally used in SCCT research, the five items of the science motivation questionnaire used to assess self-efficacy lacked specificity regarding subject and behavior. Although it may have measured global self-efficacy regarding a student’s determination to succeed in science courses, a scale consistent with the SCCT research would offer greater generalizability to the research in career development.

Future research that examines stereotype threat as a proximal contextual barrier should address the above limitations and build on the results presented in Deemer et al.’s study. As previous literature has lacked specificity of barrier constructs and often does not capture the unique interaction of environment and identity, the current dissertation proposed the use of stereotype vulnerability as an experiential variable and stigma consciousness as a dispositional variable related to the experience of stereotype threat. As
the mechanisms of stereotype threat discussed impact an individual’s self-concept through changes in physiological, cognitive, and performance areas, the current dissertation proposed they negatively related to academic self-efficacy. Specifically the current study hypothesized the following:

Hypothesis 1a. Academic self-efficacy is negatively related to stereotype threat vulnerability.

Hypothesis 1b. Academic self-efficacy is negatively related to stigma consciousness.

Deemer et al. concluded that self-efficacy may act as a “protective mechanism” that serves to buffer the impact of stereotype threat on career intentions (p. 12). This indicates an important line of research that can evaluate individual differences in assessment of threat and barriers to successful completion of academic related tasks. In other words, self-efficacy may serve as a buffer, but the mechanisms through which one appraises situations such as sexism in their academic environment as threatening and therefore discouraging compared to a challenge and thereby strengthening resolve to overcome the obstacle may reveal the buffering effect.

**Coping-Efficacy in Vocational Research**

Lent and colleagues (2001) suggested that content efficacy and coping efficacy exert both individual and combined influences on interest, choice, and performance criteria. Empirically, coping efficacy has been assessed as one's confidence in managing perceived situational and environmental demands that have the potential to impede performance in a given domain. For example, situational and environmental demands have been identified as sex and racial discrimination (Swanson, Daniels, & Tokar, 1996)
or financial and educational opportunities (Swanson & Woitke, 1997). The sparse research addressing the influence of coping efficacy has shown coping efficacy is positively related to content (academic) self-efficacy, outcome expectations, interests, and goals while being negatively related to career barriers. Coping efficacy also directly predicted academic self-efficacy and interests and mediated the strength of association between career barriers and academic self-efficacy (Byars-Winston & Fouad, 2008). Given the above findings, in the current dissertation, the following hypotheses are proposed regarding coping efficacy’s relationships with the other main variables of study:

Hypothesis 2a. Coping efficacy is positively related to academic self-efficacy.

Hypothesis 2b. Coping efficacy is negatively related to stereotype threat vulnerability.

Hypothesis 2c. Coping efficacy is negatively related to stigma consciousness.

Lent, Brown, and Hackett (2000) suggested coping efficacy may either serve as a mediator or moderator in the relationship between perceived barriers and variables predictive of career choice. Sparse literature has tested this proposed hypothesis. Using the CWB scale created by McWhirter (1997), Perrone, Civiletto, Web, and Fitch (2004) explored barriers and supports for 113 college graduates participating in a longitudinal study of academically talented students. Positing a model of the relationships between career barriers, family barriers and career or family outcome expectations as mediated by social supports and coping efficacy, Perrone et al. found evidence of a partial mediating role of coping efficacy. This led to the conclusion that even in the face of many career barriers, high coping efficacy leads to more positive outcome expectations.
More recently, Thompson (2012) examined career barriers such as social status, classism and ethnic discrimination as they relate to college outcome expectations with a sample of 121 Native American university students. Thompson hypothesized coping efficacy would serve as a mediator between barriers and career outcome expectations. Results indicated that greater experience of ethnic discrimination and classism were related to lower levels of coping efficacy. Testing for coping efficacy as a mediator, Thompson found full-mediation for the relationships between barriers and outcome expectations via coping efficacy. Thompson’s study provides support for the proposition that the strength of coping efficacy can influence how individuals from diverse backgrounds respond to negative environmental experiences. Similarly, Hackett and Byars (1996) found that coping efficacy was a useful predictor regarding successful performance beliefs in spite of expected obstacles such as racism and discrimination. These results support the need for increased understanding of how individual differences, such as coping efficacy, impact underrepresented students’ perception and management of barriers within education.

Using SCCT to explore perceived career barriers in math and science for 227 undergraduate students’ efficacy, interest, and goal behaviors, Byars-Winston and Fouad (2008) tested the mediating role of coping efficacy in the relationship between perceived barriers and self-efficacy. Their results indicated that coping efficacy significantly predicted math/science self-efficacy. Coping efficacy also mediated the relationships between perceived barriers and goals via interests. Byars-Winston and Fouad called for further exploration of the role of confidence in managing challenges faced within math
and science domains. Additionally, they pointed to a need to further assess differences regarding gender in coping efficacy.

The above studies offer support for coping efficacy as a mediator of the relationship between career barriers and self-efficacy in several different vocational domains. The present project extends this research to examine barriers that can be internalized as part of one’s identity. Specifically, the current study tests the impact of the predictor variables of stigma consciousness and stereotype vulnerability on academic self-efficacy. The variable of coping efficacy is tested as a mediator within the planned model with the following hypothesized results:

Hypothesis 3a: Coping efficacy mediates the relationship between stereotype threat vulnerability and academic self-efficacy (Mediation 1, path c’1 Figure 4).

Hypothesis 3b: Coping efficacy mediates the relationship between stigma consciousness and academic self-efficacy (Mediation 2, path c’2 Figure 4).

To date, research in counseling psychology has often expressed confusion over the difference between mediation and moderation (Frazier, Tix, & Barron, 2004). By definition “a moderator effect is nothing more than an interaction whereby the effect of one variable depends on the level of another” (Frazier, Tix, & Barron, 2004; p. 116). By contrast a mediator is defined as “the mechanism through which a predictor influences an outcome variable” (Frazier, Tix, & Barron, 2004; p. 116). Greater confusion regarding the role of intervening variables between predictors and outcomes is presented by MacKinnon, Krull, and Lockwood (2000) who asserted that there are statistical similarities among mediation, confounding, and suppression effects with the statistical effect of mediation and confounding being identical. As there is support for use of coping
efficacy as both a mediator in the relationship between barriers and self-efficacy and as a moderator of the relationship between identity and self-efficacy, the role that coping efficacy takes as a moderator in the relationships between perceived barriers and career outcomes, such as stereotype threat and academic self-efficacy, is also examined.

Thompson (2008) underscored the role of coping efficacy as a buffer between perceived identity and self-efficacy, concluding that coping efficacy “acts as a safeguard between negative experiences and one’s internalized status identity” (Thompson, 2008; p. 132). Although Thompson was studying experiences with classism, we may assume the internalized stigma that is felt in social status can be shared with gender and experiences with sexism.

Due to the mixed results and use of coping efficacy in vocational psychology as both a mediator and moderator, a competing hypothesis is being proposed testing the effects of coping efficacy as a moderator of the relationship between stereotype threat and self-efficacy:
Hypothesis 4a. Coping efficacy moderates the relationship between stereotype vulnerability and academic self-efficacy.

Hypothesis 4b. Coping efficacy moderates the relationship between stigma consciousness and academic self-efficacy.

Summary

The present study builds upon research in both vocational psychology and social psychology through integration of the concepts of academic self-efficacy and stereotype threat. As these constructs and their theoretical base inform one another, this interdisciplinary grouping “leverages understanding” through creating new knowledge concerning environmental influences on career development that is useful, disciplined, integrative and purposeful (Mansilla, 2005; p. 17). Given the limitations of previous research, the current dissertation seeks to use constructs that have been validated psychometrically with multiple populations, have construct validity, and conceptually fit with the literature. Finally, the added exploration of coping efficacy as a mediator or moderator of the relationship between stereotype threat and self-efficacy builds upon Deemer et al.’s research by exploring differential effects of threatening situations on self-efficacy. Specifically this dissertation examines the following questions:

1. What is the relationship between stereotype threat and academic self-efficacy?

   Hypothesis 1a. Academic self-efficacy is negatively related to stereotype threat vulnerability.

   Hypothesis 1b. Academic self-efficacy is negatively related to stigma consciousness.
2. What are the relationships amongst coping-efficacy, academic self-efficacy, and stereotype threat?

Hypothesis 2a. Coping efficacy is positively related to academic self-efficacy.

Hypothesis 2b. Coping efficacy is negatively related to stereotype threat vulnerability.

Hypothesis 2c. Coping efficacy is negatively related to stigma consciousness.

3. Does coping efficacy mediate the relationship between stereotype threat and academic self-efficacy?

Hypothesis 3a: Coping efficacy mediates the relationship between stereotype threat vulnerability and academic self-efficacy (Mediation 1, path c’1 Figure 4).

Hypothesis 3b: Coping efficacy mediates the relationship between stigma consciousness and academic self-efficacy (Mediation 2, path c’2 Figure 4).

4. Does coping efficacy moderate the relationship between stereotype threat and academic self-efficacy?

Hypothesis 4a. Coping efficacy moderates the relationship between stereotype threat vulnerability and academic self-efficacy.

Hypothesis 4b. Coping efficacy moderates the relationship between stigma consciousness and academic self-efficacy.
CHAPTER III

METHODOLOGY

This chapter outlines the methodology used in the present study. Undergraduate women majoring in STEM fields were sent an online survey to complete. Measures used to assess the constructs outlined in the proposed model included Coping with Barriers Scale (CWB; McWhirter, 2001), Self-efficacy for Academic Milestones Scale (AM-S; Lent et al., 1986), Stereotype Vulnerability Scale (SVS-4; Woodcock, Hernandez, Estrada & Schultz, 2013), and the Stigma Consciousness Questionnaire (SCQ; Pinel 1999).

Research Questions

The present dissertation combined previous literature concerning vocational interest in STEM fields (SCCT) and social psychological factors related to disengagement and attrition from academic domains (stereotype threat). In so doing, this study sought to investigate the following research questions:

1. What is the relationship between stereotype threat and academic self-efficacy?
2. What are the relationships amongst coping-efficacy, academic self-efficacy, and stereotype threat?
3. Does coping efficacy mediate the relationship between stereotype threat and academic self-efficacy?
4. Does coping efficacy moderate the relationship between stereotype threat and academic self-efficacy?

**Participants**

Two-hundred and thirty-two female undergraduate students in STEM programs that participate in a state-wide scholarship encouraging students to enter science, technology, engineering, mathematics and medical degree programs agreed to participate in the present study. Participation included completion of questionnaires addressing experience and perception of stereotypes concerning gender, confidence in coping with educational barriers, and confidence in completing subject areas consistent with STEM degrees. Participants ranged in age (18-43) with a mean age of 20.72 (SD = 2.92) years, and in academic years (1st year 18.7%; 2nd year 27.4%; 3rd year 25.3%; 4th year 19.1%; 5th year 8.3%, and greater than 5 years 1.2%). Racial and ethnic representation was 73% White, 14.1% Asian-American, 5% African-American/Black, 3.7%, Bicultural, 2.9% Hispanic/Latino(a), 0.8% Pacific Islander, and 0.4% Mexican-American or Chicano. Fifty-three percent of participants endorsed an intention to pursue a graduate/professional degree and all the participants attended a public and primarily white institution (PWI). With regard to extramural and supportive programing, 29% endorsed being in a scholarship program, 42.7% endorsed being involved with mentoring, 27.8% endorsed receiving academic advising, and 29.9% endorsed being involved in academic tutoring. Additionally, 48.5% of participants endorsed being involved with social opportunities with other students in their major, 24.5% endorsed being involved with study groups, 9.1% reported involvement with test preparation, and 55.2% of participants indicated
they were not involved with any academic support beyond what is normally offered in their program.

Participants were recruited through a statewide scholarship program that works with 47 colleges and universities in a large Midwestern state. Students recruited were at least 18 years of age and had declared a major in an engineering discipline, biology, chemistry, physics, mathematics, or computer science. The sample size needed to meet requirements for power and determining parameter effects for analysis within structural equation modeling as well as mediation/moderation modeling was determined following recommendations to consult theory, statistical power, and desired effect sizes for interactions (Frazier, Tix, & Barron, 2004).

For the present study, online software for a-priori sample size calculation for multiple regression based on anticipated effect size, desired statistical power level, the number of predictors, and probability level (Sooper, D.S., 2013) was used. It suggested that for sufficient power (.80) to detect mediation and moderation effects, sampled groups should consist of approximately 160 participants. The current study also used structural equation modeling (SEM). For data to converge using maximum likelihood (ML) estimation on the model in Figure 2, Jackson (2003; as cited in Kline, 2012, p. 12) was consulted and offered the $N:\!q$ rule, which specifies sample size with concern to the model complexity. Here “$N$” concerns the sample size, or number of cases, and “$q$” represents the number of model parameters. The model estimated in the current research consists of 10 parameters. Kline suggested an ideal ratio of 20:1, for the current model that would equal 200 participants (similar to estimation above). As Kline suggested reviews of
published literature have a median sample size of 200 cases, the current study sought an 
\( N \geq 200 \) to adequately estimate the proposed model.

