Onver	ony of Ontonniad
	Date: 8/20/2013
I. Mary Jean Amon , hereby submit degree of Master of Arts in Psycho	this original work as part of the requirements for the logy.
It is entitled:	
Evaluating Implicit and Explicit S Development Settings for STEM	Stereotype Activation in Professional Women
Student's name: Mary Jean	<u>n Amon</u>
	This work and its defense approved by:
	Committee chair: Rachel Kallen, Ph.D.
1/r	Committee member: Stacie Furst, Ph.D.
Cincinnati	Committee member: Steven Howe, Ph.D.
	682

# Evaluating Implicit and Explicit Stereotype Activation in Professional Development Settings for STEM Women

A thesis submitted to the

Graduate school

of the University of Cincinnati

in partial fulfillment of the

requirements for the degree of

Master Of Arts

In the Department of Psychology

Of the McMicken College of Arts and Sciences

by

Mary Jean Amon, M.A.

Master of Arts in Clinical Psychology

Teachers College, Columbia University 2010

Committee Chair: Rachel W. Kallen, Ph.D.

Committee: Stacie Furst-Holloway, Ph.D.

Steven R. Howe, Ph.D.

#### Abstract

Interventions designed to address the negative effects of stereotypes can be used to create identity-safe environments and promote attitude change among stigmatized populations. Research suggests that stigmatized individuals are sensitive to the type of stereotype priming, and the salience of stereotypes has important consequences for performance. However, stereotype threat interventions vary in the extent to which stereotypes are made explicit. The current study extends research on stereotype threat interventions to STEM women in professional development settings, and examines the effects of implicit and explicit stereotype activation on leadership aspirations. STEM women graduate students participating in leadership workshops were assigned to an experimental group exposed to gender stereotypes, or a control group with no such exposure. Pre- and post-test measures indicated that cuing stereotypes in an identitysafe environment was not sufficient to reduce graduate women's stereotype threat effects and may diminish motivation to lead. Qualitative data was analyzed for career challenges and strategies. The effect of openly discussing stereotypes on provoking negative consequences for well-being is discussed.

# Acknowledgments

I would like to sincerely thank my thesis committee, Drs. Rachel W. Kallen, Stacie Furst-Holloway, and Steven R. Howe for their help developing this project, their mentorship, and support while working on this project.

# Table of Contents

List of figures	V
Introduction	1
Experiment	11
Participants	11
Materials	11
Procedure	16
Results	17
Relationship between measures	17
Demographic differences	17
Manipulation check	18
Leadership aspirations	18
Role choice	21
Qualitative results	22
Discussion	30
References	35
Tables	44
Figures	51
Appendixes	53

i

# Tables and Figures

- Table 1. Session 2 Participant Disciplines
- Table 2. Correlations Among Study Variables.
- Table 3. Participant Gender Empowerment Score by Country of Origin
- Table 4. Pretest and Posttest Descriptive Statistics
- Table 5. Summary of Qualitative Themes and Theoretical Significance

Table 6. Illustrative Evidence for Qualitative Themes

Table 7. Control and Experimental Qualitative Group Differences

Figure 1. Mean leadership identification scores for participants from different geographical regions

Figure 2. Mean rank of roles for workshop task

Evaluating implicit and explicit stereotype activation

# in professional development settings for STEM women

Attrition for women in Science, Technology, Engineering, Mathematics, and Medicine (STEM) is progressive throughout college, graduate school, and professional ranks. STEM women enrolled in graduate school are in a unique position. Having persevered as an undergraduate in typically male-dominated fields and continuing into advanced training, they have made a considerable personal investment in their fields. They are also gaining a new perspective into the professional world ahead of them. However, as women advance in STEM they remain vulnerable to the gender stereotypes that pervade these fields, and these stereotypes affect their educational and professional outcomes.

In male-dominated fields women face both implicit and explicit stereotypes on a regular basis. For example, the gender ratio in a department can implicitly communicate how valued and accepted women are, as well as their likelihood of success. Stereotypes can be manifested explicitly as well, for example, when people complain about female leaders or discourage women from having children. Stereotypes surface in diverse and complex ways, and their presence can impact individual performance and professional outcomes in stereotyped domains. In spite of these obstacles, some women persist in male-dominated careers like STEM, and research has identified strategies that may help to reduce the burden created by stereotypes and increase participation.

# Underrepresentation of Women in STEM

Young women in high school prepare for college degrees in STEM at

approximately equal rates as young men. However, after matriculating into college, women are less likely to pursue degrees in these fields (Hill, Corbett, & St. Rose, 2010). While women are more likely to earn a bachelor's, Master's or doctoral degree than men, they remain the minority of degree-earning STEM students (United States Bureau of the Census, 2010). This is particularly true for more advanced degrees, where graduation rates in STEM favor men 4:1 (Syverson & Brown, 2004). By the time women complete their education, many have already opted out of STEM.

Gender discrepancies become more pronounced at the professional level. Women account for nearly half of the United States workforce, but compose approximately one-fourth of the positions in STEM (National Science Foundation, 2012). Gender discrepancies in STEM fields vary considerably, with women occupying 53% of positions in the social sciences, but only 26% of those in computer science and mathematics, and 13% in engineering (National Science Foundation, 2012). This pattern is evidenced across both industry and academia (Trower & Chait, 2002). Women advance more slowly and are more likely to leave their positions than male peers (Valian, 1999). Overall, the higher the rank in STEM, the less likely it is to be occupied by a woman.

Research indicates that the underrepresentation of women is not due to a lack of ability in science and math, and is instead due to the constraints placed on women within male-dominated fields. Women are excluded from STEM despite generally high levels of academic achievement (Hyde et al., 2008). In high school, girls and boys take approximately equal credits in STEM fields, with girls earning higher grades on average (Shettle et al., 2007). In higher education, women earn better grades than men and are

more likely to achieve post-secondary degrees at all levels (Buchman & DiPrete, 2006; United States Bureau of the Census, 2010). However, women who are proficient in math-intensive fields are more likely to choose careers outside of STEM and leave STEM careers as they advance when compared to men (Ceci, Williams, & Barnett, 2009).

Women's underrepresentation in STEM comes at a cost both socially and economically. From a social justice standpoint, women are denied desirable career positions, equal pay, and power associated with prestigious jobs. Economically, the loss of STEM women reduces the productivity and competitiveness of the economy (Council of Graduate Schools, 2012). Attrition from graduate programs wastes both financial resources and energy (Council of Graduate Schools, 2012). In the workforce it contributes to the shortage of high-level math and science skills (National Science Board, 2003; Council of Graduate Schools, 2007). The lack of diversity in leadership reduces the scope and quality of decision-making (White House Project, 2009). It also perpetuates the underrepresentation of women and minorities by reducing the number of role models available to other minority members, further isolating them within the workplace. Increasing women's participation in STEM can positively impact the economy by contributing to increased productivity, innovation, and diversity in leadership.

# **Theoretical Explanation for Underrepresentation**

**Stereotype threat.** Stereotypes have been identified as a source of many of the disadvantages women experience in pursuing these careers. Of the theories examining their effects, stereotype threat theory asserts that the mere presence of negative group

stereotypes has the potential to impair individual performance and affect professional outcomes among stigmatized individuals (Steele, 1997). Under certain conditions, the unconscious processing of stereotype content can be enough to diminish performance (Kiefer & Sekaquaptewa, 2007). For example, Murphy and colleagues (2007), demonstrated that women who viewed images of conference settings with a greater number of men experienced greater recall of the environment, greater physiological arousal, and reported they were less comfortable attending the conference (e.g., Murphy, Steele, & Gross, 2007). Targets are also influenced by explicit stereotype activation. For example, when told that women tend to perform worse on math tests than men, women indeed demonstrate depressed performance (e.g., Steele, Spencer, & Aronson, 2002).

In the short-term, stereotypes create a 'situational burden' that reduces feelings of belonging and depletes cognitive resources (e.g., Mello, Mallett, Andretta, & Worrell, 2012; Schmader & Johns, 2003). Resulting deficits can decrease an individual's ability to focus on a given task and impair performance (e.g., Schmader & Johns, 2003). In the long-term, stereotype threat has a significant effect on personal expectations and aspirations. Women under stereotype threat have significantly lower expectations for their performance and this is reflected in their long-term goals (Stangor, Carr, & Kiang, 1998; Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2002). Women exposed to stereotype threat express less interest in male-stereotyped careers, such as mathintensive and leadership positions (Davies, Spencer, & Steele, 2005). Relevant to STEM women, such negative outcomes can occur even when individuals do not believe the stereotype, and are more pronounced among those strongly invested in the

stereotyped domain (Steele, 1997). Repeated underperformance resulting from stereotype threat can eventually cause individuals to disengage with the domain, as the potential for success is perceived to decline over time (Steele, 1997). Thus, the consequences of stereotype threat are immediate for cognitive performance and sense of belonging, and compounding with respect to long-term professional outcomes.

A number of strategies have been identified to lessen the effects of stereotype threat on targets. Methods often aim to change the attitudes of a stigmatized group by reducing the relevancy of stereotypes to performance, increasing feelings of belonging, increasing exposure to role models, and making positive aspects of identity salient (Yeager & Walton, 2011). For instance, research has shown that women perform worse on advanced tests of quantitative ability when under stereotype threat. A classic intervention strategy invokes high performance. By changing women's construal of the situation, women under stereotype threat demonstrate enhanced performance and leadership aspirations (Davies, Spencer, Quinn, & Gerhardstein, 2002; Davies, Spencer, & Steele, 2005).

Another strategy to address threat involves making adjustments to the environment to increase feelings of belonging. These interventions utilize 'identity-safe' cues to signal that a stigmatized identity will not negatively impact performance (Murphy & Taylor, 2011). One identity-safe intervention manipulated the number of men or women present in a room when women were under stereotype threat during a math test. With each additional man in the room, there was a consistent decrease in women's test performance, while this effect was not seen with women in the room (Inzlicht & Ben-

Zeev, 2000). Increasing the ratio of women to men present during a stereotyped task sends the implicit message that a woman's identity is welcomed and her performance will not be evaluated differently. Furthermore, research conducted among African-American professionals has shown that company brochures explicitly valuing diversity, versus color-blind policies, increase trust among minority applicants and reduce negative evaluation concerns (Purdie-Vaughns et al., 2008). Based on findings such as these, Kray and Shirako (2012) suggest that organizations engage in stereotype management by acknowledging stereotypes, emphasizing positive stereotypes, and deemphasizing negative stereotypes.

