CONSEQUENCES OF GENDER COMPOSITION DURING A DIVERSITY INTERVENTION

by

Ezgi Ozgumus

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STATEMENT OF COMMITTEE APPROVAL

Dr. Evava Pietri, Chair
Department of Psychology
Dr. Peggy Stockdale
Department of Psychology
Dr. Leslie Ashburn-Nardo
Department of Psychology

Approved by:

Dr. Nicholas Grahame
Head of the Graduate Program

Dedicated to Beth Ann and Debra…

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ABSTRACT

Author: Ozgumus, Ezgi. M.S.
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Major Professor: Evava S. Pietri

Persistent gender bias (i.e., favorable treatment of men over women) has been consistently documented as the most likely cause perpetuating gender disparity in STEM occupations. It is therefore crucial to develop effective diversity interventions that increase awareness of gender bias and decrease sexism in STEM. However, interventions that facilitate greater recognition of gender bias in STEM may inadvertently trigger social identity concerns for women, suggesting they may not fit in those environments. Moreover, women may be less comfortable speaking up in groups where their gender is numerically underrepresented. To mitigate these negative consequences, current research tested the effectiveness of gender composition in a virtual group setting as an identity-safe cue. Results suggested that in groups that consisted primarily of women, participants identified more with their group and this increased identification, in turn, helped alleviate social identity threat. Additionally, participants in female majority groups were more likely than those in female minority groups to participate in group discussions via increased identification with their group. Thus, our findings indicated that diversity practitioners should consider exploring whether diversity interventions in STEM also inadvertently elicit social identity threat for women. Additionally, when developing new trainings, it is important to incorporate identity-safe cues in order to neutralize any potential threat associated with these trainings.

CHAPTER 1. INTRODUCTION

It is well documented that fewer women than men occupy high-ranking positions in STEM (Science, Technology, Engineering and Math) related fields (NSF, 2015). The predicament is two-fold: Women miss out on valuable and lucrative career opportunities while scientific disciplines lose valuable perspectives of diverse groups (Ely & Thomas, 2001). It is thus critical to develop interventions that address this lack of gender parity in STEM and document any positive and inadvertent negative consequences of such interventions (Moss-Racusin, van der Toorn, Dovidio, Brescoll, Graham & Handelsman, 2014).

To address this issue, the current research explored an unintentional outcome of a diversity intervention aimed at raising awareness of gender bias. Specifically, recent research suggested that such an intervention might increase social identity threat for women (suggesting women's identity will be devalued) and signal to women they would not belong and would feel threatened in STEM environments (Pietri et al., under review). Additionally, women may feel uncomfortable speaking up and being an active participant during a diversity training covering gender bias in STEM. Thus, the goal of the current work was to promote awareness about gender bias in the sciences without inadvertently causing women to question their fit in STEM or feel uneasy during the training. To accomplish this aim, we investigated whether learning about gender bias with a group of primarily women helped women feel comfortable during the diversity training about gender, enhanced their participation, and alleviated any social identity threat evoked by the training.

Factors Underlying the Gender Disparity in STEM

A variety of factors may result in the gender disparity in STEM and systematically lead many female students ultimately to avoid STEM disciplines (Xie & Killewald, 2012). For example, some scholars argue that there may not be a sufficient number of adolescent girls interested in STEM careers because young women may prefer to study people rather than things (Ceci & Williams, 2011). Additionally, women may perceive STEM professions as not aligning well with their careers goals to help and work with other people (i.e., communal goals; Diekman, Brown, Johnston & Clark, 2010). These career preferences (whether free or constrained) may result in women avoiding the STEM workforce (Ceci & Williams, 2010).

Gender Bias and Stereotypes

It is also plausible that the lack of women in STEM is influenced by pervasive negative stereotypes (or general beliefs) about men, women, and scientists. Stereotypes about women tend to describe them as "warm" and "nice" but " less competent", whereas stereotypes about men suggest they are "assertive" and "competent" (Rudman & Glick, 2001). Additionally, individuals generally believe that STEM disciplines require stereotypically masculine traits for success (agentic; Diekman et al., 2010), and thus, these domains are explicitly and implicitly associated with masculinity (Nosek, Smyth, Hansen, Devos, Lindner, Ranganath & Banaji, 2007; Diekman et al., 2010). These stereotypes about scientists and women's incompetency may then result in biases favoring men over women and play a role in maintaining the lack of gender parity in

STEM (Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman, 2012). For example, Moss-Racusin and her colleagues (2012) demonstrated that, regardless of their gender, experienced members of science faculty in several research universities favored hiring "John" instead of "Jennifer", who were two fictitious candidates for a lab manager position with identical application materials but with male (John) or female (Jennifer) names. Both male and female faculty members went so far as to rate "John" as significantly more competent, deserving of a higher starting salary and more career mentoring than Jennifer. In another study, Reuben, Sapienza, and Zingales (2014) found that even when math skills were indistinguishable, both men and women were twice as likely to hire a man for a job that required math skills. Although men and women may not deliberately endorse the belief that men are more competent than women in STEM, these biases may operate unconsciously or automatically because of exposure to persistent and pervasive subtle gender stereotypes in our culture (Moss-Racusin et al, 2012; Nosek et al, 2007).

Although gender bias has now been well documented in STEM, sexism can often be subtle and considered innocuous. For example, Glick and Fiske (1996) argued that sexism is a bi-dimensional construct -with hostile and benevolent sexism. Hostile sexism is easier to detect due to its aggressive nature and negative tone arguing for the *"inferiority"* of women and communicating overtly antipathetic feelings toward them. Hostile sexism is viewed as old-fashioned (Ellemers & Barreto, 2009), and not openly expressed in contemporary society because such behavior is deemed socially improper (Abrams, Viki, Masser, & Bohner, 2003). Benevolent sexism, on the other hand, is subtler in nature. It may appear positive and benign because it portrays women as naïve and helpless creatures who are in need of a gallant man to feel protected and be completed (Glick & Fiske, 1996). This conceptualization of sexism is patronizing (Barreto & Ellemers, 2005) because it implies that women are weak and best suited for conventional gender roles (Glick & Fiske, 2001). Due in large part to its positive tone, benevolent sexism is widely accepted in American society as well as in many others, and remains unchallenged (Glick, Fiske, Mladinic, Saiz, Abrams, Masser & López, 2000). In fact, it is often not recognized as a form of prejudice (Barreto & Ellemers, 2005). However, benevolent sexism is nonetheless dangerous because it perpetuates double standards imposed on women, and people fail to recognize it as an embodiment of bias (Barreto & Ellemers, 2005). Consequently, this subtle bias may ultimately promote the continued lack of gender parity in STEM.

Social Identity Threat

Another perpetrator of gender disparity in STEM is *social identity threat* (Murphy, Steele & Gross, 2007). Social identity threat occurs when individuals, who are members of stigmatized groups, enter situations in which they believe that their group identity will be devalued (Steele, Spencer & Aronson, 2002). Social identity threat may ultimately result in negative downstream consequences including increased stereotype threat and belongingness uncertainty (Branscombe, Ellemers, Spears & Doosje, 1999; Walton & Cohen, 2007, Steele et al., 2002; see Murphy & Taylor, 2012 for a review).

Stereotype threat or self-evaluative threat is the fear individuals of stigmatized groups have that anything they do may inadvertently confirm stereotypes about the group and make it more likely that they will be evaluated based on these stereotypes (Steele, 1990; Steele & Aronson, 1995). For example, when taking an evaluative test in a stereotypical domain, members of a stigmatized group may worry that they will underperform, and unconsciously direct their attention to contextual cues to determine the extent to which the environment is safe or threatening (Inzlicht & Ben-Zeev, 2000). This vigilance phase depletes valuable cognitive resources and ironically results in them underperforming in the test, thus, confirming the stereotype (Spencer, Steele & Quinn, 1999). Stereotype threat undermines women's performance in science, where their in-group is negatively stereotyped (Spencer, Steele & Quinn, 1999). Consistently facing stereotype threat in STEM fields, women may resort to distancing and "disidentfying" themselves from these disciplines, and seek out other domains on which to build their identity and esteem (Steele, 1997).