**Measures**

**Academic Self-Efficacy**

Academic self-efficacy was assessed using a version of Lent et al.’s (1987, 1987) Self-Efficacy for Academic Milestones (AM-S) index. The index measures participants’ confidence in their ability to accomplish specific academic tasks. The original scale was developed for science and engineering majors but was adapted by Byars-Winston et al. (2010) to additionally be applicable to biological science majors. The Academic Milestones index was created in response to critiques that self-efficacy measures were too global in nature and should instead be task-specific. Therefore, items on the Academic Milestones index focus on participants’ confidence in accomplishing specific tasks critical to success for science, agriculture, or engineering majors (e.g., "complete the mathematics requirements for most science, agriculture, or engineering majors"). Byars-Winston et al. (2010) additionally added an item to assess completing the “biological requirements for most science, agriculture, or engineering majors” as this task would be applicable to biological science as well as biomedical engineering majors. The modified scale consists of 11 items. Participants’ confidence ratings are determined on a 10-point Likert-type scale, ranging from 0 (no confidence) to 9 (complete confidence), indicating the degree to which participants feel they can accomplish each academic milestone. Scores are summed across items and divided by the total number of items (11), yielding a measure of strength of self-efficacy for academic milestones.
Initial reporting of the coefficient alpha for the AM-S was .89 (Lent et al., 1986; 1987) with a population of 105 undergraduates who participated in a career-planning course for engineering and science majors. The revised version employed by Byars-Winston et al. (2010) demonstrated a Spearman-Brown split-half reliability coefficient of .85 and Cronbach’s alpha coefficient of .92 for the full scale with a sample of 223 African-American, Latino/a, Southeast Asian, and Native American undergraduate students majoring in biological science and engineering majors. Lent et al. (1986) found the AM-S to be related to theoretically similar constructs including an Educational Requirements (ER) scale that assessed self-efficacy ($r = .57$). Byars-Winston et al. reported criterion validity based on positive relationships between the AM-S and participants’ reported commitment to their college major. Items for the AM-S are presented in Appendix A.

**Coping Efficacy**

Coping efficacy was measured with the Coping With Barriers (CWB) scale (Luzzo & McWhirter, 2001). The CWB was used to measure college students’ efficacy for coping with barriers related to their career and educational goals. The 28-item scale contains two subscales: Career-Related Barriers (7 items) and Education-Related Barriers (21). The present study used the Education-Related Barriers subscale. In response to education-related barriers, respondents are asked to “Please rate your degree of confidence that you could overcome each of the potential educational barriers listed below.” Ranging on a Likert-type scale ranging from 1 (*highly confident*) to 5 (*not at all confident*), participants rate items such as “Money problems,” “Not being prepared enough,” “Lack of support from friends” “Negative comments about my racial/ethnic
background [insults, jokes]”. Total scores range from 21 to 105, with higher scores indicating less perceived ability to overcome barriers (i.e., less coping efficacy).

Luzzo and McWhirter (2001) reported initial validation with a sample of 286 first-year undergraduate students, finding a Cronbach’s alpha of .88 for the Career-Related Barriers subscale and .93 for the Educational-Related Barriers subscale. Utilizing a subsample of 55 randomly selected participants, Luzzo and McWhirter (2001) reported test-retest reliabilities over a 2-month period that were moderate and ranged from .49 to .55 for the Educational-Related Barriers subscale and total scale, respectively. Lopez and Ann-Yi (2006) used the CWB to explore career indecision in three racial/ethnic groups of college women and demonstrated that the CWB subscale had high internal consistency reliabilities across their sample of White (n = 147; \( \alpha = .89 \) & \( \alpha = .93 \)), African American (n = 78; \( \alpha = .90 \) & \( \alpha = .93 \)), and Latina (n = 100; \( \alpha = .88 \) & \( \alpha = .92 \)) women, respectively. Most recently, Thompson (2012) used the CWB with a university student sample of 121 students. The CWB total score had a coefficient alpha of .87 and provided support for the CWB as a good measure of individual differences in coping with barriers in career outcome expectations. Items for the Educational-Related Barriers subscale of the CWB are presented in Appendix B.

**Stereotype Threat**

The measurement of the experience of and vulnerability to stereotype threatening situations was accomplished using two measures that have demonstrated reliable and valid results in previous use.

**Stereotype vulnerability.** To measure stereotype threat, the present study used the four-item Stereotype Vulnerability Scale (SVS-4; Woodcock, Hernandez, Estrada &
Schultz, 2013). The SVS-4 is a shortened version of the original SVS developed by Spencer (1993) to examine the impact of stereotype threat on the performance of women on math tests. The 4-item version of the scale was developed by Woodcock et al. in a longitudinal analysis of 313 African American and 250 Latino(a) undergraduate science students. Spencer’s original SVS had not been psychometrically validated, therefore Woodcock et al. ran confirmatory factor analytic (CFA) procedures to derive item content and confirm factor structure for the revised SVS-4. The 4-item scale yielded a reliability estimate of .85.

The original SVS developed by Spencer measures the experience of stereotype threat for women. Each item begins with the stem: “How often do you feel that because of your gender…” Examples of items include “Some people believe that you have less ability” and “If you do poorly on a test, people will assume that it is because of your gender.” The SVS asks participants to rate each item on a Likert-type scale ranging from (1) never to (5) almost always. Scores are summed and divided by eight providing an average ranging from 1-5. As participants in the present study could identify two identities (woman of color), the SVS for race/ethnicity was also presented to women participants with the stem: “How often do you feel that because of your ethnicity…” Higher scores on either version of the SVS indicate greater incidence of experiencing stereotype threat. All eight items were presented with post-hoc analysis to determine the appropriateness of the SVS-4 for use with women participants. Scale scores for gender and race/ethnicity were totaled separately. Items for both versions of the SVS are presented in Appendix C.
Stigma consciousness. To measure individual differences in stigma consciousness, the Stigma Consciousness Questionnaire (SCQ; Pinel, 1999) was used. The SCQ is a 10-item questionnaire that can be adapted to targeted populations who may experience negative stereotypes regarding their identity. Pinel (1999) stated the SCQ is meant to reflect an “expectation that one will be stereotyped, irrespective of one’s actual behavior” (p. 115). Initial validation was completed with a population of 753 women in introductory psychology courses. Pinel found support for a 10-item SCQ with an internal reliability alpha of .74. A cross-validation was completed with a new set of 302 female participants yielding the same factor structure and a Cronbach’s alpha of .72 (Pinel, 1999; study 1). Next, Pinel tested the SCQ for convergent, discriminant, and construct validity as well as test-retest reliability. Results showed that women high in stigma consciousness were more likely to perceive discrimination and provide more examples of sexism than women low in stigma consciousness. Further evidence of the scale’s validity was derived from exploring relationships with related constructs, such as the Modern Sexism Scale, with which the SCQ was negatively correlated ($r = -.28; p < .01$; Study 2). Test-retest reliability analysis was completed over a 1-month period with 42 participants and demonstrated strong reliability ($r = .76, p < .01$). Further evidence has shown that stigma consciousness is a useful construct in identifying individual differences among varying targeted groups (women, men, gay men, lesbians, African Americans, Whites, Asians, Latino/as; Pinel 1999, Studies 1-6; Brown & Pinel, 2003).

As Pinel discovered, stigma consciousness is a domain-specific construct, meaning it measures specific group-membership but does not inform researchers of levels of stigma consciousness with regard to other group memberships. Therefore, for the
In the present study, two versions of the SCQ were presented, one for gender (SCQ for Women; Pinel 1999) and one for race/ethnicity (SCQ for Race/Ethnicity; Pinel, 1999). Each scale consists of 10-items and includes statements such as “My race/ethnicity does not influence how people act with me” and “Stereotypes about women have not affected me personally.” Respondents are asked to indicate their level of agreement with these statements on a Likert-type scale ranging from 0 (strong disagree) to 6 (strongly agree). Scores are summed and divided by 7 yielding a mean score ranging from 0 to 6 with high-scores reflecting greater stigma consciousness. In circumstances of intersecting identities (i.e. women of color) both scales were presented. Total scores were summed separately. Items for the SCQ are presented in Appendix D.

**Demographic Data**

Participants were asked to include demographic information for three levels; institution, personal, and academic. Institutional information includes whether they attend a public or private college/university, geographical region where their university is located, and whether the college/university is a Predominantly-White Institution (PWI), Historically Black College or University (HBCU), or a Minority Serving Institution (MSI). Personal information included age, gender, and race/ethnicity. Academic information consisted of college major, commitment to major, overall college grade point average (GPA) or expected GPA, cumulative high school GPA, and current year in college. Comparison study has been conducted for reporting test scores and GPA in survey research with results indicating self-report as a reliable indicator of actual performance (Cassady, 2001). The demographics page is presented in Appendix E.
Procedure

Emails were sent to relevant department heads at universities that participate in the statewide STEM scholarship programs. The messages described the study’s aim to understand and promote the experiences of students in STEM fields and how they cope with various environmental barriers. Students wishing to participate were directed to a web site that provided informed consent and a description of the study. Additional students were recruited via online social media sites. The author gathered approximately 50 online groups that supply information and attract students interested in the sciences and engineering. Groups post information via social media that users can respond to; examples of such organizations include “Society of Women Engineers,” “National Society of Black Engineers” and “Society for Advancement of Chicanos and Native Americans in Science.” Similarly, information and a link to the study was posted on the social media newsfeeds for interested students to complete. As an incentive to participate, participants who fully completed the study were entered into a drawing for the chance to win one of several prizes such as an Amazon Kindle Fire tablet and cash awards.

Analyses

Research questions regarding relationships between variables were explored using Pearson product-moment correlation coefficients ($r$). Also, means and standard deviations were computed for all variables. Hypotheses for relationships are as follows:

Hypothesis 1a. Academic self-efficacy is negatively related to stereotype threat vulnerability.

Hypothesis 1b. Academic self-efficacy is negatively related to stigma consciousness.
Hypothesis 2a. Coping efficacy is positively related to academic self-efficacy.

Hypothesis 2b. Coping efficacy is negatively related to stereotype threat vulnerability.

Hypothesis 2c. Coping efficacy is negatively related to stigma consciousness.

Next, structural equation modeling (SEM) was used to explore direct and indirect effects of the four variables. Overall model fit was assessed by the four indices outlined in Kline (2012): chi-square goodness of fit, Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Standardized Root Mean Square Residual (SRMR). Chi-square is a null model test statistic, that is the smaller the chi-square statistic the lower the probability reported, chi-square is also referred to as a ‘badness-of-fit statistic’ (p. 199; Kline, 2012). In SEM a chi-square statistic needs to be non-significant to indicate model fit. Additional recommendations for chi-square allow the researcher to explore model specification in order to improve chi-square results and the statistic can be used as a comparison of fit with competing models. Similar to the chi-square, the RMSEA is a badness-of-fit statistic. It is estimated on approximations of a noncentral chi-square distribution and the df for a specified model. RMSEA estimates with a p-value of .05 or less are considered to be good fitting models. The Bentler Comparative Fit Index (CFI) measures the relative improvement of fit compared to a baseline model. As CFI approaches 1.0 the fit of the model improves (with 1.0 being perfect model fit). Ideal values for the CFI are ≥ .95 (Hu & Bentler, 1999). Finally, the SRMR is based on covariance residuals. An ideal value would be zero, as the differences between predicted and observed covariances would be non-existant. In practice, Hu and Bentler (1999) suggest a threshold of SRMR ≤ .08.
Tests of mediation and moderation effects between predictor and outcome variables in SEM also were conducted. For the present study, the introduction of coping efficacy and its impact on the relationships between stereotype threat, stigma, and academic self-efficacy was explored. Hypotheses for these relationships are as follows:

Hypothesis 3a: Coping efficacy mediates the relationship between stereotype threat vulnerability and academic self-efficacy (Mediation 1, path c’1 Figure 4).

Hypothesis 3b: Coping efficacy mediates the relationship between stigma consciousness and academic self-efficacy (Mediation 2, path c’2 Figure 4).

In the mediation model, direct effects and indirect effects are estimated and interpretable in all SEM programs. Although the model is tested in SEM software, the standardized and unstandardized coefficients are interpreted the same way as they are in multiple regression. In the same manner, the paths above for indirect effects can be modeled in the following equations:

\[ M = a_0 + a_1X + r \]
\[ Y = b_0 + c'X + b_1M + r \]

Where \( M \) signifies the mediator, \( a_0 \) and \( b_0 \) are intercept terms, and \( r \) is a regression residual. The paths, \( a_1 \) and \( b_1 \) are interpreted to detect the presence, strength, and significance of the indirect effect of \( X \) on \( Y \) via \( M \). The test for mediation in the current study would be as follows:

\[ CWB = a_0 + SVS + r \]
\[ AM-S = b_0 + SVS + CWB + r \] (equation 1)
\[ CWB = a_0 + SCQ + r \]
\[ AM-S = b_0 + SCQ + CWB + r \] (equation 2)
To evaluate the significance of indirect effects, Little, Card, Bovaird, Preacher, and Crandall (2007) suggest using the Wald statistic or bootstrapping techniques. Statistically significant indirect effects signal the presence of mediation. Kline (2012) suggests that in addition to exploring indirect effects, the $c'$ path also be included in alternative models to estimate the size this direct coefficient for significance. For the model being tested in the present research, the presence of “partial mediation” is expected, where the magnitude of the relationship between stereotype variables and academic self-efficacy may still be significant but the strength of this association will weaken significantly with the addition of coping efficacy as a mediator. This is represented in Little et al. (2007) in Figure 9.1 model B (p. 210):

Coping efficacy has not been tested as a moderator in the literature. For the present study, this is believed to be an important consideration as moderation is said to occur when “the strength of the relationship between two variables is dependent on a third variable” (Preacher, Rucker & Hayes, 2007; p. 191). The moderation model (Figure 4) represents an exploratory and competing hypothesis to the mediation model:
Hypothesis 4a. Coping efficacy moderates the relationship between stereotype vulnerability and academic self-efficacy.