Large effects resulting from small interventions have led researchers to test whether directly acknowledging negative stereotypes is enough to ameliorate their effects (Yeager & Walton, 2011). Some laboratory findings suggest that simply making stereotypes explicit can serve as a basic strategy to alleviate cognitive performance deficits resulting from threat (Kray, Thompson, & Galinsky, 2001). For example, women perform better on negotiation tasks when they are explicitly told that they are at a disadvantage due to their gender, in comparison to when this stereotype is not discussed (Kray, et al., 2001). These findings are contrasted by research conducted in the context of standardized testing. Women told that gender does not affect performance scored higher on math tests than women in implicit (gender not mentioned) or explicit (told gender hinders performance) stereotype threat conditions. Women in the implicit and explicit conditions did not differ in their test performance (Smith & White, 2002). The contexts of these two studies are considerably different and raise questions as to what strategies might be best for addressing stereotype threat at

the advanced educational and professional levels.

While few studies have specifically compared implicit and explicit stereotype threat, research suggests that participants are sensitive to the ways in which stereotypes may be made salient. For example, Hess, Hinson, and Statham (2004) found that implicit stereotype threat has a significant effect on the memory performance of older adults. They also found that explicit stereotype activation varies in its effect based on how pronounced the stereotypes are. When only told that age affected performance, participants were successfully able to suppress the effects of stereotype threat. In contrast, when memory tasks were also described as diagnostic of ability, participants were not able to suppress the effects of stereotype threat and they performed worse than in the implicit threat condition (Hess, et al., 2004). 'Implicit' and 'explicit' activation lie on a spectrum, and within these general categories stereotype saliency can vary. Research on the influence of implicit and explicit stereotype threat demonstrates sensitivity to the conditions of threat. A number of studies have examined the differential effects of implicit and explicit activation, but the circumstances under which explicit activation is detrimental or beneficial remains unclear.

Additional research suggests that the benefits of explicit activation primarily occur when paired with methods that combat stereotype threat effects. In studies demonstrating the advantages of explicit stereotype activation, participants were also prompted to pay attention to positive aspects of identity (McGlone & Aronson, 2007), to attribute anxiety to stereotypes (Johns et al., 2005), or were informed that gender did not influence performance (Davies et al., 2005). In the absence of strategies like these, the mere teaching of stereotype threat research is detrimental to women's math

performance (Tomasetto & Appolini, 2012). In general, identity-safe interventions are often paired with explicit activation. However, the aforementioned interventions have not systematically examined the effects of implicit and explicit activation in an intervention setting. The examination of such strategies is essential to identifying best practices for promoting women into male-dominated fields. Through identifying and disseminating stereotype threat interventions, stereotypes can be addressed more broadly.

**Role congruity theory.** Stereotype threat describes how stereotypes in the environment impact stigmatized individuals. Role congruity theory presents evidence for the origins of stereotypes as well as methods to reduce gender stereotypes broadly. Role congruity theory (Eagly & Karau, 2002) explains that stereotypes originate from observing people in the social roles that they typically occupy. Because men have traditionally occupied and continue to occupy positions in science and leadership. people associate masculine traits with success in these areas. As a result, women are viewed as unfit for STEM, particularly leadership positions, and are also evaluated more negatively when occupying these roles. Women are viewed as less likely to succeed, less likely to be promoted, and less likely to become a leader when in male-dominated sectors than when in female-dominated professions (Garcia-Retamero & Lopez-Zafra, 2006). Women who succeed in spite of these stereotypes often experience backlash for stepping outside of their prescribed social role. For instance, women in senior management typically have less authority, less opportunity for advancement, and receive fewer rewards than their male peers (Jacobs, 1992).

Social norms are difficult to change, but women subject to related stereotypes can be given effective means for coping with them. As more women are able to overcome

stereotype threat, a critical mass of women in STEM and leadership can be reached, facilitating broader change. When a small proportion of women are in power positions, they appear to be exceptions to commonly held gender beliefs, and thus allow stereotypes about women's abilities to persist. However, when a greater representation of successful women leaders is reached, stereotypes are challenged and barriers to achievement are subsequently reduced (e.g., Turock, 2001). Stereotypes therefore influence performance and professional aspirations (stereotype threat; Steele, 1997) and affect how roles are defined and restricted (role congruity theory; Eagly & Karau, 2002). The wide-ranging effects of stereotypes call for empirically validated, efficient and economical programming strategies to offset them.

# **Present Study**

Although research has explored the consequences of stereotype activation and methods to counteract it (e.g., Yeager & Walton, 2011), results are not easily generalized to STEM women in professional settings. First, with the exception of a few studies, stereotype threat is typically tested within laboratories or classrooms, with a focus on academic performance (Yeager & Walton, 2011). Studies examining high school and undergraduate student performance on tests may not generalize to professional outcomes among adults. Graduate students are transitioning from the classroom into professional settings. In the process, they are gaining insight into STEM culture and climate and refining their career goals. Second, research has demonstrated inconsistent effects of stereotype activation. The mere mention of stereotypes can decrease a person's performance, expectations, and aspirations (e.g., Steele, 1997). However, highlighting stereotypes can be beneficial (e.g., Kray, Thompson, and

Galinsky, 2001), particularly when paired with strategies to counteract threat effects (e.g., Tomasetto & Appoloni, 2012). Despite conflicting evidence regarding the influence of stereotype activation, research has not systematically studied the influence of implicit and explicit activation on intervention efficacy.

To test the effect of stereotype activation in identity-safe environments, the present study explores how explicit reference to stereotypes in a workshop setting influences STEM graduate women's desire for and pursuit of leadership positions. Women seeking advancement in STEM not only intend to continue their research in a male-dominated discipline, but also seek positions of leadership that are also dominated by men. Because workshops were advertised for STEM women interested in developing their leadership skills, outcomes were assessed in terms of their self-efficacy and intentions to continue in STEM, as well as their desire to obtain leadership positions in these areas.

Because career development workshops are designed to enhance professional outcomes, the present study utilized a two part workshop design that incorporated a number of methods previously shown to combat stereotype threat effects: (a) cuing positive aspects of identity (McGlone & Aronson, 2007), (b) identifying counter-stereotypic role models (Marx & Roman, 2002), and (c) increasing the number of women present (Inzlicht & Ben-Zeev, 2000). The workshops were therefore tailored as identity-safe environments for STEM women in order to examine implicit and explicit stereotypes in an intervention setting.

It was anticipated that women exposed to explicit activation would react against stereotype threat and demonstrate enhanced motivation to lead in STEM following the

intervention. Graduate women in STEM have persisted in spite of stereotype threat and may develop a level of resiliency that enables them to counteract the effects of stereotype threat. Interacting with other STEM women in an identity-safe environment and confronting negative stereotypes may bolster their ability to cope with negative group stereotypes. Specifically, it was hypothesized that:

*H1:* Participants exposed to explicit stereotype activation will report higher levels of stigma consciousness in comparison to the control group, reflecting their exposure to stereotype information during the manipulation.

*H2:* Participants with explicitly activated stereotypes will report greater selfreported intentions to continue in STEM, career aspirations, self-perceptions, and leadership identification than those with stereotypes activated implicitly.

*H3:* Participants exposed to explicit stereotypes will demonstrate greater preference for a leader role during a workshop task, reflecting their reactance against gender stereotypes.

*H4:* All participants will be able to identify obstacles and career strategies unique to women in STEM, but that the experimental group will report more barriers to participation and buffering strategies than the control group. This follows the assumption that an identity-safe environment, paired with explicit activation, will give participants permission to discuss their personal experiences in STEM more openly.

#### Method

#### **Participants**

Women graduate students and postdoctoral fellows in STEM fields were recruited to participate in leadership workshops through flyers and e-mails. Registrants indicated

their available timeslots and were randomly assigned or matched based on their graduate program into experimental group or control group workshops. Eighty-two women enrolled in the first workshop session, and a subset of these women enrolled in the second session (N = 46), completing both parts one and two. Eight workshops were held, such that there were four experimental groups and four control groups.

Session 1 participants' ages ranged from 21 to 53 years (M = 28, SD = 5.96). 43% of participants were international students. Session 2 participants were similarly diverse, ranging in age from 21 to 51 years (M = 29, SD = 6.13). 34.8% of the final sample was international students. A variety of fields were represented from the Natural sciences (50%), Medicine and Health (28.3%), and Engineering (21.7%; see Table 1 for disciplines).

47) in their leadership identification, t(68) = -2.48, p = .02, and educational aspirations, t(27.87) = -2.45, p = .02.

#### Materials

**Experimental manipulation.** A workshop handout was administered to both control and experimental groups outlining ten ways to become an influential leader. The handout began by describing one woman's experience advancing in leadership, along with leadership strategies that aided her career development (adapted from Garfinkle Executive Coaching, n.d.; see Appendix A for the complete handout).

The experimental group was given an additional handout outlining gender stereotypes and their effects on STEM women leaders. The experimental handout described the shortage of women in STEM along with reasons that women struggle in these fields. Materials highlighted the negative effects of stereotypes in order to activate stereotypes explicitly (see Appendix B for the complete handout).

**Pretest measures.** At the onset of the first workshop session, participants completed pretest packets containing measures assessing their intentions to continue in STEM, career aspirations, self-perceptions, leadership identification, and demographic characteristics. The *Intentions to Continue in the Field* (Schmader, Johns, & Barquissau, 2004) measure was modified to assess participants' desire to remain in STEM during graduate school and throughout their career. Participants rated three items on a scale ranging from (1) *not at all likely/never* to (7) *very likely/very often.* Two items were reversed scored, such that higher scores indicated greater intent to continue in STEM. Intent to change majors was assessed with two items, "How often do you think about changing your major or field of study?" and "How likely is it that you will

change your major or field of study?" Because participants are already enrolled in graduate school, the question "How likely is it that you will pursue graduate study related to your major?" was altered to assess their future career aspirations, "How likely is it that your eventual career after graduation will directly pertain to science or research?" A Cronbach's alpha reliability coefficient for the scale revealed an internal consistency of .67.