In contrast to stereotype threat, belonging uncertainty occurs when stigmatized individuals question their fit to their environment and their acceptance by their peers or colleagues (Walton & Cohen, 2007). For example, Walton and Cohen (2007) found evidence of belonging uncertainty among Black students, whose group is chronically stereotyped in academic environments, and this sense of uncertainty weakened the Black students' motivation and self-perceived potential to succeed in computer sciences. In a different study, Cheryan and her colleagues (2012) demonstrated that when a peer role model's physical appearance and stated preferences fit the computer science "nerd" stereotype, it signaled to women that they did not belong in computer science field, and in turn reduced their interest in pursuing a computer science major.

Social identity threat can be evoked by fairly ordinary cues that either directly or indirectly signal to individuals that they will be devalued in the environment (Steele et al., 2002). For example, the numerical underrepresentation of one's group in a setting can trigger feelings of threat and concerns of fit among stigmatized individuals (e.g., women or ethnic minorities) even when the environment did not exhibit any apparent evidence of prejudice or discrimination. In one demonstration of this phenomenon, Murphy and her colleagues (2007) developed a fictitious advertising video for a summer STEM leadership conference with two different versions. In each video they manipulated the men-to-women ratio of their imaginary attendees. Women who were shown the gender-unbalanced version of the video showed a wide range of physiological and affective outcomes, including physical threat symptoms (i.e.7 faster heart rates, greater skin conductance and greater sympathetic activation of cardiovascular system), weaker sense of belonging and lower desire to participate in the conference. Additional past research have found that when women are in settings where they are the only woman, their salient solo status weakens their sense of belonging, lowers confidence and interferes with their performance in science and mathematics (Inzlicht & Ben-Zeev, 2000; Sekaquaptewa & Thompson, 2003; Kanter, 1977a; Kanter, 1977b).

Cheryan, Plaut, Davies, and Steele (2009) also found that simple, seemingly innocuous items in the environment could trigger social identity threat. Specifically, they demonstrated that when an environment is associated with computer science "nerd" stereotype — i.e., containing casually placed Star Trek posters, comics, video game boxes, soda cans, junk food, electronics, computer parts, software, or technical books and magazines— women judged the environment as masculine and reported less interest in pursuing the particular field compared to men. These cues do not even have to be physically present in the environment to trigger social identity concerns. Van Loo and Rydell (2014) demonstrated that women who watched a social interaction involving a male actor's display of dominant behavior toward a female actor in stereotypical domain (i.e., math) reported increased social identity threat and experienced subpar performance on a math exam.

Diversity Interventions Addressing Gender Bias

Bias against a social group, women in particular, first needs to be recognized before it can be overcome (Tajfel & Turner, 1979). It is, thus, imperative that diversity interventions are effectively developed to increase recognition of subtle and harmful gender bias (Carnes, Devine, Isaac, Manwell, Ford, Byars-Winston, Fine, & Sheridan, 2012). Specifically, an efficacious diversity intervention should facilitate individuals' awareness of bias, help reduce biases, and effectively enhance institutional change regarding gender equity (Carnes et al., 2012). To achieve these goals, a diversity training should engage participants in dynamic discussions to promote better learning of and retention of material presented during the training (Moss-Racusin et al., 2014). For example, in their "*Bias Literacy Workshop*", Carnes and her colleagues (2012) engaged participants with self-identification and self-reflection exercises. To reinforce new knowledge, they ensured the trainees could perform case studies and problem-solving tasks that incorporated examples of gender bias. The workshop thus provided an outlet for practice with immediate feedback. Participants completed the training by writing a two-page commitment statement to improve gender equity in their own environment. As a result, Carnes et al. (2012) found that 75% of those partaking in their diversity workshop successfully demonstrated increased bias awareness, and were motivated to change—or had actually changed—behaviors (Carnes et al., 2012). Yet, thus far, with a few notable exceptions, there have been few studies validating diversity initiatives that address gender bias in STEM and examining the consequences of such initiatives to ensure they produce the desired outcomes (Moss-Racusin et al., 2014). Further research is needed to shed light on ways to best facilitate a diversity intervention that promotes discussion and encourages desired change in attitudes and behavior.

Diversity Interventions as a Social Identity Threat Cue

Unfortunately, making women aware of gender bias during a diversity intervention may act as an external and intense identity-threat cue, and inadvertently produce negative consequences for women's psychological wellbeing (Pietri et al., under review). Previous research suggests that perceptions of discrimination and bias may lead to negative psychological well being (e.g., increased anxiety, depression, and hopelessness) for chronically stigmatized groups (Ashburn-Nardo, Monteith, Arthur & Bain, 2007; Schmitt, Branscombe, Kobrynowicz & Owen, 2002a; Schmitt, Branscombe & Postmes, 2002b). Likewise, new research has found that a diversity intervention that effectively increased awareness of and decreased sexism in STEM also inadvertently lowered women's sense of belonging and increased reported stereotype threat in STEM (Pietri et al., under review). Thus, diversity interventions that address one problem underlying the gender disparity in STEM (gender bias) may also unintentionally exacerbate another (social identity threat).

Additionally, diversity trainings and workshops may create environments that discourage women from being active participants. Previous research found that women in organizational settings talk less compared to their male counterparts because they are concerned about repercussions or negative evaluations (i.e., backlash) from perceivers (Brescoll, 2012). Thus, diversity trainings may create a situation in which women feel anxious about expressing their opinions and thoughts. Based on this previous research, the current experiment tested following three hypotheses:

Hypothesis 1a: Compared to a training not addressing gender bias, women will experience more social identity threat in the form of decreased belonging and increased stereotype threat when they are part of a diversity intervention that increases awareness of gender bias.

Hypothesis 1b: Compared to a training not addressing gender bias, women will actively participate less in a diversity intervention that increases awareness of gender bias.

One may argue that diversity workshops should exclude women and only focus on training men. However, this would be an untenable solution because women and men both exhibit gender bias (Barreto & Ellemers, 2005) and biases against women's scientific competence (Moss-Racusin et al., 2012). As a result, it is imperative to develop effective diversity trainings that teach women about bias in a nonthreatening manner. One way to mitigate the negative effects of increased awareness bias is to incorporate identity-safe cues (i.e., cues that signal a particular social identity will be valued; Davies, Spencer and Steele, 2005) into diversity trainings (Pietri et al., under review). One particularly powerful identity-safe cue may be the presence of one's same sex peers in a workshop (i.e. group composition). For example, *the Stereotype Inoculation Model*, introduced by Dasgupta (2011) illustrated a framework to help women cope with the debilitating effects of perceiving gender bias in their environment. The model proposed that "*analogous to a vaccine, contact with successful in-group experts and peers in high-stakes achievement contexts functions as a social vaccine that inoculates individuals against self-doubt*" (p. 233). For women, contact with successful and relatable peers protects them from applying masculine STEM stereotypes to their own identities, and therefore increases identification with their gender, promotes a stronger sense of belonging in science, and helps them to feel less threatened by insidious stereotypes (Dasgupta, 2011; Stout et al., 2011).

In line with Dasgupta's theory, researchers have found that women benefit from being with female peers in a group and feel more identity-safe among other women (Murphy et al., 2007; Springer, Stanne & Donovan, 1999). Steele (2010) asserted that there is a "Critical Mass" (critical mass; Kanter, 1977a; Kanter, 1977b; Dahlerup, 1988), a hypothetical number of in-group members, that results in stigmatized individuals determining they will not be evaluated based on their social identity. If and when stigmatized individuals recognize a critical mass of their fellow disadvantaged group is present in a particular setting, they feel their identity is not threatened or marginalized. For instance, increasing the number of female students from one to three in a math testing room diminishes the stereotype threat felt by female students, and therefore results in a relatively lower performance gap between men and women's math performance (Inzlicht

& Ben-Zeev, 2000). Thus, a group composed primarily of women in diversity trainings may, in turn, mitigate the harmful effects of learning about gender bias for women.

Having a female dominant group setting may also encourage women to speak up and be an active participant. Dasgupta and her colleagues (2015) found that women college students in female majority four-person engineering teams (female-to-male ratio 75%) were more willing to speak up and contribute to the group discussion despite being in the threatening and masculine domain of engineering. Female majority groups in these "microenvironments" enabled women to focus on learning and mastery without being negatively affected by gender stereotypes and enhanced women's active participation in teamwork (Dasgupta, McManus Scircle & Hunsinger, 2015). Thus, based on this previous research, the current study tested the following hypotheses.