Hypothesis 4b. Coping efficacy moderates the relationship between stigma consciousness and academic self-efficacy.

As stated earlier, Bandura (1997) posited that coping efficacy acts as an individual difference variable such that those with high coping efficacy are likely to view new social realities as a challenge, whereas those with low coping efficacy may view the same event as a threat. In discussing contextual supports and barriers to career choice, Lent and colleagues (2000) posited that one’s perspective given an environmental demand “may be viewed alternatively as an insurmountable barrier, a minor obstacle, a character-building opportunity, or even a personal contest or challenge” (p. 47).

Therefore, in the present study one’s level of coping efficacy (high vs. low) is proposed to moderate the relationship between stereotype threat and academic self-efficacy. Theoretically, one may be conscious of a stigmatizing situation and vulnerable to stereotype threat, but as one stereotyped individual may see these barriers threatening and withdraw another may view barriers as a challenge to be overcome and persist.

Examining moderation in SEM follows the same framework used in moderated multiple regression, where a new variable that models the interaction between the predictor ($X$) and the moderating variable ($W$) is created ($XW$). This interaction is then added to the model after the parameters of $X$, $W$, and the outcome variable $Y$ are estimated. The present study will test moderation of CWB for the relationships between SVS and SCQ (Figure 5) on AM-S.

In order to evaluate the interactions in the proposed model, simple effects are
probed to discover whether the simple slope of $Y$ on $X$ under conditional values of $W$ is statistically significant. Preacher et al. (2007) suggest using the $J$-$N$ technique, which produces confidence bands to determine when $W$ moderates the relationship between $X$ and $Y$ as determined by non-zero values within the confidence intervals for $W$ (or CWB in the present study).

Figure 5. Moderation measurement model

Summary

The present study examined relationships between four variables: stereotype threat (vulnerability and stigma consciousness), coping efficacy, and academic efficacy. It is the first known empirical research designed to test relationships among social psychological variables of stereotype threat and the established social-cognitive career theory variable of self-efficacy. In exploring these relationships, the present study employed correlational
design including SEM and studying interaction effects using multiple regression. This dissertation expands the current SCCT framework and determines the impact of social barriers concerned with stereotype threat on self-efficacy for entry into STEM fields. The chosen constructs both serve as proxies for the measurement of the phenomenon of stereotype threat. The present chapter outlined the planned analysis for evaluating hypotheses and gave the background on the measures of stigma consciousness, stereotype vulnerability, coping efficacy, and academic self-efficacy.
CHAPTER IV
RESULTS

The present chapter reports the results of the current study. First, an evaluation of the factor structure and psychometric properties of the Stereotype Vulnerability Scale (SVS) is presented. Then, information related to screening of data prior to analysis is presented; including the treatment of missing data, detection and deletion of outliers, and assessment of normality within variables. Additionally, descriptive statistics are presented. Next, Hypotheses 1 through 4 are discussed and the final model is presented. Finally, exploratory findings that emerged through data analysis are presented.

Stereotype Vulnerability Scale: Factor Structure

The SVS has had limited use in prior studies (Spencer, 1993; Steele et al. 2002; Woodcock et al., 2013). Given the previous exploratory factor analysis was completed with a population of primarily African-American and Latino/a students (in comparison to the current study’s population of primarily White women), the use of an 8-factor structure, compared to Woodock et al.’s (2013) 4-factor structure, warranted exploration. Data were collected on all eight modified (for racial/ethnic stems) items of the SVS. All eight items were subjected to principal components analysis (PCA) using SPSS version 22. Prior to performing PCA, the correlation matrix was inspected; all coefficients were above the suggested .3 level (Tabachnick & Fidell, 2007). The Kaiser-Meyer-Olkin value
was .880, exceeding the recommended value of .6 (Kaiser 1970, 1974) and Bartlett’s Test of Sphericity (Bartlett, 1954) reached statistical significance ($p < .001$), indicating the data structure and correlation matrix were appropriate for factor analysis.

Decisions about factor extraction included inspection of eigenvalues greater than 1.0 (Kaiser Criterion), Cattell’s scree test, and inspection of loadings on factors greater than .3 on any component. Principal components analysis revealed the presence of a single component with an eigenvalue exceeding 1, accounting for 61.323% of the variance. The scree plot supported the single factor solution, where a clear break was visually present after the single factor. The structure could not be rotated due to a single factor being extracted. Each item within the component matrix demonstrated a strong loading (> .7) on the single factor solution.

All of the items on the original SVS loaded highly on a univariate structure. Therefore, confirmatory factor analysis (CFA) with structural equation modeling (SEM) was conducted to compare Woodcock et al.’s (2013) 4-item and Spencer’s (1993) original 8-item scale. Model comparison evaluated the appropriateness of using a revised scale with the current population. Each model was evaluated using the $\chi^2$ statistic and goodness of fit indexes including the comparative fit index (CFI), the Goodness-of-Fit Index (GFI), root mean square error of approximation (RMSEA), and Akaike’s (1987) Information Criterion (AIC). The $\chi^2$ statistic measures the null hypothesis that the model fits the data (i.e., the sample covariance matrix is equal to the predicted covariance matrix). As opposed to traditional probability value statistics, the chi-square test should be non-significant and the null hypothesis retained (i.e., the sample distribution does not differ from the predicted distribution). The CFI ranges from zero to 1.00 with values
closer to 1.00 indicating a better fit. Bentler (1992) originally suggested a value of > .90 indicating a good-fitting model, but a revised value of .95 has been suggested (Hu & Bentler, 1999). GFI provides a measure of the relative amount of variance and covariance in the variance-covariance matrix of the sample data (S) and that is jointly explained by the variance-covariance matrix for the hypothesized model (∑) (Byrne, 2010). Similar to the CFI, the GFI ranges from zero to 1.00 with values closer to 1.00 indicating better fit.

The RMSEA measures the discrepancy per degree of freedom that the hypothesized model has compared to the population. Thus, a value of zero indicates perfect fit (no difference between population and hypothesized model). Values indicative of a good fit are suggested as follows, .08 to .10 mediocre fit with values above .10 indicating poor fit (MacCallum, Browne, & Sugawara, 1996) and values of .06 and below representing a good fit (Hu & Bentler, 1999). In addition to the RMSEA value, a 90-percent confidence interval is reported, which allows for the precision of the estimate to be determined. The p-close value should be non-significant with values above .50 being ideal (Joreskog & Sorbon, 1996). Finally, the AIC provides an estimate of goodness of fit as well as parsimony with the estimated number of parameters and statistical goodness-of-fit taken into account. The lower value is indicative of better fit, and is useful in comparing models.

The initial model depicted in Figure 6 (SVS) allowed all eight original items to load on a single factor. The overall fit of the SVS indicated poor fit, χ² (20) = 194.614, p < .001; CFI = .851; GFI = .827; RMSEA = .191 (90% CI = .17-.22, p close-fit Ho <.001); AIC = 242.614. Next, the four-item revised scale (Figure 7; SVS-4) reported by Woodcock et al. (2013) was tested. Results concerning fit showed modest improvement,
\[ \chi^2 (2) = 34.044, p < .001; \text{CFI} = .922; \text{GFI} = .931; \text{RMSEA} = .258 \text{ (90\% CI} = .19-.34, p \text{ close-fit } H_0 < .001); \text{AIC} = 58.044. \]

Figure 6. Stereotype vulnerability scale (SVS) – original eight-item version CFA

Note. All values are standardized loadings.

As neither model (SVS or SVS-4) provided a good fit, the original component matrix (see Table 1) was consulted and those items that loaded the highest on the single factor of stereotype vulnerability were tested. They included items 3, 6, 7, and 8. The fit for this model indicated \[ \chi^2 (2) = 10.316, p = .006; \text{CFI} = .985; \text{GFI} = .978; \text{RMSEA} = .132 \text{ (90\% CI} = .06-.22, p \text{ close-fit } H_0 < .032); \text{AIC} = 26.316. \]
The final model (Figure 8; SVS-R) indicated a better fit to the current data. Not only were the data psychometrically more appropriate, but the content of the items also appeared to better represent the population of study. Items included, “Because of your gender… Professors expect you to do poorly” (item 3), “If you ask a simple question, people will think it is because you are a woman” (item 6), “If you do poorly on a test, people will assume that it is because you are a woman” (item 7), and “You (or other women) face unfair evaluations because of their gender” (item 8). Although the fit was better, the eight-item scale provided the highest internal reliability; SVS α = .91; followed by the current revision of the scale, SVS-R α = .88; and Woodcock et al. (2013) scale, SVS-4 α = .85.

Figure 7. Stereotype vulnerability scale – four-item version (SVS-4) CFA

Note. All values are standardized loadings.
Taken together, all scale versions displayed unacceptable RMSEA values. According to Kline (2011), RMSEA has a tendency to favor more complex models. Citing research completed by Breivik and Olsson (2001) using Monte Carlo estimation; Kline (2011) reported the RMSEA statistic consistently indicated worse fit for models with fewer variables and factors. Breivik and Olsson suggested use of the GFI as it was found to be insensitive to model size (Kline, 2011). Thus, RMSEA values were not as strictly followed in the evaluation of the current scales. As the full model showed

Table 1

*Exploratory Factor Analysis*

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*Note.* Extraction Method: Principal Axis Factoring
Figure 8. Stereotype vulnerability scale – revised-item version (SVS-R) CFA

Note. All values are standardized loadings

the highest reliability and the revised model for this study would need greater scrutiny to determine its psychometric validity, the eight-item scale, originally developed by Spencer (1993) was retained for the current study and used in the testing of the hypothesized model.

Data Cleaning

The sample began with 355 cases. Initial explorations of responses revealed 71 cases without responses on any measures or with no responses on a key measure and these were therefore removed from analysis. Another 17 cases were removed because their major did not directly match others within underrepresented STEM fields (e.g.,
nursing, dietetics, AYA education). Twenty-three cases were removed because they identified as men. In total, 111 cases were initially removed leaving a sample size of 244.

The remaining cases were inspected using missing values analysis (MVA) in SPSS v22. Results indicated that variables missing data ranged from 3.7% (SVS; 9 missing cases) to 0% (See Table 2). As the cases had less than 5% of missing data, MVA did not supply a t-test indicating missingness as related to other variables in the data set. Missing values analysis also supplies Little’s MCAR test to determine if the pattern of missing data is completely at random. A non-significant result is desired. For the current sample, Little’s MCAR test indicated a $\chi^2 (3021) = 2613.76, p = 1.00$. Therefore, it was inferred that the pattern of missing data was completely at random. Tabachnick and Fidell (2009) suggested that less than 5% of data missing can be treated with any procedure for handling missing data with similar results. For the current data set, expectation maximization (EM) methods were used to replace missing data. The procedure estimates the likely values in missing data based on the distribution of collected data. Tabachnick and Fidell (2009) explain the procedure as follows:

It is an iterative procedure with two steps – expectation and maximization – for each iteration. First, the E step finds the conditional expectation of the “missing” data, given the observed values and current estimate of the parameters, such as correlations. These expectations are then substituted for the missing data. Second, the M step performs maximum likelihood estimation as though the missing data had been filled in. (p. 68)

The values are then saved as a separate data set. This new data set was then explored for outliers using Mahalanobis distances, Cook’s D, and casewise diagnostic criteria supplied
by SPSS analysis. Criteria used to evaluate data included Cook’s D values larger than 1.00 as problematic (Tabachnick & Fidell, 2009), with casewise diagnostics supplying information on standardized residual values whose value is above 3.0 or -3.0 (Pallant, 2010). Finally, the inspection of Mahalanobis distances is dependent on critical values determined by the number of independent variables in the analysis. For the current study, cases with values above 18.47 (four independent variables) were considered for removal. Results of these analysis resulted in the removal of 17 cases total. The final data set consisted of 232 cases.

The final set of data was then inspected for normality, linearity, and homoscedasticity. Inspection revealed a negatively skewed distribution within the academic self-efficacy scale (-1.07). Inspection of the histogram is recommended as skewness may not make “substantiative difference” in samples greater than 200 (Tabachnick & Fidell, 2009, p. 80). The histogram revealed a peak of scores on the right-tail of the distribution. Transformation of the data distribution was explored using reflection with square root, logarithm, and inverse functions. These transformations lowered the skewness of the distribution, but both the square root and logarithm functions changed the meaning of the data, with a large clustering of scores in the left-tail of the distribution. The reflect and inverse transformation yielded the best results, but visual inspection showed a bimodal distribution, which was not an improvement from the untransformed distribution. As the sample is large and improvement was marginal at best, the untransformed academic self-efficacy distribution was retained.
Table 2

*Cases Included in and Excluded from the Analyses*

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<td>0.0%</td>
</tr>
<tr>
<td>AM-S</td>
<td>241</td>
<td>98.8%</td>
<td>3</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

*Note:* SCQ = Stigma Consciousness Questionnaire; SVS = Stereotype Vulnerability Scale; CWB = Coping With Barriers; AM-S = Academic Milestones Scale.