The *Career Aspiration Scale* (CAS) was developed by O'Brien (1996) to measure educational, leadership, and career aspirations. Participants rated statements on a 5-point Likert-type scale ranging from (0) *not at all true of me* to (4) *very true of me*. Items were reversed scored as necessary, such that higher scores indicated higher career aspirations. Example statements include "I hope to move up through any organization or business I work in" and "When I am established in my career, I would like to train others." The Cronbach's alpha coefficient of internal consistency for the 10-item scale was .75 (see Appendix C for the complete scale).

A six-item *Self-Perceptions* (Schmader, et al., 2004) measure was adapted to assess graduate women's self-perceptions in STEM, including their self-confidence, self-appraised ability, and performance self-esteem. Participants rated ten items on a scale ranging from (1) *strongly disagree* to (7) *strongly agree*, with items reversed scored as necessary such that higher scores indicated greater self-efficacy. Confidence in future STEM work was assessed through items such as, "When I get new material in my major, I'm usually sure I will be able to learn it." Self-appraised ability was assessed through statements such as, "My major has never been easy to me." Performance self-esteem was examined with items such as, "I feel as smart as others," originally modified

from Heatherton and Polivy's (1991) performance self-esteem subscale. The Cronbach's alpha coefficient of internal consistency was .75 (see Appendix D for the complete scale).

The *Leadership Identification Scale* was adapted from Osborne's (1997) Identification with Academics Scale to assess the importance an individual assigns to a domain, as well as how self-relevant and self-defining it is (Osborne et al., 1995, 1997). The scale was modified to assess leadership identification with statements such as "I feel that the leadership opportunities I get are an accurate reflection of my abilities," "I am often relieved if I just have a job (or opportunity) in my area," and "My role in my field will never change my opinion of how smart I am." Items were assessed along a 7-point Likert-type scale, and items were reversed as necessary such that higher scores indicated greater leadership identification. Internal consistency for the 13-item scale, as measured by a Cronbach's alpha coefficient, was .74 (see Appendix E for the complete scale).

Participant's STEM goals were assessed with two questions. The first asked participants to rank their top three careers of interest from a list of seven (e.g., professor or researcher in a university; researcher outside of a university; business/industry; teacher; clinician or field working with patients, clients, or community; consultant; entrepreneur). They also had the option of checking 'other' and writing in an alternate career choice. Participants were then prompted to write down their leadership goals through the following open-ended statement, "Please list future career goals you have that involve taking a leadership role." (See Appendix F for the complete measure).

Role choice. Participants rated their preference for leader and member roles on

a workshop task by filling out a *Role Choice Questionnaire*. Adapted from Davies, Spencer, and Steele (2005), participants were asked to rank their preferences between leader, problem-solver, and worker roles. They were told that their responses would be used to group them into teams for a workshop task (see Appendix G for the complete questionnaire).

**Posttest measures.** A posttest packet contained pretest measures, as well as the *Stigma Consciousness Questionnaire* (SCQ; Pinel, 1999) The SCQ was used as a postmanipulation examination of the extent to which participants expected to be stereotyped and also served as a manipulation check. The SCQ consists of 16-items measuring the extent to which participants believe that gender stereotypes influence their experiences interacting with men and men's views toward women. Statements were rated along a seven-point scale ranging from (1) *strongly disagree* to (7) *strongly agree*. Items were reverse-scored as necessary, such that higher scores indicated greater stigma consciousness. Example items include, "I almost never think about the fact that I am female when I interact with men" and "Most men have a problem viewing women as equals." Internal consistency among the 16 items, as measured by Cronbach's alpha coefficient, was .85 (see Appendix H for the complete scale).

**Photovoice.** Photovoice is a qualitative participatory action research method in which participants take photographs that represent their experience with a given topic and present them during a group discussion (Wang & Burris, 1997). Photovoice enables individuals to record and share their knowledge with a broader audience. It is commonly used to provide policy makers and planners with information to facilitate social action based on the preferences of the community (Wang, 1999). Participants were asked to

prepare two photographs describing their past experiences with leadership and two pictures representing their future leadership aspirations to present during Session 2 (see Appendix I for Photovoice instructions). Audio and video equipment was positioned to record each session, and the Photovoice activity was transcribed and coded to identify common themes.

Personal narratives and group discussions produced 80 single-spaced pages of transcription, 50 of which were from the experimental group. The first author and a trained research assistant independently coded the transcripts. Coding cycled between using inductive and deductive methods. Both coders were aware of the a priori research questions. Coding first examined challenges in STEM and career strategies, and experimental and control groups were tagged so that between-group differences could be examined.

Additional categories were defined using open coding. Categories were shared between researchers, though they were blind to the text included by the other researcher. After categories were identified and coded separately, the researchers compared their coding. When possible, categories were collapsed into higher order categories based on researcher consensus until no new categories or sub-categories could be identified. After all categories were independently coded, consensual validation was reached on themes and content by the coders, and only those mentioned by 25% or more participants were included as themes (Dutton & Dukerich, 1991). Relationships across categories were examined using axial coding, rendering a broader conceptual framework (Strauss & Corbin, 1998). Only findings corroborated by multiple participants were included in the final conceptual framework. This conceptual framework was

examined and adjusted by six study participants in order to verify its trustworthiness.

# Procedure

Session 1. Each group attended two workshop sessions that were held one week apart. Experimental and control groups attended separate workshop sessions, but received similar scripted content. After completing the pretest packet, participants received a workbook containing the workshop activities along with the information handout reflecting the condition manipulation. Both groups received the control handout outlining common leadership development strategies. The experimental group received an additional handout describing gender stereotypes and inequities in STEM. After individual introductions and an overview of the workshop program, the handout was briefly reviewed. The first session also included activities designed to identify leadership role models and personal values, develop personal action plans, and practice interpersonal problem-solving. Prior to the end of the workshop, participants completed the Role Choice questionnaire and were given instructions for the Photovoice activity.

**Session 2.** Session 2 was held one week later. Participants were invited to discuss their Photovoice pictures with the group. A facilitated group discussion was held to identify strategies for advancement and troubleshoot challenges identified by participants during the Photovoice activity. The last half of Session 2 focused on opportunities for STEM women on- and off-campus. Following workshop activities, the posttest packet was distributed containing pretest measures and measures of stigma consciousness.

#### Results

#### **Relationship Among Measures**

In order to assess the relationship among pretest measures, Pearson correlation coefficients were calculated between participants' leadership identification, intentions to continue in STEM, career aspirations, and field-related self-perceptions. The results, presented in Table 2, showed that three out of the six correlations were positively correlated and statistically significant, such that greater intentions to continue in STEM was associated with higher career aspirations and leadership identification. None of these measures correlated significantly with self-perceptions (p > .05), demonstrating that while intentions to continue and motivation to lead were positively correlated, women varied in their feelings of competency in STEM (see Table 4 for descriptive statistics).

# **Demographic Differences**

To further explore differences in leadership aspirations based on background characteristics, participants were assigned Gender Empowerment scores based on their country of origin. The Gender Empowerment Index was compiled by the United Nations Development Programme (2009) and describes women's representation in business and government as well as their earned income, relative to men, for countries around the world. Scores were available for 72 of the 82 participants (see Table 3), excluding those from India and Nigeria. Participants from North America were generally assigned the highest Gender Empowerment values (e.g., United States = .77), while those from the Middle East tended to receive the lowest scores (e.g., Saudi Arabia = .33), and those from South America and Asia were generally assigned values in the mid-range (e.g., Venezuela = .58; China = .53). Those from countries with higher Gender Empowerment tended to report greater leadership aspirations, as indicated by higher

leadership identification, intentions to continue in STEM and educational aspirations. There was a significant positive correlation between gender empowerment and leadership identification, r(72) = .31, p = .01; intentions to continue in STEM, r(72) = .25, p = .03; career aspirations, r(72) = .25, p = .03; and educational aspirations, r(72) = .33, p < .01 Correlations were not significant between gender empowerment, leadership aspirations and self-perceptions (p > .05).

# **Manipulation Check**

It was expected that women exposed to explicit stereotype activation would demonstrate higher stigma consciousness. However, analysis revealed no significant differences between groups based on the manipulation, t(44) = 1.34, p = .19, and the experimental group scored slightly lower than the control group in stigma consciousness (see Table 4 for descriptive statistics). Contrary to the original hypothesis, participants in *both* groups generally demonstrated a high level of stigma consciousness.

#### Leadership Aspirations

**Intentions to Continue.** It was predicted that the experimental group would demonstrate a greater desire to remain in STEM than the control group at posttest. The effect of explicit stereotype threat on intentions to continue was first analyzed using a one-way ANCOVA, controlling for pretest scores. Because the parallelism assumption was not met, a 2 (group) X 2 (pre, post) mixed-design ANOVA was used as an alternative model. Time of assessment was not a significant predictor of intentions to continue, F(1, 44) = .13, p = .72. However, there was a main effect of condition, F(1, 44) = 6.07, p = .02,  $\eta_p^2 = .12$ , as well as a significant interaction between time of assessment and condition, F(1, 44) = 5.06, p = .03,  $\eta_p^2 = .10$ . The difference between

the control group and the experimental group was greater at pretest than it was after the manipulation, and the nature of the interaction, as shown in Figure 1, did not support the prediction. The experimental group had a decrease in intentions to continue while the control group had increased intentions to continue (see Table 4 for descriptive statistics).

Career aspirations. A series of one-way ANCOVAs were used to determine whether the intervention influenced participants' career, leadership, or educational aspirations. Career aspirations at pretest were significant as a covariate, F(1, 42) =21.67, p < .001, but the interaction between condition and pretest scores, F(1, 42) =1.54, p = .22, and the main effect of condition, F(1, 42) = 1.92, p = .17, were not significant. Career aspirations did not significantly vary based on the manipulation. Similarly, while pretest scores on educational (F(1, 42) = 21.19, p < .001) and leadership (F(1, 42) = 23.07, p < .001) aspirations were significant covariates, there was no evidence that condition impacted posttest scores for either educational and leadership aspirations. The interaction between condition and educational aspirations at pretest scores was not significant, F(1, 42) = 3.09, p = .09, nor was there a main effect of condition, F(1, 42) = 3.29, p = .08. Similarly, the interaction between condition and leadership aspirations at pretest scores was not significant, F(1, 42) = 1.87, p = .18, nor was there a main effect of condition, F(1, 42) = 2.39, p = .13 (see Table 4 for descriptive statistics).