Hypothesis 2a: Compared to a female-minority group, women will experience less social identity threat in a female-majority group.

Hypothesis 2b: Compared to a female-minority group, women will actively participate more in a female-majority group.

We predicted that we would see the associated benefits with a female majority group regardless of whether participants learned about gender bias or a topic unrelated to gender bias. However, the benefits of the female majority group should be more pronounced when women were taking part in a diversity intervention that increases awareness of gender bias because the diversity training would create a threatening situation for women. Additionally, past research demonstrated that, consistent with critical mass theory (Kanter, 1977a; Kanter, 1977b; Dahlerup, 1988; Steele, 2010), having more women (than men) on the board of directors increased women's comfort level in an organizational setting, and eased some of the stresses associated with being stigmatized (Broome, Conley & Krawiec, 2010). Therefore, we predicted that participants would feel more comfortable and identify more strongly with their groups members in the female majority than female minority group, and that trust and identification with group members would be critical for alleviating social identity threat and promoting actively engagement during a training (see Figure B.1.).

Hypothesis 3a: Compared to a female-minority group, women will trust and identify more with their group members in a female-majority diversity training group.

Hypothesis 3b: Trust with group and identification with group will mediate the relationship between the female-majority group and decreased social identity threat and increased participation.

Hypothesis 3c: There will be an interaction between group composition and module condition such that the effect of group composition (i.e. female majority condition) will be more pronounced in gender bias module condition relative to control module condition.

Present Study

Overview

The present study aimed at building upon the groundwork Dasgupta and her colleagues (2015) laid out in order to provide a way to teach about gender bias in a nonthreatening manner. Female participants were recruited to partake in an online workshop in which they were randomly assigned to learn about gender bias or a topic unrelated to gender, and were randomly placed in a female-majority or a female-minority group setting. Participants' trust and identification with their training group were measured, as well as their sense of belonging and stereotype threat in a hypothetical STEM company. Finally, we assessed participants' willingness to engage actively with the group in the form of leaving a comment as part of a discussion board.

Pilot Study

Prior to running the experiment, we aimed to ensure that the manipulated virtual group appeared realistic to participants, and participants noticed that they were in a female minority or female majority group. Thus, we conducted a pilot study, with one-hundred and six female participants recruited in exchange for $1.00 compensation using Mechanical Turk panel service to recruit only women to pilot test the study paradigm. The experiment was advertised on MTurk's website as a study aimed at promoting awareness on a given topic by creating small groups and delivering information on the topic via a virtual workshop. After clicking on the embedded link in the HIT, participants were redirected to Qualtrics, an online survey database, and presented with the instructions. The instructions explained that the study was designed to teach participants about a chosen topic, and that the training would be delivered in an online group setting. Additionally, participants were told that the study required them to view a short training module, read two vignettes, and share their comments and thoughts on the vignettes.

Upon entering the experiment participants were presented with an animated spinning wheel for forty-five seconds, and instructed to wait briefly while enough participants accepted the HIT and entered the training group. They were then told that they would enter a 9-person training group. To manipulate the gender composition in the group, participants were randomly assigned as one of seven women (i.e., female-majority condition) in a group, or as one of two women (i.e., female-minority condition). Female-to-male ratio of gender disparity conditions were modeled after critical mass theory (thirty percent; Kanter, 1977a; Kanter, 1977b; Dahlerup, 1988). Thus, although each group appeared to contain nine group members, in reality, the participant was the only real group member (i.e., the other "group members" were fictitious participants). In order to help maintain the believability of group setting, the survey was kept active between 8 a.m. EST to 10 p.m. EST (i.e., manually paused outside of these hours).

After being told that the group had formed and reading brief instructions about the experiment, participants were asked to input their name and state of residency before continuing to the next page. On the next page they were again presented with an animated spinning wheel for sixty seconds, told to kindly wait "while we load participant information". Next, participants saw a list of their nine group members (the participant included) with their demographic information (i.e., their name, gender and state of residency that was requested immediately after the instructions). Group members were listed using fictitious first names and initial of their last names, along with avatar silhouettes, signaling whether the participant was a woman or a man. Fictitious group members' names were chosen from a list of most popular gender-specific male or female names. Additionally, participants had to stay on the current page for twenty-five seconds before they could continue with the goal of ensuring participants recognized the gender composition of their group.

To help participants feel more connected with their group members and bolster our cover story, they were asked to introduce themselves briefly to their supposed group members. Specifically, participants were prompted to share their first names and a short greeting message to the group. After participants submitted their own responses, they saw the same animated spinning wheel they had seen earlier, asking them to wait while "all group members were typing up and submitting their responses". They then proceeded to view the discussion board and saw other group members' fictitious greeting messages along with their avatars. This fabricated communication between the participants and fictitious group members was intended to simulate an environment of personal interactions consistent with experiences in a virtual community.

Participants were then assigned to one of two informational module conditions (a gender bias module or control information module, which will be described in detail in below). Of importance to the pilot study, participants were asked to questions about the gender composition of the group and believability of the group. Specifically, we asked them to recall their training group list and determine whether the majority of their group members were men or women (i.e., "Thinking back to your group, were members female or male? a) The group had majority female b) The group had equal numbers male and female c) The group had majority male"). Additionally, they were asked to indicate how real their group setting was (1 = *not at all real,* 5 =*extremely real*). For the purpose of the pilot study we were specifically interested in the percent of the participants who did not believe the group was real, and who incorrectly answered the group composition question. Furthermore, because our primary purpose was to test the believability of the group paradigm, we have asked one open-ended question (i.e., ”were there any characteristics of the group interaction that were not believable? If so, what were they?”).

Pilot Study Results

For the manipulation check questions, **t**hirty-one participants (22.9%) to failed to indicate the correct percentage of men and women in the group, indicating that they were not aware of the group gender composition. Moreover, thirty-six participants (34.0%) reported that they did not believe the group was real at all. When asked to provide a reason, a number of participants indicated the lack of group interaction except for the initial introduction, and the group introduction sounded too formal and well-rehearsed (e.g., lacking typo or colloquial, daily use of language). To address participants' comments and improve the authenticity of group paradigm, we made several revisions to the study design (see Design and Procedure).

CHAPTER 2. METHOD

Power Analysis

An a priori power analysis was conducted for the present research using G*Power 3.1 Software (Faul, Erdfelder, Buchner & Lang, 2009) to determine the required sample size. T-test was selected as the desired test family, with an assumed power of .80 and $\alpha = .05$. Previous research examining threatening effects of gender bias information on women's belonging and trust in STEM had found approximately medium effect sizes (d=.5), and therefore an a priori effect size of d=.5 was input to calculate the necessary sample size. These analyses revealed that an n of approximately 100 participants per cell would be needed to obtain statistical power at the recommended .80 level (Cohen, 1988). Because the experimental manipulation created for present study has not been validated yet by previous research, a sample size of 125 participants per cell was targeted to provide a more conservative sample size.

Participants

Six-hundred and twenty-five female participants were recruited from general population via MTurk and received $2.00 in exchange for completing the study.. For the purposes of current empirical investigation, we used the panel services offered by MTurk to selectively recruit women who were legal residents of the U.S. and were at least 18 years old.

With regards to attrition, one-hundred and twenty-two participants did not finish the experiment (19.5% attrition) after starting a module, but this attrition did not vary consistently across information condition, $\chi^2(1, N=625) = 2.809$, $p=.094$, or group gender composition condition, $\chi^2(1, N=625)=.034$, $p=.854$. Thirty-five participants were excluded for not passing attention and manipulation checks, and they did not vary consistently across information condition, $\chi^2(1, N=625)=.016$, $p=.900$, or group gender composition condition, $\chi^2(1, N=625)=.332$, $p=.564$ (attention and manipulation checks will be discussed under measures section). The final number of participants who successfully passed attention and manipulation checks was four-hundred and fifty-five.