**Descriptive Statistics and Correlations**

Table 3 presents bivariate correlations between the primary variables with significant correlations tagged. Table 4 presents mean values and standard deviations for the scales included in the analyses along with internal consistency reliability estimates (alpha values are indicated on the diagonals). The scale reliabilities exhibited acceptable alphas (Nunally, 1978) and were similar to or higher than prior reported alphas (Lent et al., 1986; 1987; Luzzo & McWhirter, 2001; Woodcock et al., 2013; Pinel, 1999).

**Tests of Hypotheses**

The first and second hypotheses concerned the anticipated relationships between variables based on prior research concerning coping efficacy and academic self-efficacy (Byars-Winston & Fouad, 2008; Perrone et al., 2004; Thompson, 2012), as well as the impact of stereotype threat on academic performance (Brown & Pinel, 2004; Diemer et al., 2013). The magnitude of the relationships was measured using the Pearson
Table 3

*Correlations between Primary Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>GPA</th>
<th>SVS</th>
<th>SCQ</th>
<th>CWB</th>
<th>AM-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GPA</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. SVS</td>
<td>-.01</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. SCQ</td>
<td>-.02</td>
<td>.51**</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. CWB</td>
<td>.10</td>
<td>-.19**</td>
<td>-.36**</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>5. AM-S</td>
<td>.22**</td>
<td>-.09</td>
<td>-.23**</td>
<td>.53**</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* GPA = Grade Point Average, cumulative high school; SVS = Stereotype Vulnerability Scale; SCQ = Stigma Consciousness Questionnaire; CWB = Coping With Barriers; AM-S = Academic Milestones Scale.

* p < .05. ** p < .01.

Table 4

*Mean values, standard deviation, range, and alphas of primary variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Potential Range</th>
<th>Observed Range</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GPA</td>
<td>3.88</td>
<td>.209</td>
<td>0.00 – 4.00</td>
<td>0 – 4</td>
<td>-</td>
</tr>
<tr>
<td>2. SVS</td>
<td>2.21</td>
<td>.810</td>
<td>1 – 5</td>
<td>1 – 4.86</td>
<td>.91</td>
</tr>
<tr>
<td>3. SCQ</td>
<td>3.81</td>
<td>1.06</td>
<td>0 – 6</td>
<td>.39 – 5.79</td>
<td>.78</td>
</tr>
<tr>
<td>4. CWB</td>
<td>3.94</td>
<td>.629</td>
<td>1 – 5</td>
<td>1 – 5</td>
<td>.91</td>
</tr>
<tr>
<td>5. AM-S</td>
<td>7.81</td>
<td>1.16</td>
<td>0 – 9</td>
<td>1.63 – 9.00</td>
<td>.89</td>
</tr>
</tbody>
</table>

*Note.* GPA = Grade Point Average, cumulative high school; SVS = Stereotype Vulnerability Scale; SCQ = Stigma Consciousness Questionnaire; CWB = Coping With Barriers; AM-S = Academic Milestones Scale.

correlation coefficient (r), indicating the degree of linear dependence between two variables.

Hypothesis 1a stated that academic self-efficacy (as measured by AM-S) is related negatively to stereotype vulnerability (SVS). The Pearson bivariate correlations shown in Table 3 indicate that the hypothesis was not supported (r = -.09, p = .17). Academic self-efficacy is not significantly negatively related to stereotype vulnerability.
Hypothesis 1b posited that academic self-efficacy is related negatively to stigma consciousness (SCQ). As hypothesized, the bivariate correlation indicated a significant negative relationship between AM-S and SCQ ($r = -0.23, p < 0.001$).

Hypothesis 2a stated that coping efficacy is related positively to academic self-efficacy. Results indicated that CWB and AM-S are significantly positively correlated ($r = 0.53, p < 0.001$). Thus, the hypothesis was supported. Coping efficacy also was hypothesized to be related negatively to stereotype threat vulnerability (Hypothesis 2b) and to be related negatively to stigma consciousness (Hypothesis 2c). Both Hypotheses 2b and 2c were supported, with SVS and CWB related negatively ($r = -0.19, p < 0.001$) and SCQ and CWB significantly negative related as well ($r = -0.36, p < 0.001$).

Both Hypotheses 3a and 3b concerned linear associations among variables and tests for mediation. To best address these hypotheses, structural equation modeling (SEM) was used. Based on the recommendations of Little, Rhemtulla, Gibson, and Schoemann (2013) item parcels for structural models in SEM were employed as parcels have the advantage of improved psychometric characteristics, closer approximation of model estimation and fit characteristics, and reduction of sampling error (as opposed to using items as indicators for the constructs). The shared-uniqueness strategy outlined by Hall, Snell, and Foust (1999) was applied. This strategy recommends inspection of scale items, assuming a univariate construct, with the intent of identifying secondary factors such as negatively-worded versus positively-worded items. Next, an EFA is run on each parcel forcing items into three to five factors. Items that share loadings on a secondary factor are then grouped into the same parcel. Item loadings from the construction of item
parcels for the current study are presented as part of the measurement and structural model estimates.

Hypothesis 3a stated that coping efficacy mediate the relationship between stereotype vulnerability and academic self-efficacy. In order to test this hypothesis concerning mediation, first a direct path model was created to estimate the direct effect of SVS on AM-S. As hypothesis 3b predicted coping efficacy similarly mediates the association between stigma consciousness and academic self-efficacy, SCQ also was included in this initial model (see Figure 9). Initial analysis for direct effects revealed a significant path from SCQ to AM-S (β = -.40, p < .001) but not from SVS to AM-S (β = .14, p = .220). The combined impact of SVS and SCQ accounted for 17-percent of the variance of AM-S. Although the SVS to AM-S path was non-significant, it was included in the hypothesized mediation model to assess for total fit of the original hypothesized model.

The hypothesized full mediation model (see Figure 10) was tested next, including CWB as the mediator for SVS and SCQ. Results indicate a good fit to the data; χ² (78) = 146.813, p < .001; CFI = .947; GFI = .927; RMSEA = .062 (90% CI = .05-.08, p close-fit Ho = .102); AIC = 230.813. Recommendations for testing mediation with SEM include exploration of indirect effects (Hayes & Scharkow, 2013) and use of bootstrapping over the Sobel and Wald tests for increased power of these estimates (MacKinnon et al., 2004; Wiliams & MacKinnon, 2008). The resampling strategy (bootstrapping) was applied to the full model to estimate the significance of the indirect effects. Data were resampled 5,000 times as recommended by Hayes (2009). Bias-corrected estimates with 95% confidence intervals were requested, with the assumption that if the interval for the
significance of the indirect effect does not include zero, we can reject the null hypothesis that the indirect effect is zero with 95% confidence. Estimation of direct and indirect effects was performed using maximum likelihood estimation in AMOS 22 SEM software. Results indicated significant indirect effects for the path from SCQ through CWB to AM-S (B = -.186, 95% CI = -.376 to -.080; p < .001). The indirect path from SVS to AM-S through CWB was not significant (B = .051, 95% CI = -.041 to .182; p = .267). Thus, Hypothesis 3a was not supported, but Hypothesis 3b, was supported.

Since the full model provided fit statistics that demonstrated a good fit to the data, an alternative model was estimated with the removal of SVS to see if fit could be improved. The results of the alternative mediation model (see Figure 11) showed modest improvement from the full model, $\chi^2 (46) = 88.339, p < .001; \text{CFI} = .948; \text{GFI} = 942; \text{RMSEA} = .063 \ (90\% \text{ CI} = .04-.08, p_{\text{close-fit}} H_0 = .133); \text{AIC} = 176.339$. Conducting a chi-square difference test between models indicated significant improvement $\Delta \chi^2 (32) = 58.474, p < .005$.

The final hypotheses consisted of exploratory tests of the role of coping efficacy as a moderator as opposed to a mediator of the relationships between the stereotype threat variables (SVS & SCQ) and academic self-efficacy. Moderation was initially tested using regression analysis followed by SEM analysis for comparison of model fit to the mediation model.

Testing for moderation with regression was conducted using the PROCESS software for SPSS 22 created by Hayes (2014). Analyses are run with an ordinary least squares path analytic framework and provide estimates of interaction terms at +/- 1
standard deviation of the predictor and moderator variables for visualizing moderation effects. Additionally, PROCESS mean centers predictor and moderating variables

Figure 9. Direct Path Model

Note: All values are standardized loadings
Figure 10. Full mediation model

Note. All values are standardized loadings
Figure 11. Alternative mediation model

Note: All values are standardized loadings
through transformation to reduce multicollinearity between the interaction term and predictor and moderating variables. Hypothesis 4a stated that coping efficacy (CWB) moderates the relationship between stereotype vulnerability (SVS) and academic self-efficacy (AM-S). Hypothesis 4b stated that coping efficacy moderates the relationship between stigma consciousness (SCQ) and academic self-efficacy.

As could be predicted based on the lack of relationship between SVS and AM-S in previous analyses, the interaction term for CBW and SVS was non-significant ($\beta = .23; p = .181$), thus rejecting both hypothesis 4a concerning moderation of the relationship between SVS and AM-S by CWB. Testing for Hypothesis 4b consisted of forming an interaction term in PROCESS from the transformed products of CWB and SCQ. Results indicated a significant interaction ($\beta = .37, p < .01$). Probing for conditional effects of stigma consciousness on academic self-efficacy at levels of coping efficacy revealed a significant effect at -1 standard deviation of coping efficacy ($\beta = -.36, se = .134; t = -2.65, p < .01$) with a 95% confidence interval of lower bounds equal to -.619 and upper bounds equal to -.091. The effects at the mean-value and +1 standard deviation were not significant (($\beta = -.13, se = .071; t = -1.75, p = .082$ & $\beta = .11, se = .063; t = 1.68, p = .095$, respectively). The effects were plotted for a visual representation of the effect of coping efficacy on the relationship between stigma consciousness and academic self-efficacy as seen in Figure 9. Results indicated support for hypothesis 4b.
Next, the interaction effect was modeled using SEM with the parceled variables created for the mediation hypothesis. The orthogonalizing procedure for modeling interaction terms among latent variables was used (Little, Bovaird, & Widaman, 2006). This procedure consists of first creating orthogonalized indicators from the two latent constructs in the model, CWB and SCQ. For the current study, a total of fifteen interactions could be produced (three indicators for SCQ and five indicators for CWB). The resulting interaction terms are then regressed onto the first-order effect indicators from the initial constructs. An example would be the interaction term created from the first indicators of each construct scq1*cwb1 resulting in the uncentered product term $\text{int}_{11}$. Then, all possible terms are regressed onto this single term:

$$ \text{Int}_{11} = b_0 + b_1 \text{scq}_1 + b_2 \text{scq}_2 + b_3 \text{scq}_3 + b_4 \text{cwb}_1 + b_5 \text{cwb}_2 + b_6 \text{cwb}_3 + b_7 \text{cwb}_4 + b_8 \text{cwb}_5 $$

**Figure 12.** Conditional effect of Coping With Barriers on the relationship between Academic Milestones Scale and Stigma Consciousness Questionnaire
This is repeated for each one of the fifteen interaction terms and the resulting residual for the regression is saved and used as an indicator for interaction construct in the proposed moderation model. The resulting construct is uncorrelated with the two latent variables and therefore reduces instances of multicollinearity within the model.

Finally, each of the indicators that shares unique variance is correlated. For instance, all terms that contain sqc1 (in total 5) and those terms that contain unique variance within the paired interaction term are co-varied. As an example, int15 contains sqc1 and cwb5, the parcel int15 is correlated within the model then with all product terms containing scq1 and cwb5. The completed model is shown in Figure 13.

The interaction was run using maximum likelihood estimation in AMOS 22. Results indicated an excellent fit to the data, $\chi^2 (271) = 246.083, p = .859$; CFI = 1.00; GFI = .932; RMSEA = .00 (90% CI = .00 - .02, $p_{\text{close-fit } H_0} = 1.00$); AIC = 514.083. The AIC in the moderation model, as compared to the mediation model, reflected a less parsimonious model, likely due to the increased degrees of freedom based on the large number of indicators on the interaction term.

**Exploratory Analyses**

Exploratory analyses were conducted to examine relationships among demographic factors and the main variables. First, continuous variables such as commitment to major, courses completed, college GPA, and high school GPA were selected and correlations among variables investigated. Results indicated that AM-S was significantly correlated with year in college ($r = .19, p < .01$); commitment to pursuit of major ($r = .41, p < .001$), college or anticipated college GPA ($r = .27, p < .001$), and
cumulative high school GPA ($r = .17, p < .01$). Commitment to declared major was also significantly correlated with CWB ($r = .22, p < .001$).

Next, dichotomous and categorical variables were tested to explore any group differences in the main variables. Group differences on mean scores for AM-S existed between responses (yes or no) to “Do you intend to pursue a graduate or professional degree?” Individuals indicating intent to pursue graduate/professional degrees scored higher on AM-S ($M = 8.02, SD = 1.02$) than did individuals not indicating such intent ($M$.