**Self-perceptions.** Self-perceptions were predicted to increase as a function of explicit stereotype activation. A one-way ANCOVA, using pretest Self-Perception scores as a covariate, revealed that the homogeneity-of-slopes assumption was violated.

Therefore, a 2 (group) X 2 (pretest, posttest) mixed-design ANOVA was used to assess the impact of condition and time of assessment on self-perceptions. There was a main effect of time of assessment, F(1, 44) = 4.64, p = .04,  $\eta_p^2 = .10$ , such that both groups demonstrated lower self-perceptions on average following workshop completion (M =29.39, SD = 5.90 to M = 27.74, SD = 3.30). No main effect was found for condition, F(1,44) = 2.68, p = .11, nor was there an interaction, F(1, 44) = .02, p = .88. Controlling for stigma consciousness, the main effect of time of assessment was no longer significant, F(1, 43) = .23, p = .63,  $\eta_p^2 = .005$ . While participants did express lower self-perceptions following workshop materials, this effect was largely explained by their level of stigma consciousness.

**Leadership identification.** The change in pretest and posttest scores on leadership identification was assessed using an ANCOVA, with the assumption that those exposed to explicit stereotype activation would have higher leadership identification at posttest. While pretest scores were a significant covariate, F(1, 42) = 31.68, p < .001, both the interaction, F(1, 42) = 1.04, p = .32, and main effect of condition, F(1, 42) = .96, p = .33, were non-significant. Leadership identification was stable over time for both groups and generally high (see Table 4 for descriptive statistics).

#### **Role Choice**

If explicit stereotype activation did have a positive impact on professional outcomes, we would expect women in the experimental condition to choose a leadership role more often. Using scores from the 79 Session 1 participants who completed the Role Choice Questionnaire, Fisher's Exact tests were conducted to

evaluate the effect of the experimental manipulation on choice to adopt leadership roles. The results of the test were significant but opposite the prediction. Participants were less likely to choose a leadership position following exposure to explicit stereotype threat, as compared to those not exposed to explicit threat (Figure 3). Experimental group participants were more likely to choose the worker role over the leader role, as compared to the control group, p = .04. This was not the case for leader and problem solver roles, p = .20, or problem solver and worker roles, p = 1.00. To assess role preferences across both groups, one-sample Kolmogorov-Smirnov Z tests compared preferences for leader, problem solver, and worker roles. Participants most preferred the problem solver role, followed by the leadership role, and the worker role was least preferred, p < .05. Overall preference for the problem solver role may be in line with participants' goals to pursue research, and not all participants saw value in the authority of the leader role. However, it is notable that within the context of leadership development workshops, those exposed to explicit activation demonstrated greater preference for the more subordinate role of worker, over that of the leader role.

#### **Qualitative Results**

**Summary of conceptual framework.** Research testing the effects of stereotype threat can be complemented by the examination of how these stereotypes are perceived by targets. Participants' descriptions of past experiences and future aspirations in STEM leadership were coded for similarities and differences in narratives between groups to examine these perceptions. Three complementary frameworks were identified from the participants' Photovoice narratives (see Tables 5 and 6 for themes and illustrative evidence). First, women had a broad definition of leadership. Participants

viewed leadership as a means to self-improvement, marked by both success in their fields and a healthy home-life. Leadership was also seen as a way to develop positive relationships and improve social outcomes. Career goals were often geared toward promoting the well-being of others (e.g., water conservation, disease control, social programming). Not only did participants realize the benefit of collaboration, communication, motivation and a positive work environment, they envisioned these as a means to achieve impact. Women therefore described leadership in terms of motivating team members toward the achievement of personal and pro-social goals.

Second, women experienced constraints in advancement, some of which arose from having leadership characteristics outside of the male-centric norm. While women tended to desire a transformational style of leadership, a significant amount of energy was dedicated to implementing it in work environments with conflicting expectations: Advancing in competitive fields was difficult to balance with personal development, monitoring and maintaining relationships became costly when unreciprocated by others, and women's goals for broader social impact may come into conflict with expectations to produce large amounts of research. Gender norms further added to the conflict between personal expectations and those imposed by others. Participants had to adjust their gendered behaviors to meet the demands of those within a given interaction.

Third, participants identified a number of strategies that buffered against the negative experiences they encountered. In the midst of challenges, career satisfaction was often found in teaching and applied work, where participants more quickly gained the respect of others while developing positive relationships. Family, friends, colleagues and mentors were important sources of advice and social support. Lastly, a fulfilling

personal and family life was also tied to participants' feelings of success and selfcontrol.

**Evidence for conceptual framework.** *Career strategy.* The first framework described participants' broad definitions of leadership and success. Participants not only desired to advance in their field, they expressed goals of self-actualization and social impact. Delegation and task completion were de-emphasized in comparison to themes of team building and progression toward a common goal. As one other participant put it, "I try to find a sky for me to fly, and ...if I want to be a leader I also have to find a sky for the others."

Participants noted a number of strategies important to facilitating effective collaboration (*Theme 1*). Participants believed that buy-in from team members could be increased through clear communication and justification of the goal and process. They also stressed the importance of actively motivating employees, as exemplified by one participant's statement, "Appreciating their work and being respectful of them is really important; not treating them like your workers and giving them menial tasks but giving them, making them feel valuable to the project." The value in working side-by-side with subordinates was seen as a strategy for teaching other people positive work habits, and demonstrated their preference for a more egalitarian work environment.

Participants sought to develop a full range of skills within the workplace to influence others in a meaningful way. Teaching, mentorship, service, organizational, and applied work all offered opportunities for broader impact (*Theme 2*). Some participants questioned how impactful academic work was, in comparison to applied work. One participant stated that while she had never discussed her career options

within her department, she was strongly considering going into applied work: "I don't want to belittle it by saying 'cookie-cutter' or saying this is the 'typical route' that graduate students take, you know to be a professor, right? And that ignores the need for better science education at the lower levels."

Participants' intention to elevate the interests of other people was consistent with their own desire for personal growth and impact within STEM leadership. Leadership was seen not only as a way to achieve career success, but also self-actualization (*Theme 3*). "Leadership is a good way to help me to improve myself...I don't want to just stay in one specific level." Career achievement was viewed as one component of personal success. STEM women seeking leadership therefore engaged in big picture thinking: for themselves, their projects, team members, and their communities.

*Barriers to participation.* The second framework outlined the circumstances under which these goals become especially challenging. While participants generally preferred a relationship-oriented leadership style, they experienced a number of obstacles in realizing it within their work environments. The "fair and balanced" approach some women desired may have been related to their own sense of authority (*Theme 4*). Said one participant, "I can give you a token. I can call you up and recognize you for your work and thank you. That's all I have. That's the only power." When women were given authority, they did not assume that their subordinates would take their orders seriously. They instead worked to build their legitimacy through fostering positive relationships. Participants were primarily focused on increasing their social status, rather than personal power. Power is defined by access to resources, while status is built on the positive regard of others (e.g., Sachdev & Bourhis, 1991). Because status

depends on relationship building, it is associated with greater perspective-taking than power-based authority (e.g., Magee & Galinsky, 2008), something which was also in participants' narratives.

When fostering positive relationships and social impact are not incentivized or valued within the work environment, these activities reduced personal productivity (*Theme 5*). To maintain a positive and collaborative work environment, women had to balance their perspective with the perspectives of other people. Participants frequently noted the thoughts and feelings of other people during their narratives. "We should always do well in our own business, but we also need to think about others, be considerate, and so everyone can be comfortable." Participants were also vigilant to their own behavior in relation to other people's perspectives. One participant described carefully watching her steps. "I'm walking around with my shoes untied. I always have to look and make sure I'm not going to trip and fall."

Monitoring social interactions also became challenging when they involved gender dynamics (*Theme 6*). Participants noted the dichotomy between being the "motherly figure" and the "authoritative b-word," and sometimes felt the need to adapt their leadership style to the situation. One woman with industry experience stated, "I always work in a man environment, so I cannot be too soft. They just crush you." She contrasted this with working with women, explaining, "it's like if you're in this as equals then they think you're not in it to get anything. So you have to be- somehow you have to keep your feminine, your soft side." When working with men, participants felt the need to mask their emotions and appear confident. Among women, they tried to act more egalitarian and attentive to emotion. Some women felt that situational pressures could

be overcome by adopting a more individualized leadership style, and others expressed their continuing journey to find a leadership identity. "I think balancing it is difficult, but somehow you got to do both. And in [our] tradition you say, 'you hit a child with one hand and you give them a present with your other hand,' meaning when you use that authoritative self you discipline him and you tell him, 'you know, this is why I did this, and kind of balance it so he understand where you are coming from and why you are making such decisions."

Buffering strategies. The third framework illustrates the coping strategies participants used to buffer against the career challenged they encountered. Through the trials participants sometimes experienced, they sought comfort in their achievements (Theme 7). Feelings of accomplishment reassured women that they were in the right fields. Participants were able to meet some of their leadership goals within mentoring, service and applied roles. In these positions women were more quickly elevated to the position of leader, developed relationships with others, and gained respect. One woman noted about her teaching, "I've had great success with being a leader in that people really appreciate me and I have gotten really good feedback." For some women, finding comfort in their achievements meant being appreciative of their current positions. As one participant stated, "Whatever you do and what role you are in in your future career, even though it can be boring or a simple role...as long as you have positive thinking and you are smiling you can do this job very well." This perspective was controversial among other participants, who argued that women are too easily satisfied with just having a job.

Outside of their own accomplishments, participants also found resiliency in the
social support offered by their mentors, friends and family (*Theme 8*). The encouragement of mentors helped them cope with negative experiences. They also helped participants envision their future within the field. However, the difficult balance between being the ideal woman and the ideal leader led to a lack of real world role models for some participants. "I have role models for leadership, and I have role models for like just personal growth, but both of them together they don't really exist. And it's hard to even imagine like a real tangible opportunity." Perhaps because of this, some women adopted an informal definition of mentorship, looking for guidance from coworkers, friends, and professionals outside of their field. Mentorship, outside of formal supervision, helped women navigate the politics of their fields and achieve work-life balance.

Family was another important source of support, as well as an arena where many women took on a leadership role. Participants discussed future leadership aspirations in terms of family, as numerous women considered motherhood as a significant leadership role. As one women explained, "I would like to become a mother someday. So that's another big kind of leader- leadership thing that will be hard to balance." Work-life balance is therefore not only a healthy behavior, but is compatible with a broad definition of leadership and the need for self-development. Work-life balance helped women find meaning in their work and have a sense of control over their lives (*Theme 9*). "Even if it's ten minutes it shows that you're in control and you know what you want to get out of this."