The age of participants ranged from 20 to 71, with a mean of 37.17 (M = 37.17, SD = 11.46). With regards to race and ethnicity, 76.9% of the participants identified as White/Caucasian (M = 1.23, SD = .42). 48.5% of the participants had completed a minimum of 4-year college degree (M = 1.85, SD = .62). In terms of employment status, 24% indicated that they worked part time, and 51.9% was employed full time (M = .76, SD = .43).. More than half of the participants (56.7%) self-reported that they were liberal in terms of their political orientation (M = 1.59, SD = .75). 91.2% of participants indicated they have taken a minimum of 1 STEM class during their high school education (M = 3.95, SD = 1.86). Similarly, 79.1% of participants have completed a minimum of 1 STEM class in college (M = 4.24, SD = 2.93). Finally, only 16.2% of the participants worked in a STEM-related field.

Design and Procedure

Pilot study results pointed to a number of areas of the study that required improvement. We therefore made several revisions on the study paradigm based on the pilot study, which are described below.

Similar to the pilot study, this study was advertised as being interested in how individuals learn information in training groups, and was only available between 8 a.m. and 10 p.m. When participants entered the group, they were told the group was being formed while they saw a spinning wheel for sixty seconds. We increased the length of time they had to view the spinning wheel from forty-five seconds to sixty seconds because a number of the pilot study participants pointed out that it was unrealistic to see nine MTurk workers taking the same HIT at the same time. Additionally, we utilized the same spinning wheel each time we introduced a group interaction, because in a real group, group members type their responses at varying speeds. The addition of multiple spinning wheels considerably lengthened the experiment, and therefore we increased the compensation amount by $1.00 (i.e., $2.00 total compensation per completed survey).

Next, participants were given brief instructions about the experiment and were asked to input their name and geographical location (e.g., Midwest, Northeast) along with their gender. Participants were told their answers would be used to provide a little information about the training group to all the members. As an improvement over the pilot study, we provided participants the opportunity to select from three different avatars, all varying shades of red/orange. We included the avatars for two reasons- a) to help ensure the group appeared realistic and b) to make the gender composition of the group salient. In particular, female avatars were varying shades of red whereas male avatars were different tones of blue. Additionally, to make sure participants recognized the gender composition, they were explicitly told that their group included either 78% female participants and 22% male participants (i.e., female majority condition) or 78% male and 22% female participants. However, to ensure this information did not seem out of place, participants were also told that "50% of their group participants were from Southwest, 25% were from Southeast and 25% were from Midwest". Participants were then presented with the list of group members for thirty seconds, with their different names and associated avatars (red/orange to indicate women, and blue to indicate men). The experiment was programmed such that the real participants' name and chosen avatar appeared in the group as the 9th member.

Next, participants completed the same first group interaction outlined in the pilot study (i.e., participants provided their name, and a brief introduction). To address the lack of conversational language pointed out by some participants in pilot study, group introductions were adapted from pilot participants' original greeting messages. To further enhance the believability of the group and make gender composition salient, we provided an opportunity for a second group interaction before participants begin viewing the modules. In this additional group interaction, participants were asked to share "something personal" with their group (e.g., their hobbies, favorite vacation destinations, favorite TV shows).

Information Modules and Scenarios

After this interaction, we told participants we wanted to remind them of their group members before moving on to the training modules, and presented the list of their group members a second time to ensure that group composition was clear and salient. The gender bias module presented participants with information about gender bias in the sciences in a format similar to a PowerPoint presentation (see Appendix for full module information). This module featured facts about the pervasiveness of gender bias in the sciences and harmful stereotypes associated with women's competency in STEM. It also discussed the difficult personal experiences of women who work in the sciences. The information in the module was based on real psychological research, and incorporated graphs to represent important findings from scientific literature visually. Finally, the source for each slide was shown in the right-hand corner, signaling to participants that the statements were well grounded in scientific studies. The gender bias module has been shown in previous research to successfully increase women's awareness of gender bias in STEM (Pietri, Young & Ozgumus, under review).

Participants assigned to the control module condition were presented with information about the perilous situation for giant pandas, and how giant pandas were in danger of extinction. This module was presented in the same format as the gender bias module (i.e., featured graphs, and facts from scientific research). Thus, the current experiment had a 2 (gender bias condition versus control condition) X 2 (female-majority group versus female-minority group) between-subjects cross-sectional design.

Immediately after finishing the module and attention checks, participants were informed that their group would next see two vignettes related to the module they just completed. Participants who were assigned to the experimental condition read vignettes portraying examples of subtle gender bias in a science and technology organization, whereas those assigned to the control condition read two vignettes similar in length and format, related to giant pandas and how humans were impacting pandas' natural habitats. The purpose of these vignettes was to give participants a chance to react, reflect on, and most importantly comment on the situations pertinent to their assigned module.

After each vignette participants were given an option to leave a comment about the vignette or to skip commenting. Specifically, all participants were explicitly informed that their comments, should they wish to leave any, would be visible to everyone in their group at the very end of the study (i.e., after completing the administered questionnaires). Leaving a comment was an optional step in the experiment, and participants always had the option to skip the commenting section. Furthermore, in order to control for the potential confound of group members' comments on the reaction of the real group member, participants (i.e., those who chose to leave a comment) were shown the comments at the very end of the study after they completes survey questionnaire.

After reading the vignettes, participants were asked to complete a number of measures (see Measures). Before completing the measures assessing social identity threat in a STEM environment, participants were first shown a picture of a website for a fictional "science and technology" company named "LabTech" with the motto "Making innovative discoveries" (see Appendix). The picture imitated the display of a webpage, featuring "home", "about", "products", "responsibility", "jobs" and "news" sections, with a gender-neutral scientist image placed at the lower left corner (i.e., it was not possible to determine the gender of the scientist from the picture). Participants were then asked to imagine how they would feel working for this science and technology company while answering the subsequent questions.

Measures

Attention and Manipulation Check

After the module, participants were asked three questions to determine whether they paid sufficient attention to the material in the module. These questions were intended to ensure valid responses to the survey by filtering out participants who might have had haphazardly "clicked through" the content. A sample item from the attention check is "according to the module, when women act assertive or aggressive a) they are liked a lot more, and are rewarded, b) they are perceived as better workers than men, c) they are rewarded with many job opportunities, and d) they are liked a lot less, and are punished". Participants who failed to correctly answer at least two questions out of three were excluded from the final sample, This exclusion criterion for participants' attention is similar to attention checks used in past diversity intervention research (see Pietri et al., 2017).

The believability of virtual group setting was measured with two questions. First, participants were asked to recall their group gender composition (e.g., "thinking back to your group, please rate the extent to which you believe below holds true for your group") using a 6-point response index (1 = *I'm absolutely confident that my group consisted of primarily women*, 6 = *I'm absolutely confident that my group consisted of primarily men*). Second, participants were asked to rate the extent to which they thought the group setting was real on a 5-point response scale (1 = *not at all real,* 5 =*extremely real*).

Participants who failed to correctly recall their group gender composition (i.e., female-dominant versus male-dominant) and who reported their group setting was "not at all real"(i.e., chose 1 out of 5 on the scale) were excluded from the final sample.

Primary Outcome Measures

Verbal Participation. Participants' willingness to speak up and participate during their training group was assessed by whether or not they choose to leave a comment after they read the vignettes. Verbal participation was measured such that those who did not leave any comments were coded as 0, those who commented on either one of the vignettes were coded as 1, and participants who commented on both vignettes were coded as 2.

Stereotype Threat. Participants' predicted stereotype threat was measured by Belmi, Barragan, Neale and Cohen's (2015) five-item self-report stereotype threat scale that tapped onto participants' anticipated concern that they would be evaluated at the company based on their gender (e.g., "At this company, I would worry that people will draw conclusions about my competence based on my gender group"; $\alpha = .97$). Three items in this measure were originally developed by Cohen and Garcia (2005), and have been utilized widely in past research to assess self-report stereotype threat (see Van Loo & Rydell, 2013; Cheryan et al., 2009, Pietri et al., prep). Participants rated their level of agreement with the items using a 5-point response scale (1 = strongly disagree, 5 = strongly agree). Items were averaged to index one overall stereotype threat score, with higher scores indicating a higher level of predicted threat.