Figure 13. Moderation model
= 7.52, \( SD = 1.33 \), \( t (195.52) = 3.10; p = .002 \). Intention to pursue a graduate or professional degree also differed based on college cumulative or anticipated GPA, with those responding “Yes” \( (M = 3.39, SD = .41) \) reporting significantly higher GPAs than those responding “No” \( (M = 3.24, SD = .41) \), \( t (252) = 2.85; p = .005 \).

Differences based on endorsement of involvement in a form of supportive programming yielded significant differences among students involved in a learning community on AM-S \( (M = 7.99, SD = 1.03) \) compared to those who were not \( (M = 7.67, SD = 1.26) \), \( t (196.26) = 2.11, p = .036 \). Students involved in a learning community reported significantly higher GPAs in high school \( (M = 3.92, SD = .14) \) than did those not so involved \( (M = 3.84, SD = .26) \), \( t (247.94) = 2.98, p = .003 \). There were no group differences identified by involvement in a scholarship program.

Longer exposure to the academic environment could feasibly related to individuals’ perceptions of and confidence in their success. Therefore, the categorical variable year in college was examined for between-group differences using an analysis of variance test. Main effects were found for AM-S \( [F(5, 224) = 4.38, p = .001, \text{ eta squared} = .09] \), college GPA \( [F(5, 248) = 3.56, p = .004, \text{ eta squared} = .07] \), commitment to major \( [F(5, 248) = 2.46, p = .034, \text{ eta squared} = .05] \), cumulative high school GPA \( [F(5, 246) = 4.84, p < .001, \text{ eta squared} = .09] \) and SVS \( [F(5, 226) = 2.50, p = .032, \text{ eta squared} = .05] \). Post hoc comparisons using the Tukey HSD test indicated that the mean score for 1st-year students on AM-S \( (M = 7.31, SD = 1.20) \) was significantly lower than that of 4th year students \( (M = 8.34, SD = .72) \). For college GPA, 5th year students \( (M = 3.07, SD = .44) \) were significantly lower than that of 3rd year students \( (M = 3.39, SD = .38) \) and from that of 4th year students \( (M = 3.40, SD = .31) \). Finally, commitment to major differed
significantly lower in 1st year students ($M = 4.16, SD = .88$) than in 3rd year students ($M = 4.61, SD = .54$). The post hoc tests for high school GPA revealed the group identifying as >5 years ($n = 6$) was the outlier ($M = 3.48$) and was significantly lower from the years 1-5 ($M = 3.87$). No group differences were detected in SVS at post hoc analysis; this could be due to the conservative nature of these tests that seek to minimize Type 1 error with large groups of comparisons.

In order to investigate further the relationship of SVS across college year, a curve estimation regression was run to examine curvilinear effects of SVS over cohorts. Inspection of the means at each year revealed those in >5 years consisted of only 4 responses and endorsed much higher experiences of stereotype vulnerability ($M = 3.28$) compared to the group mean ($M = 2.28$). Students identifying as 5th year were a smaller group as well ($n = 17$) but were closer to the group mean of SVS scores ($M = 2.27$). It was decided that inspection would be done without students >5 years, but an analysis would be run with 5th years and without. Curve estimation regression was run selecting model solutions for linear, quadratic, and cubic regression models. Results of the linear, quadratic, and cubic regressions for 1-5 years were all non-significant. When >5 and 5th year scores on SVS were removed, only the quadratic model was significant, $F(2, 208) = 3.087, p = .048$. The model explained 3% of the variance in year in college with the first slope, $\beta = .899, p = .017$, increasing across year and SVS score, while the second slope ($\beta = -.844, p = .024$) decreased in SVS as year in college continued to increase. SPSS 22 output supplied a fitted curve to this trend; the graph is duplicated in Figure 14.

Based on the changing relationship in each cohort year, the data file was split by year and correlations run between SVS and AM-S. The results indicated fluctuation in the
direction of the relationships with 1st ($r = -0.13$, $p = 0.401$), 3rd ($r = -0.29$, $p < 0.05$), 5th ($r = -0.10$, $p = 0.715$), and >5th year ($r = -0.31$, $p < 0.802$) in college having negative relationship, while 2nd ($r = 0.01$, $p = 0.929$) and 4th ($r = 0.06$, $p = 0.695$) year yielded a positive direction in their result. The direction of a non-significant relationship could indicate a fluctuation around zero, which would lead to the conclusion that there is no linear relationship between AM-S and SVS. All the above correlations were non-significant with the exception of 3rd year in college, which demonstrated a significant negative relationship between AM-S and SVS, as originally hypothesized.

Figure 14. Curvilinear relationship of Stereotype Vulnerability across year in college

Note: YIC = Year in College; SVS_G = Stereotype Vulnerability Scale for Gender
Summary

Research results supported the majority of hypotheses. Support for hypotheses are summarized in Table 5. There were significant relationships among the main variables in the study. Self-efficacy was positively related to coping efficacy and negatively related to stigma consciousness. Hypothesis 1a predicted a negative relationship between self-efficacy and stereotype vulnerability. Stigma consciousness and stereotype vulnerability were positively related and both were negatively related to coping efficacy. A total of four models (Figures 9, 10, 11, & 13) were tested using SEM analyses. The mediation model containing a path from stigma consciousness to self-efficacy and a path to the mediator, coping efficacy, showed a good fit and accounted for 47% of the variance. The competing model, using moderation, evaluated the interaction term of coping efficacy and stigma consciousness. The path from the interaction to self-efficacy was significant and the total model demonstrated good fit, accounting for 55% of the variance in self-efficacy.
### Summary of Research Hypotheses and Outcomes

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypothesis 1a.</strong> Academic self-efficacy is negatively related to stereotype threat vulnerability.</td>
<td>Not Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 1b.</strong> Academic self-efficacy is negatively related to stigma consciousness.</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 2a.</strong> Coping efficacy is positively related to academic self-efficacy.</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 2b.</strong> Coping efficacy is negatively related to stereotype threat vulnerability.</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 2c.</strong> Coping efficacy is negatively related to stigma consciousness.</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 3a.</strong> Coping efficacy mediates the relationship between stereotype threat vulnerability and academic self-efficacy.</td>
<td>Not Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 3b.</strong> Coping efficacy mediates the relationship between stigma consciousness and academic self-efficacy.</td>
<td>Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 4a.</strong> Coping efficacy moderates the relationship between stereotype vulnerability and academic self-efficacy.</td>
<td>Not Supported</td>
</tr>
<tr>
<td><strong>Hypothesis 4b.</strong> Coping efficacy moderates the relationship between stigma consciousness and academic self-efficacy.</td>
<td>Supported</td>
</tr>
</tbody>
</table>
CHAPTER V
SUMMARY AND DISCUSSION

Research has shown a consistent underrepresentation of women and minority students earning degrees in science, technology, engineering, and mathematics (STEM) fields (NSB, 2012). STEM occupations earn annual wages 33% higher than those in non-STEM fields (National Science Foundation, 2013). This disparity contributes to discrepancies in opportunity, income, and social mobility for women in society. In order to address this problem, the current study focused on social identity and vocational development barriers for women in STEM majors within higher education institutions. This chapter begins by providing an overview of the current study. Next, the results are discussed with regard to how they build upon existing literature in vocational psychology. Then, limitations are presented followed by implications for practice and education. Finally, implications for future research are discussed.

Overview of the Current Study

The discipline of vocational psychology generally and proponents of Social Cognitive Career Theory (SCCT) in particular have become increasingly interested in the role that contextual barriers might play in shaping the career development of individuals historically underrepresented in various occupational domains and especially in science, technology, engineering, and mathematics (STEM) fields (Lent, Brown, Hackett, 2000;
Byars-Winston & Fouad, 2008). Research guided by SCCT has defined environmental context in broad terms including peer and family support (McWhirter, Hackett, et al., 1998), in-group and out-group orientation (Cabrera Nora, Terenzini, Pascarella, & Hagedorn, 1999), social class experiences and identity (Thompson & Subich, 2008), and educational barriers (Hackett, Betz, Casa, & Tocha-Singh, 1992). Only recently has the construct of stereotype threat been included within the SCCT framework for understanding non-completion of college degree programs by students underrepresented in STEM fields (Deemer et al., 2013). The vocational psychology literature contains a great deal of research identifying factors that lead women and racial/ethnic minority students to successfully complete STEM degrees. Yet, knowledge about how social and cultural factors may impede such success remains much in need (Lent et al., 2000). Understanding how individuals are able to cope and overcome obstacles in completing college degrees in STEM fields is also of importance (Deemer et al., 2013; Lent et al., 2000).

The current study furthered calls for understanding how contextual barriers become internalized (Byars & Hackett, 1998; Lent et al., 2000; Lent et al., 2001). Specifically, the present study used the variables of stigma consciousness and stereotype vulnerability to answer the question, when stereotypes become internalized how do they impact academic self-efficacy? Additionally, coping was included as a variable that could lead to an understanding of how levels of confidence in responding to educational barriers might buffer the impact of negative stereotypes. Thus, the current study also responded to a call for advancing research using social cognitive career variables with
implications for the potential development of interventions to assist individuals in coping with environmentally imposed barriers (Lent et al., 2000).

Two-hundred and thirty-two female undergraduate students in STEM programs that participate in a state-wide scholarship encouraging students to enter science, technology, engineering, mathematics and medical degree programs agreed to participate in the present study. Participation included completion of questionnaires concerned with experience and perception of stereotypes concerning gender, confidence in coping with educational barriers, and confidence in completing subject areas consistent with STEM degrees. Participants ranged in age from 18-43 years, in terms of year in school, with over half (52.7%) being second or third year students. In representing race, the majority of participants (73%) were white women.

Results of the Current Study

Overall, results from the analysis of the data supported the majority of hypotheses. Results are discussed herein corresponding to information presented in Chapter 4 while situating them within the current literature. The hypotheses are grouped by key variable and discussed in aggregate for conceptual clarity. The relationships among variables are first discussed regarding coping and academic self-efficacy. This is followed by a discussion of the relationships found among the barriers, stereotype vulnerability, and stigma consciousness variables studied. Finally, the mediation model and moderation model are discussed.

Stereotype Vulnerability Scale Development

First, because it has been limited in use, the psychometric properties of the Stereotype Vulnerability Scale (SVS) were examined for its appropriateness for use with
the population under study. The scale structure was examined to offer an enhanced understanding of the use of the SVS in capturing stereotype threat through a self-report measurement. Results indicated an inconsistent factor structure regarding the univariate scale of measurement of vulnerability to stereotype threat. The current study consisted of a sample of women similar to the scales use within previous studies (Spencer, 1993; Steele et al., 2004). These previous studies used an 8-item scale. In the current study a 4-item scale was supported, similar to the findings of Woodcock and colleagues (2013). Although the same number of items was retained, different items loaded more strongly to the experience of stereotype threat among women in the current sample compared to those in Woodcock et al.’s sample of African-American and Latino/a students. This could suggest that different populations experience stereotype threat differently.

The inconsistency between these two populations studied warrants further exploration of the structure of the SVS, and possibly its validity for investigating experiences of stereotype threat. The items retained in the current study’s 4-item SVS scale included wording that was specific to gender identity. As race versus gender is often exchanged in other scales such as the Stigma Consciousness Questionnaire, it may be that the current scale does not capture identity or instances of stereotype threat equally across identity variables.

**Relationship of Coping Efficacy to Vocational Constructs**

Results of the current study support previous findings as Hypothesis 2a showed a positive correlation between CWB and AM-S. The correlation was moderate ($r = .53, p < .01$) indicating a related, yet separate construct represented in the current study. As other research in SCCT has overlapped coping efficacy and academic self-efficacy, the current
study supports keeping these variables as separate measurements of confidence. Coping efficacy can therefore be thought of as a measurement of one’s confidence in overcoming barriers, whereas academic self-efficacy is task specific.

Previous studies have used coping efficacy as a mediator between barriers and self-efficacy in structural equation modeling and regression analyses. Consistently, these studies have shown that coping efficacy is closely related to self-efficacy and associated constructs. For example, in a sample of academically talented college graduates, Perrone et al. (2004) measured coping efficacy with regards to overcoming barriers for career and family goals. They found that coping efficacy was positively related to outcome expectations in both domains of family and career, thus demonstrating that high coping efficacy was related to an increased goal directed behavior, greater interests toward achieving goals, and increased motivation to act on goals (Lent et al., 2000; Meyer, Schacht-Cole, & Gellatly, 1988). This relationship has been consistent showing a strong relationship between positive coping efficacy and academic self-efficacy among undergraduate students in math and science (Byars-Winston & Fouad, 2008), engineering majors (Lent et al., 2003), and equally related across men, women, and students at Historically Black Colleges and Universities (HBCUs) (Lent et al., 2005).

**Relationship of Barrier Constructs to Vocational Constructs**

Barriers to vocational development are understood to vary by objective, subjective, and temporal (distal versus proximal) features. The current study sought to discover the relationship of proximal variables that are subjective in nature within the development of sustained career interest. The results of the current study extended the exploration of barriers by examining relationships among two constructs related to
stereotype threat. Stigma consciousness was negatively related to both coping and academic self-efficacy as predicted by Hypotheses 1b and 2c. There was a significant positive relationship as expected between the variables representing stereotype threat: stigma consciousness and stereotype vulnerability. Although stereotype vulnerability was negatively related to coping, its relationship with academic self-efficacy was non-significant.