Qualitative Group Differences. While there was consistency across group narratives, there were also differences between groups (see Table 7 for summary of

group differences). Participants who received the experimental manipulation spoke approximately 74 percent more than those in the control group (Total Word Count = 7765 and 4471, respectively). This difference was reflected in how much depth participants in the different groups went into regarding their personal experiences and was expressed in a number of ways. For instance, statements drawn from the experimental group involved specific situations and people. One woman shared how her husband guided her to become more assertive. She shared, "And I was a firm person. I started doing that and I was like, 'they are totally doing what I want.' It totally changed and he was like, 'I told you.'" Experimental group participants also frequently quoted conversations they had with others, and they also offered more specific solutions to overcome challenges. One experimental group participant even shared a practical solution for reducing the wage gap experienced by STEM women. She suggested that women need to be educated about mean starting salaries and organizations invest in helping women properly negotiate this point, "...we need to educate. There need to be advocates for yourself for higher starting salary." In contrast, the control group described more general obstacles to advancement in STEM, such as "...there are people who sometimes just disappear, grad students who just pack up their stuff on a Saturday and they never come back because they just can't handle it. So we, you know, we handle it. We handle it all the time."

The experimental group similarly described work activities in more specific and personal terms than the control group. Accomplishments shared by the control group involved obtaining a new position, a promotion, or completing projects. Participants generally described themselves as facilitating projects through organizing and

mobilizing others, "I a lot of times just became the leader just because I was like, 'Ok! This is what needs to happen. Let's do this!' So even if I wasn't intending to be the leader of the group, that sometimes happened." Rather than facilitating the work of others, the experimental group was more likely to tie work to their personal values. One experimental participant worked in multiple outreach programs stating, "There's another group that I also work with, but I think they share the same drive and passion and goal."

Interestingly, although participants across both groups indicated research as a top career choice (55% and 54%, respectively), the control group did not often discuss research. Research was only mentioned by approximately six of the 22 participants assigned to the control condition. Of these participants, one described research as a means for enhancing her clinical work, one woman stated that she desired to be part of a small research lab, and another participant described her devastation over a failed experiment. Members of the experimental group more frequently discussed research and noted difficulties that they had encountered within a laboratory setting.

#### Discussion

The present study examined the effect of implicit versus explicit stereotype activation in identity-safe, professional development workshops. Results indicate no benefit of explicit stereotype activation in career development settings and suggest that, in contrast, it may elicit the negative effects of stereotype threat. Contrary to the original hypothesis, STEM women generally believed that stereotypes impacted their work environment, and this belief was associated with differences in self-efficacy following workshop material. Those with greater awareness of stereotype threat were more sensitive to both implicit and explicit activation, showing that individual differences are

sometimes more important than stereotype saliency in predicting reactions to threat.

In general, implicit versus explicit stereotype activation did not affect participants' leadership aspirations. As with self-perceptions, differences in leadership identification between participants were better explained by individual characteristics, such as country of origin, rather than the experimental manipulation. These marginally significant and non-significant findings may reflect previous research showing that people influenced by stereotype threat do not reliably report stereotype-related concerns (e.g., Bosson, Haymovitz, & Pinel, 2004; Wheller & Petty, 2001; Johns, Schmader, & Martens, 2005). The effects of stereotype threat may occur largely unconsciously, regardless of implicit or explicit activation.

Although women's self-reported motivation to lead did not vary as a function of explicit stereotype threat, their choice to engage in leadership roles during a workshop task did vary. The experimental group was significantly less likely to choose a leadership role than the control group, extending the findings of Davies et al. (2005) to an operational setting. While participants equally preferred a problem solver role, those exposed to explicit stereotype activation chose the more subordinate worker role over the leader role. The reduced likelihood of choosing a leadership role within leadership training workshops is noteworthy and indicates that explicit stereotype activation may have decreased workshop engagement. In addition, the significance of this behavioral choice suggests that, in line with previous findings, the effects of stereotype threat may be better assessed through behavioral choice, rather than self-report (e.g., Steele & Aronson, 1995).

The qualitative data complement quantitative findings by showing a number of

differences between the control and experimental groups. The experimental manipulation may have given women permission to share their experiences, as women exposed to explicit stereotype threat spoke considerably more during the Photovoice activity. Women also shared more negative experiences in their fields, indicating that explicit activation may have evoked negative emotions in the process. Network models of emotion help explain when positive and negative events will be shared with others (e.g., Bower, 1981). While people are generally just as likely to share positive and negative experiences in a social setting (e.g., Rimé, Mesquita, Philippot, & Boca, 1991). this changes when a specific emotion is activated. The sharing of a particular event tends to evoke emotional responses similar to that which was shared (see Rimé, Philippot, Boca, & Mesquita, 1992 for review), and, according to network models, the activation of a particular emotion can make similarly valenced experiences more salient (e.g., Bower, 1981). Highlighting the effects of gender stereotypes provoked the sharing of negatively valenced experiences in STEM, suggesting that negative emotions may have been activated more broadly by explicit activation.

Photovoice was also utilized as an exploratory research method. Research often discusses how women are affected by stereotypes, but rarely examines how women perceive these obstacles. Despite some differences between control and experimental group narratives, qualitative analyses uncovered a number of themes common to both groups. Within STEM, the style of leadership pursued by many women requires effort beyond mere task completion. Building status through relationships, meeting role expectations, elevating the interests of others, while pursuing personal development and social impact all require time and energy. Not all work environments reward these

activities, in which case it becomes less likely that other workers will reciprocate. This is consistent with research emphasizing the role of organizational culture and climate in communicating bias, stereotype, and inequality (e.g., Settles et al., 2006). In unsupportive work environments, women do not receive the same payoff for the time and energy they spent on these pursuits. Instead, they increasingly act as constraints in the environment, limiting task completion and professional outcomes.

Quantitative data indicates that explicit stereotype activation may be detrimental within an intervention setting. Researchers and practitioners must therefore use caution in structuring 'identity-safe' environments and addressing stereotypes during career development interventions. The use of cognitive reframing and other methods to overcome stereotype threat in these settings must also be explored. Stereotype activation may need to be treated directly after it is evoked, rather than assuming that contextual factors reduce their negative effects.

Given the novel setting of the present research, findings must also be considered in terms of stereotype threat generalizability. Stereotype threat is typically tested in settings where the preconditions for a given effect are met (Sackett & Ryan, 2011). In contrast to laboratory or testing settings, professional development settings allow for considerable variability in participant experience. Personal characteristics and properties of the environment may interact to produce more variable reactions between participants (Schmader & Beilock, 2011). Pretest measures included in the present study highlight the need to consider STEM women as a diverse population. Participants from this sample represented a wide variety of ethnicities and nationalities, and these factors were associated with leadership aspirations. The present research suggests that

stereotype threat can occur within interventions oriented toward women's advancement and this effect varies based on individual characteristics.

The exploratory nature of the present study is limited in a number of ways. The small sample size drawn from Session 2 reduced the statistical power of the manipulation. A second limitation involves the inclusion of multiple novel research methods, including: 1) the addition of implicit or explicit stereotype activation to stereotype threat intervention strategies, 2) testing in a novel setting, aimed at enhancing real world professional outcomes. 3) the inclusion of a participatory action research method. While useful in extending stereotype threat interventions to professional domains, results are difficult to interpret in light of previous research. By encouraging personal sharing, participants may have had a disproportionate impact on other group members. Lastly, preliminary findings demonstrate the influence of implicit and explicit stereotype activation on self-reported aspirations and short-term behavioral outcomes. Future studies must longitudinally investigate stereotype threat reduction strategies that can be practically and effectively incorporated into interventions.

In sum, non-significant findings may be explained by the interaction between the manipulation, various individual and contextual factors, and a modest sample size. The negative effect of explicit stereotype activation may be attributed in part to raising stereotype threat concerns in an otherwise identity-safe environment. Once activated, stereotype threat could not be totally eliminated. Researchers and practitioners alike must therefore be cognizant of highlighting negative group stereotypes when implementing interventions. The present study suggests that the acknowledgment of stereotypes' negative effects is not beneficial to women during stereotype threat

interventions. While research increasingly highlights the significance of stereotypes in affecting women's careers, acknowledging them in a professional setting has the potential to restrict outcomes and its effect must be carefully considered before advancing intervention strategies.

#### References

- Bosson, J. K., Haymovitz, E. L., & Pinel, E. C. (2004). When saying and doing diverge: The effects of stereotype threat on self-reported versus non-verbal anxiety. *Journal of Experimental Social Psychology, 40,* 247-255. doi: 10.1016/S0022-1031(03)00099-4
- Bower, G. H. (1981). Mood and memory. *American Psychologist, 36,* 129-148.
  Buchmann, C., & DiPrete, T. A. (2006). The growing female advantage in college completion: The role of family background and academic achievement. *American Sociological Review, 71,* 515-541. doi: 10.1177/000312240607100401

Burns, J.M. (1978). *Leadership*. New York. NY: Harper & Row.

- Cadinu, M., Maass, A., Frigerio, S., Impagliazzo, L., & Latinotti, S. (2002). Stereotype threat: The effect of expectancy on performance. *European Journal of Social Psychology*, 33, 267-285. doi: 10.1002/ejsp.145
- Ceci, S. J., Williams, W. M., & Barnett, S. M. (2009). Women's underrepresentation in science: Sociocultural and biological considerations. *Psychological Bulletin, 135,* 218-261. doi: 10.1037/a0014412
- Council of Graduate Schools (2012). *Attrition and completion*. Retrieved from http://www.cgsnet.org/attrition-and-completion
- Council of Graduate Schools. (2007). *Graduate education: The backbone of American competitiveness and innovation.* Washington, DC: Author.
- Crocker, J., & Major, B. (1989). Social stigma and self-esteem: The self-protective properties of stigma. *Psychological Review, 96,* 608-630.