Organizational Belonging. To examine participants' predicted sense of belonging at the hypothetical LabTech organization, we employed three scales that assessed distinct constructs related to belonging. In particular, we employed Walton and Cohen's (2007) three-item measure of social fit (e.g., "People in this company would like me"; $\alpha = .80$), Purdie-Vaughns et al.'s (2008) six-item measure of trust and comfort (e.g., "I think I could be myself at this company"; $\alpha = .89$), and Highhouse, Lievens, and Sinar's (2003)'s five-item measure of organizational attraction (e.g., "This company is attractive to me as a place for employment"; $\alpha = .94$). For all three assessments, participants rated their level of agreement using a 5-point response index (1 = strongly disagree, 5 = strongly agree). These three subscales (i.e., social fit, trust and comfort and organizational attraction scales) were all significantly correlated (see Table 2.). In order to determine these three scales tapped into distinct constructs, we submitted the items to principal components analysis with a direct oblimin rotation. The factor analysis revealed three dimensions with eigenvalues greater than one; however, these three factors were still significantly correlated. As a result, z-scores were calculated and averaged to obtain a composite measure indexing general organizational belonging. Higher scores indicated greater sense of anticipated belonging at hypothetical LabTech Company ($\alpha = .95$).

Awareness of Gender Bias in STEM As an Additional Exploratory Measure. To demonstrate that our gender bias module functions as an efficacious diversity intervention, we assessed participants' awareness of gender bias in the sciences using Pietri et al's (2017) eight-item scale (e.g., "In my opinion women in science fields often are not taken as seriously as their male colleagues"). We added this measure for two reasons- a) to demonstrate that the gender bias module was efficacious at increasing awareness of gender bias and b) because increased awareness of gender bias in STEM would help to explain why participants might predict decreased organizational belonging at a STEM company.

Participants rated their level of agreement on items using a 5-point response index (1 = strongly disagree, 5 = strongly agree) and items were averaged, with higher scores indicating a higher awareness of subtle gender bias in STEM-related disciplines. (α =.88).

Mediators

Trust with Group. Participants' predicted trust with their group was measured using a six-item scale developed by Jarvenpaa, Knoll and Leidner (1998). Participants rated their level of agreement on items using a 5-point response index (1 = strongly disagree, 5 = strongly agree) indexing how much they trusted and felt comfortable with their training group. A sample item from this scale is "I expect that I would be able to rely on people in my group". Items were averaged with higher scores reflecting a higher sense of trust with group (α = .89).

Identification with Group. Participants' perceived identification with their group was measured using a modified three-item scale originally employed by Pietri, Johnson, and Ozgumus (under review), assessing participants' predicted sense of identification with and similarity to the people in their virtual group (e.g., "I identify with the people in my group"). Participants rated their level of agreement on items using a 5-point response index (1 = strongly disagree, 5 = strongly agree) and items were averaged, with higher scores indicating a higher sense of perceived identification with group (α = .91).

Demographics

Participants were asked to provide demographic information including: (a) Age, (b) Race and ethnicity, (c) Country and state of residency, (d) Political orientation (e) Educational attainment, (f) Number of STEM courses they had taken in high school and college, and (g) if they ever worked or are currently working in a STEM field.

CHAPTER 3. RESULTS

To examine the hypothesized main effects for information condition (Hypotheses 1a & 1b) and group gender composition condition (Hypotheses 2a & 2b), separate between-subjects ANOVAs were run with information condition and group gender composition condition as between-subjects predictors. Hypotheses 3a, 3b and 3c, which predicted a moderated mediation model, were tested using Hayes' (2013) PROCESS Macro. All means, standard deviations and intercorrelations between measures are presented in Tables 1 through 5.

Organizational Belonging

As anticipated, there was a significant information condition by group gender composition condition interaction predicting participants' organizational belonging, $F(1,445)=4.715$, $p=.030$, $\eta_p^2=.010$ (see Figure 2.). In line with hypothesis 2a, in female minority condition participants who were assigned to gender bias information condition were significantly lower in their predicted organizational belonging compared to participants assigned to control condition, $F(1,445)=4.398$, $p=.037$, $\eta_p^2=.010$, Mean difference: .25, 95% CI: .016, .490. In contrast, in female majority condition, there was no significant difference of information condition on participants' organizational belonging, $F(1,445)= .937$, $p=.334$, $\eta_p^2=.002$, Mean difference=.12, 95% CI: -.119, .350. For participants in female majority group condition, greater representation of their gender protected their predicted sense of organizational belonging to hypothetical LabTech company. Finally, there was no main effect of information condition, $F(1,445)= .655$,

p=.419, η_p^2=.001, or group gender composition, F(1,445)= .027, p=.869, ηp2=.0001, on participants' organizational belonging.

Stereotype Threat

Contrary to our predictions, which hypothesized that group gender composition would result in participants in female majority groups experiencing lower stereotype threat, there was no significant interaction of information condition by group gender composition condition predicting participants' anticipated stereotype threat, F(1,447)=.242, p=.623, η_p^2=.001. Similarly, the main effect of group gender composition on participants' anticipated stereotype threat was not significant, F(1,447)=.191, p=.662, η_p^2=.0001. However, in line with our hypothesis 1a, the main effect of information condition was statistically significant, F(1, 447)=64.041, p<.001, η_p^2=.125, Mean difference=.77, 95% CI: .584, .964. Participants assigned to gender bias module information indicated significantly greater stereotype threat than those assigned to view the control module information. Thus, increasing awareness of gender bias in STEM increased women's self-reported stereotype threat, but having a female majority group did not alleviate this threat.

Verbal Participation

Contrary to predictions, the interaction between information condition and group gender composition predicting participants' likelihood to comment on the vignettes (i.e., verbal participation) did not reach significance, F(1,450)=.291, p=.59, η_p^2=.001. Similarly, the main effects of information condition, F(1,450)=.284, p=.59, η_p^2=.001 and group gender composition condition, $F(1,450)=.007$, $p=.93$, $\eta_p^2=.0001$ were not significant.

Awareness of Gender Bias in STEM

In line with previous research validating this measure (e.g., Pietri et al., under review), there was no significant interaction of information condition by group gender composition condition interaction predicting participants' awareness of subtle gender bias in sciences, $F(1,449)=.031$, $p=.860$, $\eta_p^2=.0001$. Similarly, the main effect of group gender composition on perceived awareness of gender bias was not statistically significant, $F(1,449)=.611$, $p=.435$, $\eta_p^2=.001$. In contrast, the main effect of information condition on participants' recognition of gender bias was significant, $F(1,449)=.54.996$, $p<.0001$, $\eta_p^2=.109$, Mean difference=.50 , 95% CI: .371, .638.

Mediators

Identification with Group

In line with our predictions, there was significant information condition by group gender composition condition interaction predicting participants' identification with their group, $F(1,450)=8.231$, $p=.004$, $\eta_p^2=.018$. Participants in the female majority condition felt significantly more identification with their group when they were assigned to gender bias module condition, $F(1,450)=11.612$, $p=.001$, $\eta_p^2=.025$., Mean difference=.36, 95% CI: .151, .561, relative to those assigned to control module condition. In contrast, participants in the female minority condition did not significantly differ in their predicted identification with their training group, *F*(1, 450)=.445, *p=.505,* η_p^2=.001, Mean difference=. -.07, 95% CI: -.279, .137. Additionally, neither the main effect of group gender composition, *F*(1, 450)=3.675, *p*=.056, η_p^2=.008, or information condition, *F*(1, 450)=3.684, *p*=.056, η_p^2=.008, was not statistically significant.

Trust with Group

Contrary to earlier predictions, there was no significant interaction of information condition by group gender composition condition interaction predicting participants' perceived trust with their group, *F*(1,448)=1.198, *p*=.274*,* η_p^2=.003. Similarly, the main effect of information condition, *F*(1,448)=.010, *p*=.920*,* η_p^2=.0001, Mean difference= -.01, 95% CI: -.117, .105, and of group gender composition on participants' trust with their group were not significant.