Previous studies demonstrated that when barriers are included in the SCCT model it decreased strength in academic self-efficacy (Byars-Winston & Fouad, 2008; Lent et al., 2001; Lent et al., 2003). Additionally, studies have demonstrated coping’s negative relationship with barriers to vocational goals (Byars-Winston & Fouad, 2008; Perrone et al., 2004). The current study supports these relationships and adds a new perspective regarding the barrier framework of SCCT. The use of both stereotype vulnerability and stigma consciousness explored new types of barriers to students pursuing a STEM degree in the context of SCCT. Stigma consciousness was the only one negatively related to self-efficacy, so it provides important information about the main research question; that is, does stereotype threat impact self-efficacy for women in STEM?

Brown and Pinel (2003) used stigma consciousness as a proxy for stereotype threat in their study with women who identified math as important to them and performed well in math on a screening questionnaire. They found that those who scored high on stigma consciousness and were therefore indicating chronic awareness of stereotypes impacting them were more susceptible to stereotype threat in experimentally induced conditions that provided diagnostic challenging situations. As stigma consciousness has been directly linked to susceptibility of stereotype threat, it can be inferred that those
students in the current study who scored high on the SCQ may react to more stereotype-threat inducing situations throughout their academic experiences.

The absence of a relationship between academic self-efficacy and stereotype vulnerability could be due to a number of factors. First, the SVS has limited use in empirical study. Woodcock et al. (2013) worked to validate the scale, but there is no assurance that the SVS-4 measures stereotype threat. Second, their sample consisted of African-American and Latino/a students whose questions were stemmed to prime them to think about situations regarding their race. It could be that how one views stereotypes regarding their gender differs from how students respond to stereotypes regarding race. Although the above are important considerations, an alternative explanation revealed by exploratory analyses of the present study showed cohort differences by year in college on the measure of stereotype vulnerability. One group, third year students, had a negative relationship between stereotype vulnerability and academic self-efficacy ($r = -.29, p < .05$). When examining stereotype vulnerability across years, there was a significant curvilinear (quadratic) relationship for stereotype vulnerability across year in school. As time in school increased, SVS scores also increased until year three. After students’ third year, scores followed a downward trend. This relationship could be due to a number of factors concerning how women experience stereotypes throughout their academic studies. One hypothesis could be that as women are exposed to more courses within their major and even begin cooperative education placements, their exposure to sexist environments and negative feedback regarding women in STEM increases. This may lead to drop-out from STEM fields for students who are more aware of the stereotypic gender roles within STEM fields and the stereotypes regarding women's ability in mathematics. The students
who remain may be less aware of these stereotypes or not internalize them to the same extent. Therefore, year-four women could report less stereotype exposure as a result.

Overall, the proxy measurement of stereotype threat using stigma consciousness provides evidence that the level of perceived sexism and negative attitudes about women negatively impacts how confident women feel about their abilities toward completing a STEM degree. The current study adds to the barrier framework within SCCT by emphasizing the existing negative relationships between exposure to negative environments and academic self-efficacy.

**Mediation Model**

Although support exists for the negative relationship among stigma consciousness and academic self-efficacy, the degree to which women believe they have confidence to cope with educational barriers provides added information regarding individual differences in how women navigate barriers to their educational goals. The present investigation modeled the relationships among stigma consciousness and academic self-efficacy with coping with barriers serving as a mediator. The data indicated a significant mediation effect for coping within the model. This is consistent with previous studies that found coping efficacy mediated relationships between perceived barriers and outcome expectations for Native American students (Thompson, 2012), barriers regarding perceived support for academic goals and academic self-efficacy for African American students (Byars-Winston & Fouad, 2008), systemic and personal classism, perceived social status, and career outcome expectations (Thompson & Dahling, 2012) as well as the relationship between career barriers and career outcome expectations (Perrone, Civilette, Webb, & Fitch, 2004). Further, Hackett and Byars (1996) found that coping
efficacy was a useful predictor of successful performance beliefs in spite of expected obstacles such as racism and discrimination and Lent et al. (2005) found both coping and self-efficacy mediated the negative effect of barriers on interest (or goal related behaviors). Thus, previous studies have found support for the mediating effect of coping within a social cognitive framework.

The current study supported previous mediation analyses, but this can be questioned due to the statistical similarities of mediation, confounding, and suppression (MacKinnon, et al., 2000). MacKinnon et al. suggested that mediation and confounding effects are identical statistically; distinguishing between them must be done on conceptual grounds. Mediation can be thought to be present when the independent variable causes the mediator that thereby causes the dependent variable. By contrast, a confounding effect is conceptually defined as a third variable that explains the relationship between the independent and dependent variables. Based on the method and statistics used in the current dissertation, finding either mediation or confounding represented in the current study stretches the theoretical understanding of how these constructs should behave. For example, to state that coping mediates the relationships between stigma and self-efficacy would suggest that awareness of negative stereotypes about women influences women’s confidence in coping with barriers which in turn influences academic self-efficacy. Although this hypothesis could explain some part of the effect, the current study tested mediation from a single time point. As causal effects, and therefore true mediation, must be determined across time, it is difficult to determine if mediation is an appropriate conclusion in the present study. MacKinnon et al. (2000) explained this further:
For example, temporal precedence among variables may make the direction of the relationship clearer, or the causal nature of the relationship may be evident in a randomized study in which the manipulation of one variable results in changes in another. In most cases, however, the researcher must rely on theory and accumulated knowledge about the phenomenon she is studying to make informed decisions about the direction and causal nature of the relationships in the proposed model. (p. 181).

Theoretically, coping efficacy is discussed by Bandura (1986) as an orientation to environmental barriers, where someone with high coping efficacy may view social barriers as a challenge and those with low coping efficacy would see the same barrier as a threat. Lent et al. (2000) concluded that these differing perceptions lead to diverse motivations for pursuing or rejecting choice options. Therefore, further exploration of this factor was conducted, specifically within a moderation framework.

**Moderation Model**

Prior research includes limited exploration of coping efficacy as a moderator within a social cognitive framework. Meanwhile, confusion in counseling psychology exists about the difference between mediation and moderation (Frazier, Tix, & Barron, 2004). Returning to the definition offered by Frazier and colleagues (2004), "a moderator effect is nothing more than an interaction whereby the effect of one variable depends on the level of another” (p. 116). Supporting this effect, Thompson (2008) reported that coping efficacy served to moderate the effect of perceived social status on career decision self-efficacy. Moderation is determined through the interaction between a predictor variable and the moderating variable. When the path of this interaction term is
significant, the level of the moderator determines the relationship between the predictor and dependent variable. In the present study, the interaction of stigma consciousness and coping was modeled as a predictor of academic self-efficacy. The current study sought to compare this model to the mediation model. The results of the moderation model showed a significant path from the interaction term to academic self-efficacy. Thus, the level of confidence women reported in coping with a range of educational barriers moderated the negative relationship of stigma and academic self-efficacy. As was displayed in Figure 12, women scoring one standard deviation above the mean for the sample on coping efficacy negated the negative impact of high scores on stigma consciousness on academic self-efficacy compared to women who scored low coping efficacy women; one standard deviation below the mean. Although there is little previous research studying coping as a moderator of barriers and self-efficacy within SCCT, the relationship is an important area of consideration. In their paper discussing contextual barriers that constrain personal agency in career development, Lent and colleagues (2000) stated:

SCCT might suggest that how individuals view a particular contextual factor, and whether it deters or motivates their choice behavior, may partly depend on such factors as their faith in their coping efficacy and content-specific self-efficacy (cf. Albert & Luzzo, 1999), and the strength and nature of their various process expectations. Citing "the power of efficacy belief to influence construal processes," Bandura (1997, p. 141) has suggested that those with high coping efficacy are likely to view new social realities as a challenge, whereas those with low coping efficacy may view the same events as a threat. (p.47)
The individual "construal process" and how this changes the relationship between perceived barriers and academic self-efficacy is an important area of discovery in the current study. If coping efficacy serves as the individual difference between those who are successful in spite of discouraging environments, an immediate tool for assisting women in STEM could be to facilitate greater coping efficacy along with instituting the slow process of changing the beliefs of those within STEM environments. The findings within this study underscore that an individual’s global confidence that they can overcome educational barriers protects against their awareness and chronic experiences of discrimination due to their identity as a woman in a STEM-degree program.

**Exploratory Analyses**

Notable results from post-hoc analyses showed a positive relationship for year in college, commitment to major, college GPA, and high school GPA with academic self-efficacy. These relationships correspond with SCCT in that GPA represents both current and past performance accomplishments, commitment to major could represent a form of goal behavior or interests, and year in school - with the later the year the stronger reported self-efficacy - could represent learning experiences. Among dichotomous variables, group differences observed for intention to pursue a graduate degree may be a proxy for outcome expectations, with students who anticipated pursuit of a professional degree having higher academic self-efficacy. As well, those students who indicated they were involved in a learning community also reported higher academic self-efficacy. Within an SCCT framework, learning communities may represent a supportive environment. Thus, taken together, the bidirectional relationship between academic self-
efficacy and the above variables demonstrate support for the social cognitive career model as well as the validity of measurement for the population of the current study.

In order to gather more information about the behavior of the stereotype vulnerability scale with the current population further analyses were run. Results showed a quadratic relationship for SVS across year in college. The curved line followed an upward trend from years one through three, with third year students reporting the highest scores on stereotype vulnerability. The fitted line then decreased from year three forward, showing a downward trend regarding stereotype vulnerability. Examining correlations by year, 3rd-year students had a significant negative relationship with academic self-efficacy. This preliminary trend points to a possible explanation for the lack of significance in the path model for SVS. As correlational design does not capture non-linear relationship, the curvilinear trend of stereotype vulnerability across year could shed some light on its near-zero relationship with academic self-efficacy (which increases across all years). There was not a significant curvilinear effect for stereotype vulnerability across academic self-efficacy scores. The results here could point to an increase in stereotype threatening experiences as students move from general coursework toward those courses that are more concentrated in their major. As students leave STEM majors, other students who remain may reach a peak experience of stereotype vulnerability in their third year of study. Following this year of increased salience of stereotype threat, students faced with this barrier may withdraw or switch majors as the environment becomes threatening. This would then explain the drop in year four and five, where students either are less aware or feel their experience of stereotype threat as less inhibitive. It would also follow that students who feel heightened stereotype threat also report lower self-efficacy and are less
likely to state they are committed to their major or have plans to pursue a professional
degree in their field, a process labeled disengagement by Steele (1997) that ultimately
leads to disidentification. Here, students whose performance is diminished by
experiencing chronic stereotype threat first disengage with the subject matter to protect
their self-esteem and confidence. As this experience is replicated in subjects, such as
mathematics, students ultimately disidentify with the domain in question. Such a
phenomenon could explain the curvilinear nature of the stereotype vulnerability variable
across year in school. Thus, increased experiences of stereotype threat lead to a tipping
point where students finally disidentify with STEM fields and withdraw or transfer to a
different major.

**Limitations**

The present study is limited by the generalizability of the findings to other
underrepresented populations as well as other disciplines, by the nature of the
correlational research design, and finally by the difficulty in measuring stereotype threat
through self-reports. These will be discussed next along with suggestions for remedying
these limitations in future research.

First, the participants in the current study consisted of predominantly white
women (73%) who were majoring in differing disciplines of engineering and computer
science. Therefore, the results may not generalize to other underrepresented populations
across disciplines. Specifically, African-American/Black, Latino/a, Southeast Asian, and
Native American represent a racial and ethnic disparity in STEM fields. Therefore,
research expanding the present model to include exploration of how racial bias and
stereotypes impact academic self-efficacy would serve to support the present findings.
Additionally, exploration of the combined effect of racial or ethnic minority identity along with gender would assist to understand how multiple underrepresented identities are navigated within STEM fields and also point to coping beliefs and their role in buffering these potential negative effects. Further, the population sampled was geographically limited to women from a Midwestern state and from Predominantly White Institutions (PWIs). Differences across geographic locations and sampling among minority serving institutions and HBCUs could illuminate important differences in environment and the prevalence and impact of negative stereotypes on academic self-efficacy for underrepresented students in STEM fields.

A recent report by Ceci, Williams, Ginther, and Kahn (2014) specifies sex differences better denoted by disparities within math-based science fields, including geoscience, engineering, economics, mathematics/computer science, and the physical sciences — including chemistry and physics (abbreviated by the authors as GEEMP). While the current study represents areas in GEEMP fields (engineering and computer science), future studies should directly attempt to replicate the current model across other fields of study specifically recruiting women in economics, geoscience, and the physical sciences.