Crocker, J., Major, B., & Steele, C. (1998). Social stigma. In D. T. Gilbert, S. T. Fiske, &

G. Lindzey (Eds.), *The handbook of social psychology* (504-553). New York, NY: McGraw-Hill.

- Crocker, J., Voelkl, K., Testa, M., & Major, B. (1991). Social stigma: The affective consequences of attributional ambiguity. *Journal of Personality and Social Psychology*, 60, 218-228.
- Davies, P. G., Spencer, S. J., Quinn, D. M., & Gerhardstein, R. (2002). Consuming images: How television commercials that elicit stereotype threat can restrain women academically and professionally. *Personality and Social Psychology Bulletin, 28,* 1615-1628. doi: 10.1177/014616702237644
- Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: Identity safety moderates the effects of stereotype threat on women's leadership aspirations.
   *Journal of Personality and Social Psychology, 88,* 276-287. doi: 10.1037/0022-3514.88.2.276
- Dutton, J. E., & Dukerich, J. M. (1991). Keeping an eye on the mirror: Image and identity in organizational adaptation. *The Academy of Management Journal, 34*, 517-554.
- Eagly, A. H., & Karau, S. J. (2002). Role congruity theory of prejudice toward female leaders. *Psychological Review*, *109*, 573-598. doi: 10.1037/0033-295X.109.3.573
- Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*. 2, 300–319. doi: 10.1037/1089-2680.2.3.300
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion, 19,* 313-332. doi:

### 10.1080/02699930441000238

- Garcia-Retamero, R., & Lopez-Zafra, E. (2006). Prejudice against women in malecongenial environments: Perceptions of gender role congruity in leadership. *Sex Roles, 55*, 51-61. doi: 10.1007/s11199-006-9068-1
- Garfinkle Executive Coaching. (n.d.) *10 ways to become a powerful leader at work.* Retrieved from http://www.garfinkleexecutivecoaching.com/articles/10waysto becomeapowerfulleader.html
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.
- Government Accountability Office. (2005). *Federal science, technology, engineering, and mathematics programs and related trends* (GAO-06-114). Washington DC: Author.
- Gray, M. P., & O'Brien, K. M. (2007). Advancing the assessment of women's career choices: The career aspiration scale. *Journal of Career Assessment, 15*, 317-336. doi: 10.1177/1069072707301211
- Heatherton, T. F., & Polivy, J. (1991). Development and validation of a scale for measuring state self-esteem. *Journal of Personality and Social Psychology, 60,* 895-910. doi: 10.1037/0022-3514.60.6.895
- Hess, T. M., Hinson, J. T., & Statham, J. A. (2004). Explicit and implicit stereotype activation effects on memory: Do age and awareness moderate the impact of priming? *Psychology and Aging, 19,* 495-505. doi: 10.1037/0882-7974.19.3.495
- Hill, C., Corbett, C., & St. Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics.* Washington, DC: American

Association of University Women (AAUW).

- Inzlicht, M., & Ben-Zeev, T. (2000). A threatening intellectual environment: Why females Are susceptible to experiencing problem-solving deficits in the presence of males. Psychological Science, 11, 365–371. doi:10.1111/1467-9280.00272.
- Jacobs, J. A. (1992). Women's entry into management: Trends in earnings, authority, and values among salaried managers. Administrative Science Quarterly, 37, 282–301.
- Johns, M., Schmader, T., & Martens, A. (2005). Knowing is half the battle: Teaching stereotype threat as a means of improving women's math performance. *Psychological Science, 16,* 175-179.

Kanter, R. M. (1977). Men and women of the corporation. New York: Basic Books.

- Kiefer, A. K., & Sekaquaptewa, D. (2007). Implicit stereotypes and women's math performance: How implicit gender-math stereotypes influence women's susceptibility to stereotype threat. *Journal of Experimental Social Psychology, 43,* 825-832. doi: 10.1016/j.jesp.2006.08.004
- Kray, L. J., Galinsky, A. D., & Thompson, L. (2001). Battle of the sexes: Gender stereotype confirmation and reactance in negotiations. *Journal of Personality and Social Psychology, 80,* 942-958. doi: 10.1037/0022-3514.80.6.942
- Kray, L. J., & Shirako, A. (2012). Stereotype threat in organizations: An examination of its scope, triggers, and possible interventions. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (172-187). New York, NY: Oxford University Press. doi: 10.1093/acprof:oso/9780199732449.003.0011

Magee, J. C., & Galinsky, A. D. (2008). Social hierarchy: The self-reinforcing nature of

power and status. *The Academy of Management Annals, 2,* 351-398. doi: 10.1080/19416520802211628

- Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin, 28*, 1183–1193.
- McGlone, M. A., & Aronson, J. (2007). Forewarning and forearming stereotypethreatened students. *Communication Education*, *56*, 119-133. doi: 10.1080/03634520601158681
- Mello, A. R., Mallett, R. K., Andretta, J. R., & Worrell, F. C. (2012). Stereotype threat and school belonging in adolescents from diverse racial/ethnic backgrounds. *Journal of At-Risk Issues, 17,* 9-14.
- Murphy, M. C., & Taylor, V. J. (2012) The role of situational cues in signaling and maintaining stereotype threat. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (16-34). New York, NY: Oxford University Press. doi: 10.1093/acprof:oso/9780199732449.001.0001
- Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: How situational cues affect women in math, science, and engineering settings. *Psychological Science, 18,* 879-885. doi: 10.1111/j.1467-9280.2007.01995.x
- National Science Board. (2003, August). *The science and engineering workforce: Realizing America's potential* (NSB 03-69). Retrieved from http://www.nsf.gov/ nsb/documents/2003/nsb0369/nsb0369.pdf
- National Science Foundation. (2012) *Science and engineering indicators: 2012*. Retrieved from http://www.nsf.gov/statistics/seind12/c3/c3h.htm#s4 National Science Board. 2012. Science and Engineering Indicators 2012. Arlington VA:

National Science Foundation (NSB 12-01).

- O'Brien, K.M., Gray, M.P., Tourajdi, P.P., & Eigenbrode, S.P. (1996). The operationalization of women's career choices: The career aspiration scale. *Journal of Career Assessment, 15,* 317-337.
- Osborne, J. W. (1995). Academics, self-esteem, and race: A look at the underlying assumptions of the disidentification hypothesis. *Personality and Social Psychology Bulletin*, *21*, 449-455. doi: 10.1177/0146167295215003
- Osborne, J. (1997). Identification with academics and academic success among community college students. *Community College Review, 25*, 59-67. doi: 10.1177/009155219702500105
- Pinel, E. C. (1999). Stigma consciousness: The psychological legacy of social stereotypes. Journal of Personality and Social Psychology, 76, 114-128. doi: 10.1037/0022-3514.76.1.114
- Purdie-Vaughns, V., Steele, C. M., Davies, P. G., Ditlmann, R., & Crosby, J. R. (2008).
  Social identity contingencies: How diversity cues signal threat or safety for
  African Americans in mainstream institutions. Journal of Personality and Social
  Psychology, 94, 615– 630. doi: 10.1037/0022-3514.94.4.615
- Rimé, B., Mesquita, B., Philippot, P., & Boca, S. (1991). Beyond the emotional event:
  Six studies on the social sharing of emotion. *Cognition & Emotion, 5*, 436-466.
  doi:10.1080/02699939108411052
- Rimé, B., Philippot, P., Boca, S., & Mesquita, B. (1992). Long-lasting cognitive and social consequences of emotion: Social sharing and rumination. *European Review of Social Psychology, 3*, 225-258. doi: 10.1080/14792779243000078

- Sachdev, I., & Bourhis, R. Y. (1991). Power and status differentials in minority and majority group relations. *European Journal of Social Psychology, 21,* 1-24. doi: 10.1002/ejsp.2420210102
- Sackett, P., & Ryan, A. M. (2011). Concerns about generalizing stereotype threat findings to operational high stakes testing. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (249-263). New York: Oxford University Press.
- Schmader, T., & Beilock, S. (2011). An integration of processes that underlie stereotype threat. In M. Inzlicht & T. Schmader (Eds.), *Stereotype threat: Theory, process, and application* (34-50). New York: Oxford University Press.
- Schmader, T., & Johns, M. (2003). Convergent evidence that stereotype threat reduces working memory capacity. Journal of Personality and Social Psychology, 85, 440–452. doi: 10.1037/0022-3514.85.3.440
- Schmader, T., Johns, M., & Barquissau, M. (2004). The costs of accepting gender differences: The role of stereotype endorsement in women's experience in the math domain. Sex Roles: A Journal of Research, 50, 835-850. doi: 10.1023/B:SERS.0000029101.74557.a0
- Settles, I. H., Cortina, L. M., Malley, J., & Stewart, A. J. (2006). The climate for women in academic science: The good, the bad, and the changeable. *Psychology of Women Quarterly, 30*, 47–58.
- Shettle, C., S. Roey, J. Mordica, R. Perkins, C. Nord, J. Teodorovic, J. Brown, M. Lyons, C. Averett, and D. Kastberg. 2007. *The Nation's Report Card: America's high school graduates: Results from the 2005 NAEP high school transcript*

*study.* (NCES 2007-467). Washington, DC: U.S. Department of Education, National Center for Education Statistics.

- Smith, J. L., & White, P. H. (2002). An examination of implicitly activated, explicitly activated, and nullified stereotypes on mathematical performance: It's not just a woman's issue. *Sex Roles, 47,* 179-191.
- Stangor, C., Carr, C., & Kiang, L. (1998). Activating stereotypes undermines task performance. *Journal of Personality and Social Psychology*, *75*, 1191-1197.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*, 613-629.
- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69,* 797-811.
- Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. *Advances in Experimental Social Psychology, 34,* 379-440. doi:
- Strauss, A., & Corbin J. (1998). *Basics of qualitative research*. Thousand Oaks, CA: Sage.
- Syverson, P. D., & Brown, H. A. (2002). *Graduate enrollment and degrees: 1986–2000.* Washington, DC: Council Of Graduate Schools.