Moderated Mediation Analyses

The full hypothesized framework (see Figure 1) predicted that in female majority condition, gender bias information condition would increase trust and identification with group, and these indirect effects would result in greater organizational belonging, decreased stereotype threat and greater willingness to speak up in the form of commenting on diversity scenarios (i.e., conditional indirect effects). However, between-subjects ANOVA results revealed that trust with group did not demonstrate statistically significant main or interactive effects with any of the predictors. Thus, instead of testing moderated parallel mediation model (i.e., with 2 parallel mediators), trust with group variable was omitted from the model, and moderated mediation analyses were conducted with only one mediator (i.e., identification with group). Thus, to test the full model, we ran a moderated mediation analysis predicting organizational belonging, stereotype threat, and speak-up (across three separate models) using Hayes' (2013) PROCESS Macro Model 8 and 10,000 bootstrap resamples, with information condition as the independent variable, group gender composition as moderator, and identification with group as mediator. Model 8 tests both the direct and indirect effects of the independent variable on the outcome variable, and both of these effects (i.e., the path from independent variable to mediator variable as well as the direct path between independent variable and the outcome variable controlling for the mediator) are moderated.

Organizational Belonging

First, with organizational belonging as the outcome variable, we found that in the female minority condition, the conditional indirect effect of information condition on participants' organizational belonging was not significant (-.011, 95% CI: -.0603, .0234) (see Figure 2). In contrast, the conditional indirect effect of information condition on organizational belonging in female majority condition was significant (.060, 95% CI: .0170, .1267). Participants in female majority condition indicated significantly higher identification with their group in the gender bias information than control information condition, and higher identification with their group predicted more organizational belonging at the STEM company.

Stereotype Threat

Next, with stereotype threat as the outcome variable (see Figure 3.), we found that in the female minority condition, the conditional indirect effect of information condition on participants' stereotype threat was not significant (.004, 95% CI: -.0072, .0447). Likewise, the conditional indirect effect of information condition on stereotype threat via identification with group in female majority condition was also not significant (-.020, 95% CI: -.0774, .0231).

Verbal Participation

Testing verbal participation as the outcome (see Figure 4), we found that in the female minority condition, the conditional indirect effect of information condition on participants' verbal participation again was not statistically significant (-.012, 95% CI: -.0548, .0245). However, the conditional indirect effect in female majority condition was statistically significant (.063, 95% CI: .0209, .1255). Thus, participants in the female majority group experienced more identification with their group in the gender bias information condition than in the control information condition, and identifying more strongly with their group increased the likelihood of them speaking-up in the form of leaving a comment for the vignette.

Exploratory Moderated Parallel Mediation Model

As anticipated, the conditional indirect effect of information condition on participants' organizational belonging at the STEM company through identification with group was significant in female majority condition. As expected, however, the total effect of information condition on organizational belonging was not significant (see Figure 2). Information condition (i.e., gender bias module) increased awareness of gender bias in STEM, which in turn led to lower organizational belonging. In parallel to that, gender bias module also increased identification group, with led to greater organizational belonging.

In order to further examine why this nonsignificant finding occurred, we ran a moderated parallel mediation analysis predicting organizational belonging once again using PROCESS model 8 and 10,000 bootstrap resamples, with information condition as the independent variable, group gender composition as moderator, and identification with group and awareness of gender bias in STEM as the mediators (see Figure 7). In female majority condition, there was a significant indirect effect of identification with group (.06, 95% CI: .0174, .1244) and awareness of gender bias (-.11, 95% CI: -.2050, -.0452), and because these indirect effects were going in opposite directions, they suppressed each other (i.e., resulted in a null effect). Put differently, in the female majority condition the total effect (.12) of information condition on organizational belonging is the combination of the direct effect (*ć*=.14) plus the indirect effect of identification with group (.06) and the indirect effect of awareness of bias (-.11). Thus, the indirect effect of awareness of bias nullifies the indirect effect of identification with group in female majority condition, and the total effect of information condition on organizational belonging is not significant.

However, in the female minority condition, there was again a significant indirect effect of awareness of bias –(.11, 95% CI: -.2100, -.0482) but no indirect effect of identification with group (-.01, 95% CI: -.0598, .0211). As a result, the indirect effect of identification with group does not suppress the indirect effect of awareness of gender bias, and the total effect of information condition on organizational belonging is significant. In the female minority condition, the gender bias information resulted in increased awareness of gender bias in the sciences, which decreased participants' anticipated organizational belonging at a STEM company (see Figure 8).

CHAPTER 4. DISCUSSION

General Discussion

The primary goal of the current research was to raise awareness of gender bias against women in STEM disciplines without inadvertently eliciting social identity threat. Prior research suggested that increased perceptions of bias and discrimination against one's social identity harm one's psychological wellbeing (Ashburn-Nardo et al., 2007; Schmitt et al, 2002a; 2002b). Knowledge of bias also may act as a potent identity-threatening cue, which can trigger social identity threat concerns for chronically stigmatized individuals (Murphy & Taylor, 2012). In particular, this information can elicit concerns about belonging and stereotype threat. Indeed, recent research documented that a brief diversity intervention consisting of short, compelling videos portraying examples of how sexism takes place in STEM environments resulted in women reporting decreased belonging and increased stereotype threat in a STEM environment (Pietri et al., under review). Thus, diversity interventions targeting positive outcomes (i.e., increasing awareness of gender bias and reducing sexism) in STEM may also inadvertently lead to negative outcomes for women (Pietri et al., under review).

Fortunately, prior research has also suggested that adding subtle identity-safe cues to a setting (e.g., exposure to successful female role models, numerical representation of women in a group) can help neutralize a threatening environment (Murphy & Taylor, 2012). For example, Dasgupta (Stereotype Inoculation Model; 2011) suggested that exposure to relatable role models may help women identify more with the sciences, reinforce their sense of belonging in these fields, and avoid internalizing harmful gender stereotypes about women's ability in these domains (Stout et al., 2011). In related work, Dasgupta and her colleagues (2015) further found that female students in an engineering class experienced lower social identity threat when they worked in small groups consisting of a female majority compared to their counterparts in male-dominant small groups. Consequently, the female majority groups acted as an identity-safe cue that helped protect women against the detrimental gender stereotypes prevalent in engineering (Dasgupta et al., 2015). Additionally, women in female-dominant groups were far more likely to speak up than those in female minority groups. Their findings reinforced the importance of women's numerical representation, and how the presence of same-sex peers can enhance perceptions of identity-safety for women in negatively stereotyped domains.

The current research expands upon past work and research by demonstrating that group gender composition (i.e., female majority group settings) can help mitigate the harmful effects associated with increasing gender bias awareness, and at least indirectly, encourage women to speak up and engage in discussions about sexism. In particular, replicating previous research (Pietri et al., under review), we found that participants in female minority condition anticipated experiencing a lower sense of belonging (i.e., a decrease in predicted organizational belonging) and higher stereotype threat at a hypothetical STEM company compared to the participants in the control information condition. In contrast, there was no significant effect of gender bias information on participants' predicted organizational belonging in female majority condition. Consequently, the numerical overrepresentation of their gender protected women in female-dominant groups from some of the negative effects associated with a diversity intervention that encourages awareness of gender bias in STEM.

Interestingly and contrary to predictions (Hypothesis 3a), participants in the control condition did not identify more with their groups in female majority condition, compared to female minority condition. However, when participants learned about gender bias information and experienced social identity threat, they identified more strongly with the female majority training group as opposed to female minority group. This particular finding nicely replicates recent work (Pietri, Young & Ozgumus, under review), which found that compared to control information, information about gender bias in STEM encouraged identification with female scientist role models, even when they were portrayed as particularly atypical. Increased identification with these successful scientists, then, partially alleviated the social identity threat triggered by increased awareness of gender bias. That is, without a successful female role model, female participants anticipated feeling less belonging and trust at a STEM company; however, being presented and identifying with a successful female scientist protected women from this negative consequence. The current experiment extended this research by demonstrating that gender bias information also encouraged participants to identify with female majority training groups, which were comprised of typical women from the general population (e.g., accountants, homemakers) and who were not successful scientists. Additionally, identifying more with their training group predicted higher organizational belonging, and ultimately protected female participants from experiencing belonging concerns in a STEM environment. Extending Dasgupta's (2011) Stereotype Inoculation model, the current experiment demonstrated that even non-scientist female peers can act as successful identity-safe cues, and help partially alleviate the social identity threat elicited by bias awareness in diversity interventions.