Second, the research design of the current study relied on statistical relationships among variables based in correlational design with measurement gathered from self-report instruments. Both methods of data collection have their strengths; namely, ecological validity and the ability to measure many variables and their strength of association. Yet, there are also limitations to the current study design. For example, correlational methods can only depict the association of multiple variables and therefore
establishing causality between relationships can be difficult. Consequently, future studies would do well to use longitudinal and experimental designs in order to discover with greater specificity the relationships among the variables studied. Specifically, to understand how the experience of stereotype threat impacts self-efficacy in math-based fields and how one may employ coping efforts to increase their self-efficacy. Further, experimental designs may study the impact of various interventions on coping with discrimination, stigma, and stereotypes regarding identity in math-based fields. Mixed methods or strictly qualitative investigations might gather greater information about the complexity of the relationships represented in the current study. For instance, qualitative studies could help to understand both the experience of stigma and stereotypes as well as the implementation and use of methods for coping with barriers to educational goals.

Finally, the current study was limited by the measurement of the phenomenon in question: stereotype threat. Previous research has employed experimental designs to demonstrate the impact of stereotypes on performance. In the current study, the use of the Stereotype Vulnerability Scale (SVS) and Stigma Consciousness Questionnaire sought to capture the stereotype threat phenomenon outside of the laboratory setting. As discussed above, the psychometric properties of the SVS have been challenged and the construct validity of the instrument has yet to be fully determined. The scale has shown internal consistency and reliability, whether or not it measures experience of stereotype threat can be questioned. The questions posed on the SVS are meant to tap the perception of stereotypes regarding intelligence for women, but the process of internalizing stereotypes and how this process is understood by and affects participants may not be this straightforward. For instance, interventions to reduce the impact of stereotype threat can
simply involve making students aware of the negative impact of stereotypes (Johns, Schmader, & Martens, 2005). The SVS asks participants to endorse the outcomes of stereotype threat, for example "If you do poorly on a test, people will assume that it is because of your gender." Such direct awareness of the impact of the stereotype may not be as present for students most susceptible to the negative effects of their stigmatized identity. In essence, awareness of the negative outcomes may suggest a greater consciousness of an oppressive system, whereby those women who have an awareness of the negative stereotypes that characterize their experiences as a result have less internalized sexism regarding stereotypes about women's intelligence. By contrast, women with greater levels of internalized oppression may not endorse these items, as they see these phrases as external attribution and instead believe their negative performance is fundamental to their identity rather than an outside attribution in response to their gender. Regardless, greater investigation of how stereotypes regarding intellectual performance are internalized among minority groups susceptible to stereotype threat is warranted.

**Implications**

The current study responded to calls for better understanding of the impact of contextual barriers when internalized, as is the case with high levels of stigma consciousness. Results indicated that the impact of negative stereotypes associated with gender and their awareness among women in STEM fields is associated with lower self-efficacy toward accomplishing tasks related to completing a STEM degree. The findings of the present study aid in answering the question of how internalized barriers impact career development. Additionally, findings from the current study suggest a possible
intervention strategy for the negative impact of stigma through increasing students’ reported level of coping efficacy. These implications may be realized in practice, education, and future research.

**Implications for Practice**

Overall, the study findings highlight important areas of consideration for practitioners working within career development among girls and women. Foremost, the role that socialization plays toward self-efficacy is an important consideration. As Hackett and Betz (1981) demonstrated, the role verbal persuasion, role models, past performance accomplishments, and physiological states play in shaping women's self-efficacy in male-dominated vocational domains is substantial. Assessment and awareness of how these differing perceptions and learning experiences shape beliefs about abilities can be an important first step in understanding women's vocational development within STEM fields. Utilization of career counseling by students would be an ideal way to discuss barriers toward persistence in STEM careers for women. As this may not consistently be the case, however, suggestions for practice are discussed herein both at the individual level in traditional counseling and for larger group interventions and programs to assist women in STEM.

Based on the results of this study, two areas are important to consider for counselors who may engage in career counseling with women who are in pursuit of a STEM degree. First, as the chronic awareness of stigma about women was shown to decrease self-efficacy toward achieving a STEM degree, an awareness regarding how these stereotypes are internalized and processed by counseling clients will be important. Toward this end, Juntunen (1996) studied the use of a feminist approach to career
counseling and found women who listened to five minutes of a feminist career counseling session rated their own career self-efficacy significantly higher than those who were exposed to a traditional developmental approach. The feminist approach underscored the role that socialization plays in gender-bias toward and beliefs about career choice for women. In the condition using feminist counseling, clients were encouraged to critically engage in how they self-referenced their abilities, interests, and choices in pursuit of non-traditional careers for women. The results of Juntunen's study demonstrate the usefulness of pairing career counseling with discussion and education about the role that environment and socialization play in self-efficacy in certain career domains, especially those traditionally pursued by men. Indeed, the role of culture and socialization is a hallmark of multiculturally focused career counseling (Leong & Hartung, 1997).

Competency and awareness of multiple roles that impact career interest and choice are paramount in providing career services. Similarly, the impact of role salience and meaning of life roles in concert with social influence and cultural backgrounds of clients form a useful framework for career guidance and assessment across theories (Hartung, 2002). Specific to STEM-focused career interventions, Byars-Winston (2013) advocated that counselors increase their awareness of STEM fields, including their own biases toward who inhabits and fits certain fields. Further, counselors should become aware of the barriers toward attaining STEM degrees, especially those that restrict access for women in STEM. Finally, Byars-Winston suggested counselors become aware of research-based practices that increase interest in STEM as well as knowledge of educational and government initiatives, programming, and industry partnerships available to facilitate STEM career interest and support.
Next, the current study showed coping efficacy as a strong moderator of the relationship between stigma consciousness and academic self-efficacy for women in STEM. While the distinct mechanisms that increase coping efficacy are not well delineated in the literature, practitioners may use standard practices aimed at increasing coping behaviors for women in STEM. Increases in coping confidence could specifically target the stress, anxiety, and potential symptoms of depression that often are associated with experiences of sexism (Klonoff & Landrine, 1995; Moradi & Subich, 2002; Moradi & Subich, 2004). For example, Regerhr, Glancy, and Pitts (2013) conducted a meta-analysis on interventions aimed at reducing stress and found that use of cognitive, behavioral, and mindfulness-based interventions and therapies are useful approaches for reducing the negative impact of stress including reduction of stress-related mental health symptoms.

Beyond individual counseling approaches, programming and larger interventions aimed at addressing stereotype threat for women seeking career counseling could serve to lessen the impact of negative environments. Numerous interventions have been developed to combat the decreased performance observed among targeted individuals experiencing stereotype threat. Research supports efforts to reduce anxiety and self-doubt through reframing the task as non-diagnostic or sex-fair (Good, Aronson, & Harder, 2008; Quinn & Spencer, 2001), deemphasizing targeted social identity (Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2004), encouraging self-affirmation (Martens, Johns, Greenberg, & Schimel, 2006), attributing anxiety and worry to an outside stimuli (Ben-Zeev, Fein, & Inzlicht, 2005), and emphasizing an incremental view of intelligence (Aronson, Fried, & Good, 2002). Further, environmental supports have been shown to
reduce stereotype threat through providing role models (Blanton, Crocker, & Miller, 2000) and encouraging high standards for ability and assuring students educators believe in their abilities (Cohen, Steele, & Ross, 1999).

Interventions that address stereotype threat have overlap with theory-based interventions aimed at increasing career self-efficacy. In a review of self-efficacy's influence on career assessment and practice, Gainor (2006) noted that interventions and programs that addressed the four components of efficacy expectations proved efficacious in improving participants' academic and/or occupational choice self-efficacy. For instance, verbal persuasion social encouragement, integrating feedback, anxiety reduction, and positive emotional experiences along with family support (O'Brien, Dukstein, Jackson, Tomlinson, & Kamatuka, 1999) resulted in greater confidence in ability for success in math and science. Exploring the impact of vicarious learning, performance accomplishment and combined intervention effects, Luzzo, Hasper, Albert, Bibby and Martinelli (1999) found that for college women who were undecided performance accomplishments and combined intervention of performance and vicarious learning increased their confidence in their math and science ability. Their intervention consisted of videotapes with students discussing their choice of a math or science major and a problem solving task that involved instruction for completing numerical problems. The authors state the ease with which such interventions can be utilized by career counselors, and can be combined with interest inventories and self-efficacy scales to aid career development. Such interventions can be framed and presented for outreach and long-term programming as well.
The above review represents a small examination of the potential interventions and programs that could be used by counselors to support women pursuing STEM careers. Across decisions for practice, choice of intervention seems optimally based on the areas of self-efficacy: performance accomplishments, vicarious learning, verbal persuasion, and attending to physiological states, such as anxiety (Gainor, 2006). It may be assumed that interventions designed to increase math or science academic self-efficacy will likely decrease the negative impact of stereotype threat. Regardless, stereotype threat interventions often focus on awareness of stigma and stereotypes as well as their negative impact on performance (Aronson, McColskey, Montrosse, Lewis, & Mooney, 2009). Other interventions could include self-affirmation, anxiety management, and increasing active coping styles.

**Implications for Education**

Education can be seen to cover three main areas. First, education would likely do well to address the needs of women in STEM fields and overlap with the interventions mentioned above. Second, counseling psychology and career counseling courses may consider covering a greater content area of pathways and access to STEM fields as well as the underrepresentation of women and minority students. Finally, education for STEM faculty may do well to include the needs of women in STEM and additionally assist faculty to be aware and attentive to needs of diversity in academic preparation and success for all students.

First, education for women in STEM can begin through discussing the prevalence of stereotypes regarding women and mathematical ability. Some research refutes the claim that women have lower mathematical and spatial ability compared to men (Hyde,
Fennema, & Lamon, 1990; Hyde, Lindberg, Linn, Ellis, & Williams, 2008). Therefore, teaching women about the fallacy of claims against their intelligence and abilities can serve to strengthen their confidence in mathematical performance. As supported by the present study, women in learning communities have greater self-efficacy concerning completing tasks involved in STEM curriculum. Therefore, increasing and facilitating opportunities for women to learn from one another, as well as mentor and serve as role models and supports through the academic pipeline may enhance their educational experiences while increasing their success across STEM disciplines.

Second, education should follow those recommendations put forward by Byars-Winston (2013) for career counselors working in STEM fields. Byars-Winston suggests for students and professionals working with career issues, greater awareness and understanding of the STEM career market, the opportunities needed for success, and the professional networks, internships, and faculty connections available serves to optimize the role a counselor can play in facilitating the career success of women in STEM. Further, education for counselors and psychologists should continue to address the prevalence of discrimination and oppression across its various manifestations (e.g., sexism and microaggressions), as well as their intersection with women's career development. Additionally, specific education regarding the role of stereotype threat – how it impacts women in educational environments, and ways to nullify its negative impact – would provide counselors and psychologists with a useful theoretical and practical framework for understanding the environmental impediments for women in STEM.
Finally, faculty within STEM fields should be encouraged to view the research and literature concerning underrepresentation of women and racial/ethnic minorities in STEM fields. Enhancing STEM faculty awareness of the problems and how they can be empowered to close the gap of representation would place greater responsibility on the educational environment to adapt to lessen the disparities present. Additionally, bias within STEM should be challenged. Teaching faculty about the impact of social psychological phenomenon such as stereotype threat and stigma could serve to increase awareness of women and minority students’ experiences in STEM. Further, building on awareness, faculty may then choose to change or adapt their pedagogy and structure of their courses to increase inclusivity and encouragement of underrepresented students.

**Implications for Future Research**

Findings from the current study support increased research in the areas of stereotype threat and coping with educational barriers and how they impact self-efficacy for women and other underrepresented students in STEM. Results point to the need to follow previous calls for employing both experimental and longitudinal designs to understand the nature of stereotype threat and how it directly impacts self-efficacy within a social cognitive framework (Deemer et al., 2013; Lent et al., 2010). For instance, experimental studies could examine the role of anxiety, worry, and other physiological markers that can be induced under laboratory conditions for stereotype threat and how they impact self-beliefs regarding ability. As self-report measures for stereotype threat gather greater psychometric validation, these can be used over time to observe how the experience of stereotype threat across time impacts academic self-efficacy and persistence for STEM students.
Toward improving the measurement of stereotype vulnerability, pairing administration of the SVS with experimental inducement of stereotype threat, as was done by Brown and Pinel (2003), could assist in determining construct validity of the SVS for stereotype threat conditions. Moreover, using measurement of stereotype threat along with associated measures of the phenomenological experience of stereotype threat including qualitative information on experiences with discrimination could serve to contextualize stereotype threat's measurement with its correlates.

The current study also highlights the need for continued inclusion of stereotype threat as a construct within the proximal barriers of SCCT. Recently, Lent, Miller, Smith, Watford, Hui, and Lim (2014) conducted a longitudinal analysis of SCCT across gender and race/ethnicity. Within their model they included satisfaction and intention to persist within engineering majors. Their results showed consistent fit for the model with self-efficacy as the most reliable predictor of intended persistence. Using the results of the current study, future research should expand similar longitudinal designs to determine the role that person-environment barriers such as stereotype threat play in persistence for women in STEM by integrating both self-efficacy, coping, and stereotype threat into a full SCCT model. This would also offer additional insight toward the interactions and relationships of the full theoretical model with the barrier framework of stereotype threat.