United States Bureau of the Census. (2010, April). Census Bureau reports nearly 6 in 10 advanced degree holder age 25-29 are women. Retrieved from http://www.census.gov/newsroom/releases/archives/education/cb10-55.html Tomasetto, C., & Appoloni, S. (2012). A lesson not to be learned? Understanding stereotype threat does not protect women from stereotype threat. *Social Psychology of Education,* 1-15. doi: 10.1007/s11218-012-9210-6

- Trower, C. A., & Chait, R. P. (2002). Faculty diversity: Too little for too long. *Harvard Magazine, 104*, 33-38. Retrieved from http://harvardmagazine.com/2002/03/ faculty-diversity.html
- Turock, B. J. (2001). Women and leadership. *Journal of Library Administration, 32,* 115-137. doi: 10.1300/J111v32n03\_08
- Valian, V. (1999). *Why so slow? The advancement of women*. Cambridge, MA: MIT Press. The White House Project . (2009, November). *The white house project report: Benchmarking women's leadership.* Retrieved from http://www.thewhite house project .org/documents/Report.pdf
- United Nations Development Programme. (2009). *Human Development Report 2009.* New York: Palgrave Macmillan.
- Wang, C., & Burris, M. A. (1997). Photovoice: Concept, methodology, and use for participatory needs assessment. *Health Education & Behavior, 24,* 369-387. doi: 10.1177/109019819702400309
- Wang, C. C. (1999). Photovoice: A participatory action research strategy applied to women's health. *Journal of Women's Health, 8,* 185-192. doi: 10.1089/jwh.1999.8.185
- Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education: They're not magic. *Review of Educational Research*, *81*, 267-301. doi: 10.3102/0034654311405999

# Table 1

# Session 2 Participant Disciplines

Discipline	Department	Ν	Percentage
Natural Science and Math	23	50	
	Anthropology	1	2
	Biology	5	11
	Chemistry	3	7
	Information Systems	4	9
	Math	1	2
	Physics	2	3
	Psychology	7	15
Engineering		13	28
	Aerospace	2	4
	Biomedical	2	4
	Chemical	2	4
	Electrical	1	2
	Environmental	5	11
	Mechanical	1	2
Medicine & Health		12	26
	Audiology	1	2
	Biomedical Science	1	2
	Communication Science	1	2
	Epidemiology	1	2
	Health Education	1	2
	Medicine	1	2
	Neuroscience	1	2
	Nutrition	2	4
	Pharmaceutical sciences	2	4
	Physiology	1	2

## Table 2

# Correlations Among Study Variables

Measure	Leadership identification	Intentions to continue	CAS	Self-
Leadership	laonanoation		0,10	perceptione
identification	-			
Intentions to continue	.31**	-		
CAS	.65**	.30**	-	
Self-perceptions	.07	.07	.18	-

\**p* < 0.01 level.

\*\**p* < 0.05 level.

# Table 3

## Participant Gender Empowerment Score By Country of Origin

	Gender Empowerment	International Rank (out
Country	Score	of 118)
Brazil	0.50	82
Canada	0.83	12
China	0.53	72
Colombia	0.51	80
Iran	0.33	103
Saudi Arabia	0.30	106
Sri Lanka	0.39	98
Thailand	0.51	76
Turkey	0.38	101
United States	0.77	18
Venezuela	0.58	55
Vietnam	0.55	62
Xlepal	0.49	83

Note. Scores were unavailable for participants from India or Nigeria.

## Table 4

## Pretest and Posttest Descriptive Statistics

		Pr	etest		Posttest				
	<u>Control</u>	<u>Group</u>	Exp Group*		Control Group		<u>Exp G</u>	roup*	
Measure	М	SD	М	SD	М	SD	М	SD	
Intentions to Continue	16.36	3.95	19.17	2.3	17.14	2.78	18.1	2.55	
Career Aspiration	27.23	2.31	27.58	4.69	27.81	2.85	27	4.16	
Leadership subscale	19.96	2.06	20.08	4.05	20.68	2.19	19.88	3.46	
Educational subscale	7.27	1.08	7.5	1.02	7.13	1.17	7.13	1.33	
Self-Perceptions	28.45	6.43	30.25	5.36	26.68	1.62	28.71	4.11	
Leadership Identification	70.14	6.47	72.05	9.21	69.77	7.95	71.75	8.98	
Stigma Consciousness	-	-	-	-	46.59	11.36	42.68	8.28	

\*Exp group = Experimental Group

## Table 5

# Summary of Themes and Theoretical Significance

Aggregate theoretical	Theme		
dimensions number Theme			First-order codes
Career	1	Collaboration	Work with one or more people toward a common goal.
Strategies	0	Casial impact	Activities or goals that have social value and affect the surrounding
-	Ζ		community.
	3	Self- development	Work to advance personal skills and potential.
	4	Lack of authority	Lack of power or right to make decisions, influence, or enforce obedience.
Barriers to participation	5	Non-reciprocity	Perceptions of a positive action or intention not being returned.
	6	Gender stereotypes	Generalizations about gender differences and roles.
	7	Accomplishment	Positive experiences or recognition.
Buffering strategies	8	Social support	Positive social engagement that enhances psychological resources or leads an individual to believe that they are valued and accepted.
-	9	Work-life balance	A comfortable balance between professional work and personal lifestyle.

# Table 6

# Illustrative Evidence for Themes

Dimension	Illustrative quotations
Self-development	"I want to improve myself, to get more."
Collaboration	"It was sort of like a musical kind of harmony, where somebody is playing 'the lead' obviously but then the backup is just as important."
Social impact	"I hope to be a leader amongst my peers professionally as well as in the community."
Authority	"I can give you a token. I can call you up and recognize you for your work and thank you. That's all I have. That's the only power."
Social evaluation	"It's about motivating those under you and you want them to like you."
Workload	"I find it very difficult to wear a lot of different hats in my position."
Non-reciprocity	"We haven't really butted heads with anybody or really said a whole lot um one of them yeah so it – you just kind of listen and deal with it."
Gender stereotypes	"She's either going to be an authoritative b-word, or she's going to be like this motherly figure."
Accomplishment	"But the whole, the cause itself is really really great. And I think it was a really good way for me to connect um teaching, mentoring, um and science."
Social support	"So I got a really good friend, good mentor a very supportive family."
Work-life balance	"Even if it's ten minutes it shows that you're in control and you know what you want to get out of this."

# Table 7

## Control and Experimental Qualitative Group Differences

Control group	Experimental group	Differential coding
		Discussion focused leadership generally;
Broad discussion	Personal narrative	versus on personal experiences.
Facilitating work	Value-driven work	Organizing people and projects; versus engaging in meaningful work.
Applied work	Research work	Focus on work in business, industry or service; versus research and lab work.



*Figure 1*. Mean leadership identification scores for experimental and control groups from pretest to posttest. There was a significant interaction between condition and time of assessment.



*Figure 2.* Mean leadership identification scores for participants from different geographical regions. Significant differences were found in the leadership identification between participants originating from the Asia/Pacific and North America regions.



*Figure 3.* Mean rank of roles for workshop task, with lower scores indicating greater preference (N = 76).

Appendix A: Control Handout Text (Implicit Stereotype Activation)

### 10 Ways to Become a Powerful Leader

A client was interviewing a woman at IBM and was reminded of the person she once aspired to become. The executive was capable, strong, confident and articulate. Meeting her was like opening a bottle of champagne. Her passion and enthusiasm were contagious.

My client thought to herself, "What happened to me? The person I'd hope to become... where did she go?" She realized that she had become much quieter than when she first started her job. She was less likely to share her opinions and limits her own powerful presence in her work. She has taken a back seat to her powerful leader she once was earlier in her career. Instead of focusing on changing herself, my client's first reaction was to change her circumstances. She was determined to join a new company and make a fresh start. She thought that her work environment had caused her to temper her personal style and not be herself. However, I expressed to my client that it's not about the environment; it's about who you are. "When you started this job, you decided to hide and thus you became less known and visible," I advised her. "The end result was that you lost yourself at the same time. You have the power to change and alter what you originally created. You can't change the company, but you can change yourself. Let's focus on acting differently right where you are."

Her passive, introspective self was most evident when she was around her superiors. My client was able to be herself with her own team, people below her, partners/clients and sometimes even with her boss. However, when it came to working with the senior executives, she felt she didn't know enough to contribute. Even though

she was highly skilled and often knew as much (if not more) than her superiors, she let herself disappear. She surrendered her power and confidence to them. She became fearful she would say something that would be seen as wrong and thus she would be reprimanded. She minimized herself in their presence.

She wants her real self back - the confident self reflected in the woman she was interviewing. She wants to let this powerful presence out and to stand up for who she actually is. She began to get her powerful leader self back by doing the following:

**1. Recognize and appreciate the perspectives of others.** Most people receive very little workplace recognition in a given year. So it's vital that you recognize the perspectives and work of other people.

**2. Stand out and become more visible.** This involves the willingness to be seen and to get recognized. You will have to participate and share more of who you are with others. This can mean going the extra mile with your work, showing up to meetings or events, or speaking up in a group.

**3. Recognize the little things that make you valuable.** Maybe you have the patience to do extra background research, have editing skills that others do not, have a talent for making things aesthetically pleasing, or take the time to listen to others. Doing these things in addition to what you are asked to increase your value within an organization.

**4. See yourself in as great a light as others project onto you.** Often, people will see you in a different and more positive light than you see yourself. Your own self-limiting view can cause a distorted understanding of your sense of power and worth. So, it's important that you work on your confidence and begin to see yourself in as great a light as others see you.

**5. Speak your mind and tell others what you think.** Begin to share what you think and be more assertive. Continue to share without caring what others think or what the repercussions might be. The more you are true to yourself, the easier it is to be confident.

**6.** Build relationships with senior people. Engage with people above you. As you build relationships with executives, you'll increase your confidence. Don't be intimidated by their title or influence. It's important to see them as equal and to recognize the value and benefit of having them as advocates supporting your career.

**7. Find more opportunities to be yourself.** Look at your current projects and responsibilities and see how you can be more of yourself in the work you are currently doing. Also, look at new things you can do (outside your current work). Choose opportunities that allow you to be more you!

**8. Find your edge.** You might feel a little anger for letting yourself get so disempowered and withdrawn. Channel this anger and find your edge. Feel the fire in your belly. This fire is the fuel to help you move forward, speak out and speak up. Be willing to challenge where you are and the limits surrounding you. Break out of the box of limitations and be more of your powerful, confident and leader-like self. To live with the fire in the belly is to live with passion and to want something more from your work.

**9. What's the worst that can happen?** Fears about being punished for speaking up are almost always unwarranted. The next time you find yourself holding your tongue around your superiors, ask yourself, "What's the worst that can happen?" You'll discover your concerns are usually not justified.

10. Finally, be positive and offer solutions. You'll build your self-confidence (and the

confidence of your superiors) if you offer positive solutions.