Finally, in the gender bias information condition, participants in the female majority condition felt more identification with their group than participants in the female minority group and this enhanced identification related to a higher likelihood of speaking up in the form of leaving a comment. Thus, we found that female majority group, at least indirectly, encouraged more participation than the female minority group through feelings of identification. This provides some initial evidence that in a diversity training group, women may be more inclined to participate in a female majority than in a female minority group.

Practical Implications

Stark gender disparities continue to persist in many STEM disciplines, with women earning only 20% of the undergraduate degrees in math-intensive sciences (NSF, 2015). In particular, gender bias (Moss-Racusin et al., 2012) and an unwelcoming environment (Cheryan, Ziegler, Montaya & Jiang, 2016) that signals women that they might not belong in these fields have been consistently documented as most likely culprits of this notable disparity. It is, therefore, imperative to raise awareness of often-subtle sexism occurring in sciences to create and sustain diverse, fair and inclusive climates in STEM environments. Despite a few notable exceptions, however (e.g., Carnes et al., 2012; 2015, Shields, Zawadzki & Johnsson, 2011), theoretically informed diversity interventions addressing gender inequities are rare, and even more so for STEM disciplines (Moss-Racusin et al., 2014). Moreover, a number of these diversity workshops (e.g., WAGES; Shields et al., 2011) can be resource intensive in terms of time and financial commitments required.

Many successful diversity interventions addressing gender bias educate participants by first recognizing the pernicious effects pertaining to sexism (e.g., Becker & Swim, 2011; Carnes et al., 2014; 2015; Cundiff, et al., 2014; Pietri et al., 2017, Zawadzki et al., 2012). Thus, the current work has several practical implications for future diversity trainings and workshops, and how they are implemented. In the current research, we found that even a brief online diversity intervention increased social identity threat for women in the female minority training group. Thus, our findings indicate that diversity practitioners should consider exploring whether interventions that raise increase recognition of sexism in STEM also inadvertently elicit social identity threat for women. Additionally, when developing new trainings, it will be important to incorporate identity-safe cues in order to neutralize any potential threat associated with these trainings.

In the current research, we identified gender composition as a potential way to counter the social identity threat elicited by diversity trainings. It is compelling that the female-dominant group consisted of female peers (and not successful scientists) in an online training setting. Even these virtual peers were effective identity-safe cues that protected women from the concerns about belonging at STEM company. As a result, diversity practitioners may consider integrating this fairly easy identity cue (i.e., female numerical representation) in their online diversity trainings. Specifically, in the current experiment we employed a brief online diversity intervention that was resource efficient and easy to administer, which diversity practitioners could use independently or in combination with existing training modules. As such, diversity trainings, which can be time and resource intensive, may be implemented online in a resource-efficient and non-threatening manner. Indeed, many new initiatives and trainings for graduate students and postdocs focus on administering trainings via an online platform. For example, Center for the Integration of Research, Teaching and Learning (CIRTL) is an NSF-funded project, whose mission is to provide training for graduate students and postdocs, and enhance teaching effectiveness and classroom inclusivity in STEM fields throughout United States. To accomplish this goal, they utilize an online network to administer virtual training courses (McDaniels, Pfund & Barnicle, 2016).

Finally, the current experiment speaks more broadly to gender composition as an identity-safe cue in online settings that are not necessarily associated with diversity trainings. Dasgupta et al. (2015) found that female-dominant small workgroups helped protecting women against social identity threat in engineering classrooms. However, an increasing number of STEM classes are being delivered online (e.g., Massive Open Online Courses-MOOCs, MIT Open Courseware). Thus, a practical implication of current study indicates that having female majority online learning groups may help protect women from social identity threat in threatening STEM online classes and may ultimately enhance the learning outcomes of women in virtual STEM settings.

Limitations and Future Directions

Contrary to our prior predictions, female majority group setting did not result in more trust with group (i.e., neither the interaction nor the main effects were significant). It is possible that this nonsignificant finding is a result of utilizing crowdsourcing sampling (MTurk). MTurk participants are different from typical student samples in that they are older, geographically diverse, and have prior work experience in a wide range of professions. Therefore an initial future step for this research could entail validating the same experimental design utilizing a primarily student sample who do not necessarily have extensive work experience or established careers. In addition, it could be of particular interest to replicate this group composition design by recruiting STEM majors as well as women with established STEM careers (i.e., STEM-identified participants).

It is also possible that the virtual group setting contributed to the lack of effect on trust with their group members. In an in-person group setting, participants may be more inclined to feel higher or lower trust with their group members, particularly as a result of interpersonal contact. Additionally, although we found that the female majority group indirectly resulted in more verbal participation through its influence on identification, we did not find any main effects of information or group composition conditions on this outcome. This lack of effect may have been another limitation associated with the online group setting. Certainly, leaving a comment is far less intimidating compared to speaking up in an in-person group setting, where one group member could immediately dismiss another's comments. Indeed, in in-person groups women are less likely than men to initiate conversations (Dovidio, Brown, Heltman, Ellyson & Keating, 1988) or speak-up (e.g., Brescoll, 2011). Furthermore, our virtual group setting might have resulted in participants' having a less "personable" experience. Participants were aware of the brief nature of their interaction with other participants (i.e., "strangers") and therefore might have chosen not to invest in any efforts in verbally participating. Consequently, future research might productively replicate our findings using in-person groups.

Another limitation of present work was that gender bias information increased reported stereotype threat at the hypothetical STEM company, but the female majority identity-cue did not alleviate this threat. Though contrary to our predictions, this pattern of results was also found in previous research (Pietri et al., under review). Mitigating this increased self-reported stereotype threat may be challenging. After women are made aware of gender bias in the sciences, they may be particularly vigilant about the possibility of being evaluated based on their gender in STEM environments, and ultimately report higher stereotype threat (Pietri et al., under review). Thus, even with the presence of identity-safe cues, women may report increased feelings of stereotype threat after learning about gender bias. However, it is also important to note that identity-safe cues do not necessarily have to alleviate all aspects of social identity threat. Rather, these cues should encourage beliefs that the threat will not hinder potential (Davis et al., 2005; Murphy & Taylor, 2012; Walton et al., 2015). In the current experiment, the female majority identity-safe cue did not decrease reported stereotype threat in the gender bias information condition but did promote the belief that women could still have positive experiences at a STEM company (i.e., fitting in and belonging) in spite of this threat. Finally, it is also possible that an in-person female-dominant group may have been a stronger identity-safe cue and may alleviate the increased reported stereotype threat.

Contrary to our hypothesis predicting that female majority group setting would benefit women regardless of information condition (i.e., hypotheses 2a and 2b) the female majority group did not differ from the female minority group on any outcome variables in the control condition. Our findings, in this case, did not replicate Dasgupta and colleagues (2015)' effects of female-majority small engineering groups. This limitation may have been a consequence of virtual group setting (i.e., the engineer groups in Dasgupta's work were in-person small groups). Additionally, engineering is a threatening domain where women are negatively stereotyped (Dasgupta et al., 2011; 2015), and Dasgupta and colleagues did not manipulate the threatening engineering context (i.e., did not test whether the female majority groups had beneficial consequences in non-threatening domains). In the current experiment, the female participants in the control information condition most likely did not feel threatened, and therefore, may not have experienced any benefits from being in a female majority as oppose to a female minority group. However, when participants were exposed to social identity threat cues (i.e., were in the gender bias information condition), we nicely replicated Dasgupta et al.'s (2015) results.

One should also note that it may not always be plausible to have groups primarily made up of women, considering how severely underrepresented women are particularly in physical sciences, information technology and engineering domains (NSF, 2015). As such, a future avenue for research can be to engage men in diversity initiatives and formulate ways to make male majority groups an identity-safe cue during diversity trainings. One particular way to convey identity-safety to women is to have men acting as allies against sexism. Emerging research on the role of men in confronting sexism demonstrated in the context of sexism, male allies were more convincing than women in drawing other males' attention into recognizing subtle sexism (Drury & Kaiser, 2014). Thus, to achieve significant progress toward closing the gender gap, organizations should ensure men as well as women are brought on board to combat gender inequalities (Prime & Moss-Racusin, 2009). Diversity researchers and practitioners alike can benefit from examining ways to motivate men into thinking more critically about gender bias and champion gender equality in STEM (Moss-Racusin, Molenda & Cramer, 2015).