Next, results point to the need to gain greater understanding of how individuals increase confidence in coping with educational barriers. As coping efficacy played a central role in nullifying the negative impact of stigma consciousness on academic self-efficacy, efforts to understand the mechanisms through which coping efficacy is determined or enhanced for individuals could offer important insights into interventions
for populations at-risk for stereotype threat. Lent and colleagues (2000) suggested that future coping research takes into account the interplay between coping efficacy and barrier perceptions. In order to better understand the role that coping efficacy plays in research on stereotype threat and self-efficacy, future studies should look at how personality and dispositional inputs determine the perception and construal of barriers within an environment. Greater understanding of the phenomenological experience of women in STEM and how they view education and career related barriers as well as how they plan to cope with these barriers could provide important insight into different processes of coping.

Finally, the current study's model should be extended and reproduced with different populations who are underrepresented in STEM fields. Following the above methodological and research design suggestions, broadening current and future findings regarding stereotype threat's impact on career related variables across racial, ethnic, gender, class, ability, sexuality and other marginalized identities would support stereotype threat as useful barrier construct in SCCT. Future research should take care to follow existing theory within social cognitive and social identity theories guiding the design and intersection of two overlapping but distinct areas of study.

**Conclusion**

While the scope of the presenting problem was beyond the limits of the present study, important conclusions can be made that address the social and psychological factors that lead to a disparity of women represented in STEM education. First, results of the present study offer the use of stigma consciousness as a personal and contextual barrier regarding sex discrimination within a social cognitive career development model.
Second, as high levels of stigma consciousness result in greater incidence of stereotype threat effects (Brown & Pinel, 2003), stigma consciousness may represent an important variable that identifies one’s vulnerability to and impact of stereotype threat in real-world contexts for women in STEM. Third, coping efficacy demonstrates an important individual difference regarding how individuals may overcome negative stereotypes that lower self-efficacy. Future research that addresses the mechanisms and strategies that undergird high coping efficacy has the potential to be facilitative of success for women in STEM. Finally, results of the present study underscore the importance of environment in retention and successful completion of STEM degrees for women.
REFERENCES


APPENDICES
APPENDIX A.

ACADEMIC MILESTONES INDEX

For each task listed below, please indicate whether or not you feel you could successfully complete it -- assuming you were motivated to make your best effort. For each YES, indicate how sure you are by circling one of the numbers on the scale.

<table>
<thead>
<tr>
<th>Task</th>
<th>no confidence</th>
<th>complete confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete the math requirements for most science, agriculture, or engineering majors</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Complete the chemistry requirements for most science, agriculture, or engineering majors</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Complete the biological science requirements for most science, agriculture, or engineering majors</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Complete the physics requirements for most science, agriculture, or engineering majors</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Complete a science, agriculture, or engineering degree</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Remain in a science, agriculture, or engineering major over the next semester</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Remain in a science, agriculture, or engineering major over the next two semesters</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Remain in a science, agriculture, or engineering major over the next three semesters</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Excel in science, agriculture, or engineering over the next semester</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Excel in science, agriculture, or engineering over the next two semesters</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
<tr>
<td>Excel in science, agriculture, or engineering over the next three semesters</td>
<td>0 1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B

COPING WITH BARRIERS

Please rate your degree of confidence that you could overcome each of the potential educational barriers listed below.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Not At All Confident</th>
<th>Highly Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Money problems...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>2. Family problems...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>3. Not being smart enough...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>4. Negative family attitudes about college...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>5. Not fitting in at college...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>6. Lack of support from teachers...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>7. Not being prepared enough...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>8. Not knowing how to study well...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>9. Not having enough confidence...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>10. Lack of support from friends...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>11. My gender...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>12. People's attitudes about my gender...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>13. My ethnic background...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>14. People's attitudes about my ethnic background...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>15. Childcare concerns...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>16. Lack of support from my &quot;significant other&quot;...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>17. My desire to have children...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>18. Relationship concerns...</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>
19. Having to work while I go to school...  & 1 & 2 & 3 & 4 & 5 \\
20. Lack of role models or mentors... & 1 & 2 & 3 & 4 & 5 \\
21. Lack of financial support... & 1 & 2 & 3 & 4 & 5 \\

APPENDIX C

STEREOTYPE VULNERABILITY SCALE

Ethnicity

Items for the Revised Stereotype Vulnerability Scale (SVS) and the SVS-4

<table>
<thead>
<tr>
<th>Because of your ethnicity:</th>
<th>Never</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Some people believe that you have less ability.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B: If you’re not better than average, people assume you are limited.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C: Professors expect you to do poorly.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D: Professors are less likely to encourage you.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E: You are not fully accepted or included into your program.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F: If you ask a simple question, people will think it is because of your ethnicity.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G: If you do poorly on a test, people will assume that it is because of your ethnicity.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>H: People of your ethnicity face unfair evaluations because of their ethnicity.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Gender

Items for the Revised Stereotype Vulnerability Scale (SVS) and the SVS-4

<table>
<thead>
<tr>
<th>Because of your gender:</th>
<th>Never</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Some people believe that you have less ability.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B: If you’re not better than average, people assume you are limited.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C: Professors expect you to do poorly.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D: Professors are less likely to encourage you.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E: You are not fully accepted or included into your program.</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
F: If you ask a simple question, people will think it is because of your gender.

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

H: People of your gender face unfair evaluations because of their gender.

Note. Items included in the shortened SVS-4 are bolded.
APPENDIX D

STIGMA CONSCIOUSNESS QUESTIONNAIRE

The 10 SCQ for Women

Please indicate your agreement with the following list of statements corresponding the the following scale:

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Neither agree, nor disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Item

1. Stereotypes about women have not affected me personally. (R)
   
2. I never worry that my behaviors will be viewed as stereotypically female. (R)
   
3. When interacting with men, I feel like they interpret all my behaviors in terms of the fact that I am a woman.
   
4. Most men do not judge women on the basis of their gender. (R)
   
5. My being female does not influence how men act with me. (R)
   
6. I almost never think about the fact that I am female when I interact with men. (R)
   
7. My being female does not influence how people act with me. (R)
   
8. Most men have a lot more sexist thoughts than they actually express.
9. I often think that men are unfairly accused of being sexist. (R)

   0  1  2  3  4  5  6

10. Most men have a problem viewing women as equals.

   0  1  2  3  4  5  6

Note. R = reverse scored.

The SCQ for Racial/Ethnic Minorities

Please indicate your agreement with the following list of statements corresponding to the following scale:

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Neither agree, nor disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>0  1  2  3  4  5  6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Item

1. Stereotypes about my race have not affected me personally. (R)

   0  1  2  3  4  5  6

2. I never worry that my behaviors will be viewed as stereotypical of my race. (R)

   0  1  2  3  4  5  6

3. When interacting with whites, I feel like they interpret all my behaviors in terms of the fact that I am a racial minority.

   0  1  2  3  4  5  6

4. Most whites do not judge racial minorities on the basis of their race. (R)

   0  1  2  3  4  5  6

5. My being a racial minority does not influence how whites act with me. (R)

   0  1  2  3  4  5  6

6. I almost never think about the fact that I am racial minority when I interact with whites. (R)

   0  1  2  3  4  5  6
7. My being a racial minority does not influence how people act with me. (R) 

    0 1 2 3 4 5 6

8. Most whites have a lot more racist thoughts than they actually express. 

    0 1 2 3 4 5 6

9. I often think that whites are unfairly accused of being racist. (R) 

    0 1 2 3 4 5 6

10. Most whites have a problem viewing racial minorities as equals. 

    0 1 2 3 4 5 6

Note. R = reverse scored.
APPENDIX E
DEMOGRAPHICS

1. Please fill in the blank or check the one response that best describes you.

1. Your age: [ ]

2. Sex: _____ Male _____ Female

3. Select current year in college:
   _____ 1st year _____ 2nd year _____ 3rd year _____ 4th year _____ 5th year _____ >5 years

4. Race/Ethnicity:
   _____ Black or African-American
   _____ Pacific-Islander
   _____ American Indian
   _____ Asian-American
   (Please indicate Asian racial/ethnic heritage):
   _________________________________
   _____ Hispanic, Latino(a)
   _____ Mexican-American or Chicano
   _____ White, Caucasian, European, Not Hispanic
   _____ Bicultural (Please indicate racial/ethnic heritage of both parents):
   Mother: ____________________ Father: ____________________

5. What is your declared college major? ______________________________

6. How many courses have you completed for your major? __________________

7. How strongly committed do you feel to pursuing this major? CHECK ONE:
   _____ Not strongly committed
   _____ Slightly committed
   _____ Moderately committed
   _____ Very committed
   _____ Extremely committed

7. What is your current major grade-point average (GPA) or expected GPA? ________

8. What is your overall college GPA or expected GPA? ________

9. What was your cumulative high school GPA? ________
10. Do you intend to pursue a graduate or professional degree?
   ______ Yes  ______ No

   If yes, in what area? ______________________________________
   (Ex., business, medical or law school, Master’s/Ph.D. in certain area)

II. Please fill in the blank or check the one response that best describes your institution.

   1. Which best describes your college or university:   _____ Public   _____ Private

   2. Which category best describes your college or university:
      a. Predominantly-White Institution (PWI)
      b. Historically Black College or University (HBCU)
      c. Minority Serving Institution (MSI)
APPENDIX F

INFORMED CONSENT

PLEASE READ THE FOLLOWING INFORMATION IN ITS ENTIRETY BEFORE CONSENTING TO PARTICIPATE:

Title of Study: Stereotype Threat as a Barrier to Women and Minorities Entering STEM Careers

Introduction: You are invited to participate in a research project being conducted by Michael Cadaret, MA (a doctoral student in the Department of Counseling at The University of Akron) under the supervision of Suzette L. Speight, PhD (a faculty member in the Department of Psychology at the University of Akron).

Purpose: The purpose of this study is to understand the experiences of students within STEM majors in higher education institutions.

Procedures: If you agree to participate, you will be asked to answer a number of questions about your opinions, preferences, and beliefs. The survey will take approximately about 12-15 minutes.

Exclusion: You must be at least 18 years old to participate in this research study and currently enrolled in a college or university with a Science, Technology, Engineering, or Mathematics (STEM) major declared. Additionally, you must also identify as a racial and/or ethnic minority excluding students who identify as Chinese, Japanese, or Indian. Finally, all women are invited to participate regardless of race or ethnicity.

Risks and Discomforts: No adverse events are expected beyond those encountered in daily life.

Benefits: You will receive no direct benefit from your participation in this study, but your interests and experiences will help researchers better understand the academic environment for STEM students in higher education.

Payments to Participants: You will have the option of entering a drawing with the chance to win an Amazon Kindle Fire HD (1 drawing); $100 cash (2 drawings); or $50 cash (5 drawings) with 8 total chances to win for completing the survey.

Right to refuse or withdraw: Participating in this study is completely voluntary. You can quit at any time and you won’t lose anything, even if you do not complete the study.

Confidential Data Collection: Data will be kept confidential. No identifying information will be collected. Data will be kept in a secure location and only the researcher will have access to the data. All data will be presented in aggregate for any publication or presentation of the research results.

Confidentiality of records: The data will be kept for no less than 5 years and destroyed after that time in accordance with APA guidelines.

Who to contact with questions: If you have any questions about this study, you may contact the Principal Investigator, Michael Cadaret at mcc53@uakron.edu. This project has been reviewed and approved by The University of Akron Institutional Review Board. If you have any questions about your rights as a research participant, you may call the IRB at (330) 972-7666.

Acceptance: I have read the information provided and all of my questions have been answered. I voluntarily agree to participate in this study. Checking the “Yes” box below will serve as my consent. I may print a copy of this consent statement for future reference.

[ ] Yes (I agree to participate, and I am at least 18 years old)
[ ] No (I do not agree to participate)
APPENDIX G

INSTITUTIONAL REVIEW BOARD APPROVAL

NOTICE OF APPROVAL

March 25, 2014

Michael Cadaret
900 W. Market St., #505
Akron, Ohio 44313

From: Sharon McWhorter, IRB Administrator

Re: IRB Number 20140319 “Stereotype Threat as a Barrier to Women and Minorities Entering STEM Careers”

Thank you for submitting your IRB Application for Review of Research Involving Human Subjects for the referenced project. Your application was approved on March 25, 2014. Your protocol represents minimal risk to subjects and matches the following federal category for exemption:

☐ Exemption 1 – Research conducted in established or commonly accepted educational settings, involving normal educational practices.

☒ Exemption 2 – Research Involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior.

☐ Exemption 3 – Research involving the use of educational tests, survey procedures, interview procedures, or observation of public behavior not exempt under category 2, but subjects are elected or appointed public officials or candidates for public office.

☐ Exemption 4 – Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens.

☐ Exemption 5 – Research and demonstration projects conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine public programs or benefits.

☐ Exemption 6 – Taste and food quality evaluation and consumer acceptance studies.

Annual continuation applications are not required for exempt projects. If you make changes to the study’s design or procedures that increase the risk to subjects or include activities that do not fall within the approved exemption category, please contact me to discuss whether or not a new application must be submitted. Any such changes or modifications must be reviewed and approved by the IRB prior to implementation.

Please retain this letter for your files. This office will hold your exemption application for a period of three years from the approval date. If you wish to continue this protocol beyond this period, you will need to submit another Exemption Request. If the research is being conducted for a master’s thesis or doctoral dissertation, the student must file a copy of this letter with the thesis or dissertation.

Cc: Suzette Speight - Advisor
Cc: Valerie Callanan – IRB Chair

☒ Approved consent form/s enclosed