This is your time to put a stake in the ground and to begin the journey of being a beacon of strength for yourself. Stand up for yourself and for your own powerful presence that yearns to be fully realized.

\*Adapted from Garfinkle Executive Coaching. (n.d.) *10 ways to become a powerful leader at work.* Retrieved from http://www.garfinkleexecutivecoaching.com/articles/ 10waystobecomeapowerfulleader.html

Appendix B: Experimental Handout Text (Explicit Stereotype Activation)

Women in Science and Leadership: Two Leaky Pipelines

Women's progression into leadership positions has been referred to as a leaky pipeline.

## Shortage of Women Leaders

- In Fortune 500 companies, women constitute 7.6% of the highest earning positions.
- Women account for 16.8%, 17%, and 16.8% of seats in the U.S. Congress, Senate, and House of Representatives.
- The shortage of women leaders exists in all sectors and pervades across the world.
- Science professions often have greater shortages of women than other occupations, particularly in leadership positions.

## **Obstacles to Advancement**

Not only are women underrepresented within leadership, they often experience disadvantage when in these positions. Women leaders are less liked, receive lower performance ratings, have less opportunity for advancement, receive fewer rewards, and have less authority.

## Why so few?

- The underrepresentation of women in science and leadership is often discussed in terms of stereotypes.
- Stereotypes are beliefs about groups of people.
- Stereotypes about men and women are based on the roles that they usually

occupy (i.e. women as homemakers, men as breadwinners).

- Women are often viewed as communal, emotional, tolerant, and warm. Men are often framed as independent, logical, and decisive.
- Beliefs that women are less logical and assertive make women seem unsuited for certain careers. These beliefs can make women less likely to pursue science and leadership, and make others view them as less fit for the job.

## However, stereotypes are NOT always accurate.

How do you want to address stereotypes about women? Can you think of women who do not fit common gender stereotypes? Can you think of stereotypes about leaders that are inaccurate? What traits and skills have you liked and disliked in leaders?

## Appendix C: Career Aspiration Scale

In the space next to the statements below please circle a number from "0" (not at

all true of me) to "4" (very true of me). If the statement does not apply, circle "0."

Not Tru	at All e of me 0	Slightly True of me 1	Moderately True of me 2	Quite a l True of r 3	Bit me	Very True of 4	me	
1.	I hope to becc	ome a leader ir	n my career field	. (	) 1	2	3	4
2.	When I am es	tablished in m	y career, I would	l like to (	) 1	2	3	4
	manage other	employees.						
3.	I would be sat	tisfied just doin	ig my job in a ca	reer I am <sub>(</sub>	) 1	2	3	4
	interested in.							
4.	l do not plan t	o devote energ	gy to getting pro	moted in	) 1	2	3	4
	the organization	on or business	I am working in					
5.	When I am es	tablished in m	y career, I would	like to (	) 1	2	3	4
	train others.							
6.	I hope to mov	e up through a	iny organization	or (	) 1	2	3	4
	business I wo	rk in.						
7.	Once I finish t	he basic level	of education ne	eded for	) 1	2	3	4
	a particular jol	b, I see no nee	ed to continue in	school.				
8.	I plan on deve	eloping as an e	expert in my care	er field. (	) 1	2	3	4
9.	I think I would	like to pursue	graduate trainir	ig in my <sub>(</sub>	) 1	2	3	4
	occupational a	area of interest	t.					
10.	Attaining lead	ership status ii	n my career is n	ot that	) 1	2	3	4

important to me.

### Appendix D: Self-Perceptions Scale

Please answer the following questions about your experiences in your field of study or the career opportunities you have had in science, research, and STEM in general. Circle the one number below each question that corresponds to your level of agreement or disagreement.

1 = "I strongly agree" 4 = "I am neutral" 7 = "I strongly agree"

1. When I get new material in my major, I'm usually sure I will be able to learn it.

Strongly L	1 Disagree	2	3	4	5	6	7 Strongly Agree	
2. I sometimes d	oubt my a	ability to	o perfoi	rm well	in my	major.		
Strongly L	1 Disagree	2	3	4	5	6	7 Strongly Agree	
3. I am good at n	ny field of	study	compa	red to c	other p	eople ir	n my major.	
Strongly L	1 Disagree	2	3	4	5	6	7 Strongly Agree	
4. My field of stu	dy has alv	ways co	ome pr	etty ea	sy to m	ie.		
Strongly L	1 Disagree	2	3	4	5	6	7 Strongly Agree	
5. My major has never been easy to me.								
Strongly L	1 Disagree	2	3	4	5	6	7 Strongly Agree	
<b>.</b>								

6. I feel like I have to work harder than other people in my major to do well.

	1	2	3	4	5	6	7
Strongly Disa	agree						Strongly Agree

Appendix E: Leadership Identification Scale

Please answer the following questions about your leadership experiences and aspirations. Circle the one number below each question that corresponds to your level of agreement or disagreement.

1 =	= "I strongly disagree"		4 = "l	am ne	utral"		7 = "I strongly agree"		
1.	Becoming a leader is a	an impo	ortant p	art of v	vho I ai	m			
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
2.	I feel that the leadersh	ір оррс	ortunitie	es I get	are an	accura	ate reflection of my abilities.		
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
3.	My leadership opportu	nities d	o not te	ell me a	anythin	g abou	t my career potential.		
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
4.	I don't really care abou	ut what	leaders	ship op	portun	ities sa	y about my abilities.		
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
5.	Acting as a leader is sa	atisfying	g for m	e beca	use it g	gives m	e a sense of		
	accomplishment.								
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
6.	If leadership opportuni	ties we	re fair,	l would	d be do	ing mu	ch better in my career.		
	1 Strongly Disagree	2	3	4	5	6	7 Strongly Agree		
7.	I am often relieved if I	just hav	ve a jot	o (or op	portun	ity) to c	do in my area.		
	1	2	3	4	5	6	7		
	Strongly Disagree							Strongly Agree	
---	---	---------------------	---	---	---	---	---	---------------------	--
8.	I often do my best work when I act as a leader.								
	Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
9.	Pursing leadership is not very interesting to me, and I don't feel is very important.								
	Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
10	10.1 put a great deal of my efforts into advancing as far as I can in my field because it								
	has special meaning or interest for me.								
	Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
11.I enjoy pursuing leadership roles because it gives me a chance to do many									
interesting things.									
	Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
12. I feel like pursuing leadership roles is a waste of my time more than the things I do									
	outside of my fie Strongly Dis	eld. 1 sagree	2	3	4	5	6	7 Strongly Agree	
13. My role in my field will never change my opinion of how smart I am.									
	Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	

Appendix F: Leadership Goal Questionnaire

Please list future career goals you have that involve taking a leadership role.

a.	
b.	
c.	
d.	
e.	
	Please rank the top three types of careers you would like to have.
1= <i>n</i>	nost interested; 2=next most interested in; 3 = interested in
	Professor or researcher in a university
	Researcher outside of a university
	Business/industry
	Teacher
	Clinician or field (working with patients, clients, or the community)
	Consultant
	Entrepreneur
	Other. Please specify:

### Appendix G: Role Choice Questionnaire

### Let's form groups

In the next workshop session small groups will be formed to discuss team dynamics and the leadership role. To make the discussion topic more real, we will form groups based on the roles that people choose to take. Please rank the roles from what you are most comfortable to least comfortable with.

1 = role you are *most comfortable with* 

2 = role you are next most comfortable with

3 = role you are *least comfortable with* 

"**Problem Solver**": With the team objective in mind, weigh options and make judgments about the ideas the group will present.

"Worker": Follow through with decisions made by the group and create a product which may be presented.

"Leader": Focus on team objectives, draw out team members, delegate work, and manage group relationships and conflicts.

Appendix H: Stigma Consciousness Questionnaire

Please answer the following questions about your experiences in your field of study or the career opportunities you have had in science, research, and STEM in general. Circle the one number below each question that corresponds to your level of agreement or disagreement.

1 = "I strongly agreed	4 = "I am neutral"				7 = "I strongly agree"			
1. Stereotypes about women have not affected me personally in my field.								
Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
2. I never worry that my behaviors will be viewed as stereotypically female.								
Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
3. When interacting	3. When interacting with men, I feel like they interpret all my behaviors in terms of the							
fact that I am a w Strongly Dis	voman. 1 agree	2	3	4	5	6	7 Strongly Agree	
4. Most men do not judge women on the basis of their gender.								
Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
5. My being female does not influence how men act with me.								
Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
6. I almost never think about the fact that I am female when I interact with men.								
Strongly Dis	1 agree	2	3	4	5	6	7 Strongly Agree	
7. My being female does not influence how people act with me.								

Strongly D	1 isagree	2	3	4	5	6	7 Strongly Agree		
8. Most men have a lot more sexist thoughts than they actually express.									
Strongly D	1 isagree	2	3	4	5	6	7 Strongly Agree		
9. I often think that men are unfairly accused of being sexist.									
Strongly D	1 isagree	2	3	4	5	6	7 Strongly Agree		
10. Most men have a problem viewing women as equals.									
Strongly D	1 isagree	2	3	4	5	6	7 Strongly Agree		

Appendix I: Photovoice Instruction Text

#### STEM Leadership Training Part II

For the next meeting take four pictures you would like to share with the group. Two should describe your past experience with leadership. Two should describe your future pursuits.

By (Date) get your pictures to the facilitator. Three options:

- E-mail the pictures to (*e-mail address*).
- Text them to (*phone number*)
- OR, drop off film for development (*mailbox number*).

Topic: Boundaries and achievement in leadership

What is Photo Novella?

Photo novella, or photovoice, gives people the chance to express themselves through imagery and narrative description. It is often used to encourage people to express themselves. It can also be used to facilitate group discussion. For the purposes of this training, it will also allow us to share the opportunities that we have had with leadership, as well as troubleshoot the obstacles we have encountered.

What will we do with the photos?

Please take 4 photos and give them to the facilitator to develop by (DATE). Take 2 of your past experience with leadership, and 2 of your future career pursuits. You will be asked at the next session to share your photos. After this, we will have a group discussion about the opportunities and boundaries that were brought up. You will be given a copy and the facilitator will keep a copy.

Important principles of photovoice:

70

- Confidentiality: What we share in this group will remain in this group.
- Diverse opinions are welcome.
- Have a good time- Creating a comfortable space is about coming together, being mutually supportive, and enjoying the activity!