Conclusion

In spite of these limitations and avenues for future research, our current work represents important first steps. Through present research, we showed that diversity interventions that increase recognition of gender bias in STEM trigger social identity concerns for women. Nevertheless, deleterious effects of bias awareness can be partially mitigated through the use of identity-safe cues. Diversity interventions are imperative for addressing the favorable treatment of men over women and for advancing gender equity efforts in STEM. Therefore this work has important implications for ultimately working achieve gender parity in the sciences.

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TABLES

Table 1. Reliability Statistics for Outcome Variables

Outcome Variable	Cronbach's α
Identification with Group	.91
Organizational Belonging	.95
Stereotype Threat	.97
Trust with Group	.89

Table 2. Correlations (Pearson's *r*) Among Subscales of Organizational Belonging

Subscale Name	1	2	3
Social Fit	1.00	.747**	.637**
Trust & Comfort at Company	.747**	1.00	.744**
Organizational Attraction	.637**	.744**	1.00

Note. ** p<.01

Table 3. Means and Standard Deviations Across Information and Group Gender Composition Conditions

	Female Majority Group (N=235)		Female Minority Group (N=239)	
	Gender Bias Information (N=107)	Control Information (N=128)	Gender Bias Information (N=127)	Control Information (N=112)
Identification with Group	3.37 (.67)	2.99 (.86)	3.04 (.78)	3.10 (.83)
Organizational Belonging*	.07 (.83)	-.06 (.93)	-.09 (.84)	.12 (.96)
Stereotype Threat	3.18 (.93)	2.46 (1.07)	3.14 (1.02)	2.38 (1.07)
Trust with Group	3.59 (.57)	3.55 (.63)	3.50 (.65)	3.58 (.59)
Verbal Participation**	1.21 (.87)	1.14 (.87)	1.21 (.83)	1.21 (.85)

Note. *Standardized. ** Verbal Participation was coded such that 0=Did not comment at either vignettes, 1=Commented at either vignettes, 2=Commented at both vignettes.

Table 4. Means and Standard Deviations for Demographic Variables

	Mean (Standard Deviation)
Age	37.17 (11.46)
Race & Ethnicity	1.23 (.42)[a]
Political Orientation	1.59 (.75)[b]
Educational Attainment	1.85 (.62)[c]
Employment	.76 (.43)[d]
# STEM courses taken in high school	3.95 (1.86)
# STEM courses taken in college	4.24 (2.93)

Note. [a] 1 = White/Caucasian, 2 = Non-White. [b] 1 = Liberal, 2 = Conservative, 3 = Neutral. [c] 1 = High School, 2 = Associate or Bachelor's Degree, 3 = Advanced Degree. [d] 0 = Unemployed, 1 = Employed.

Table 5. Correlations Between All Variables

	1	2	3	4	5	6	7	8	9	10	11	12
Age	1.00	-.09	-.01	.01	-.01	-.14**	0.00	-.12**	-.002	.12*	-.15**	.20**
Race & Ethnicity	-.09	1.00	.04	-.11*	.005	.04	.07	-.05	.07	.03	.03	-.11*
Educational Attainment	-.01	.04	1.00	-.02	.13**	.30**	.15**	-.11*	-.13**	-.05	.11*	-.03
Political Orientation	.01	-.11*	-.02	1.00	-.03	-.04	.02	.03	.07	.10*	-.18**	-.04
Employment	-.01	.01	.13**	-.03	1.00	.09	-.02	-.01	-.04	.01	-.03	-.06
# STEM courses taken in high school	-.14**	.04	.30**	-.04	.09	1.00	.48**	-.18**	-.16**	.02	.11*	.09
# STEM courses taken in college	0.00	.07	.15**	.02	-.02	.48**	1.00	-.14**	-.07	.07	.02	.08
Trust with Group	.12**	-.05	-.11*	.03	-.01	-.18**	-.14**	1.00	.47**	.27**	-.03	.10*
Identification with Group	-.01	-.07	-.13**	.07	-.04	-.16**	-.07	.47**	1.00	.16**	-.01	.17**
Organizational Belonging	.20**	.03	-.05	.10*	-.01	.02	.07	.27**	.16**	1.00	-.24**	.04
Stereotype Threat	-.15**	.03	.11*	-.18**	-.03	.11*	.02	.03	-.01	-.24**	1.00	.05
Verbal Participation	.20**	-.11*	-.03	-.04	-.06	.09	.08	.10*	.16**	.04	.05	1.00

Note. * $p<.05$. ** $p<.01$

FIGURES

Figure 1. Proposed Conceptual Model

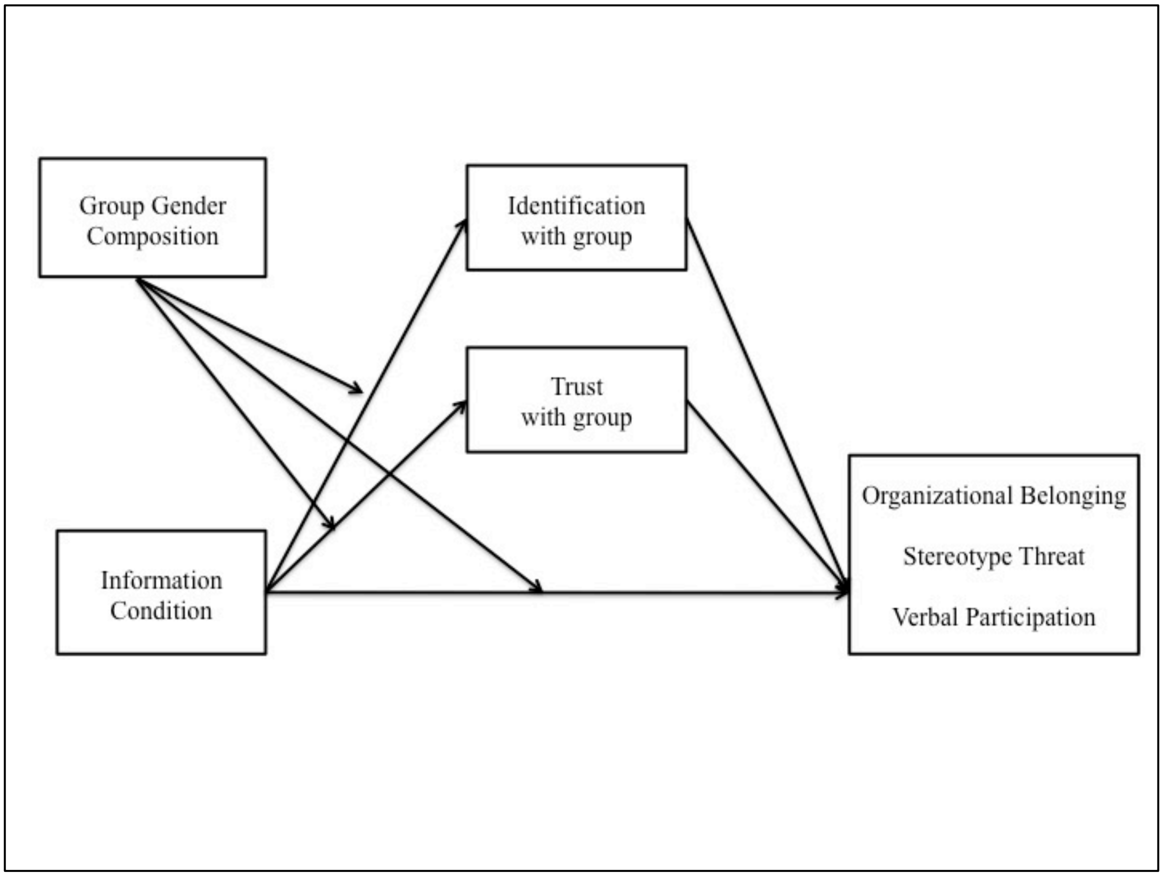


Figure 2. Moderated Mediation Model Predicting Organizational Belonging

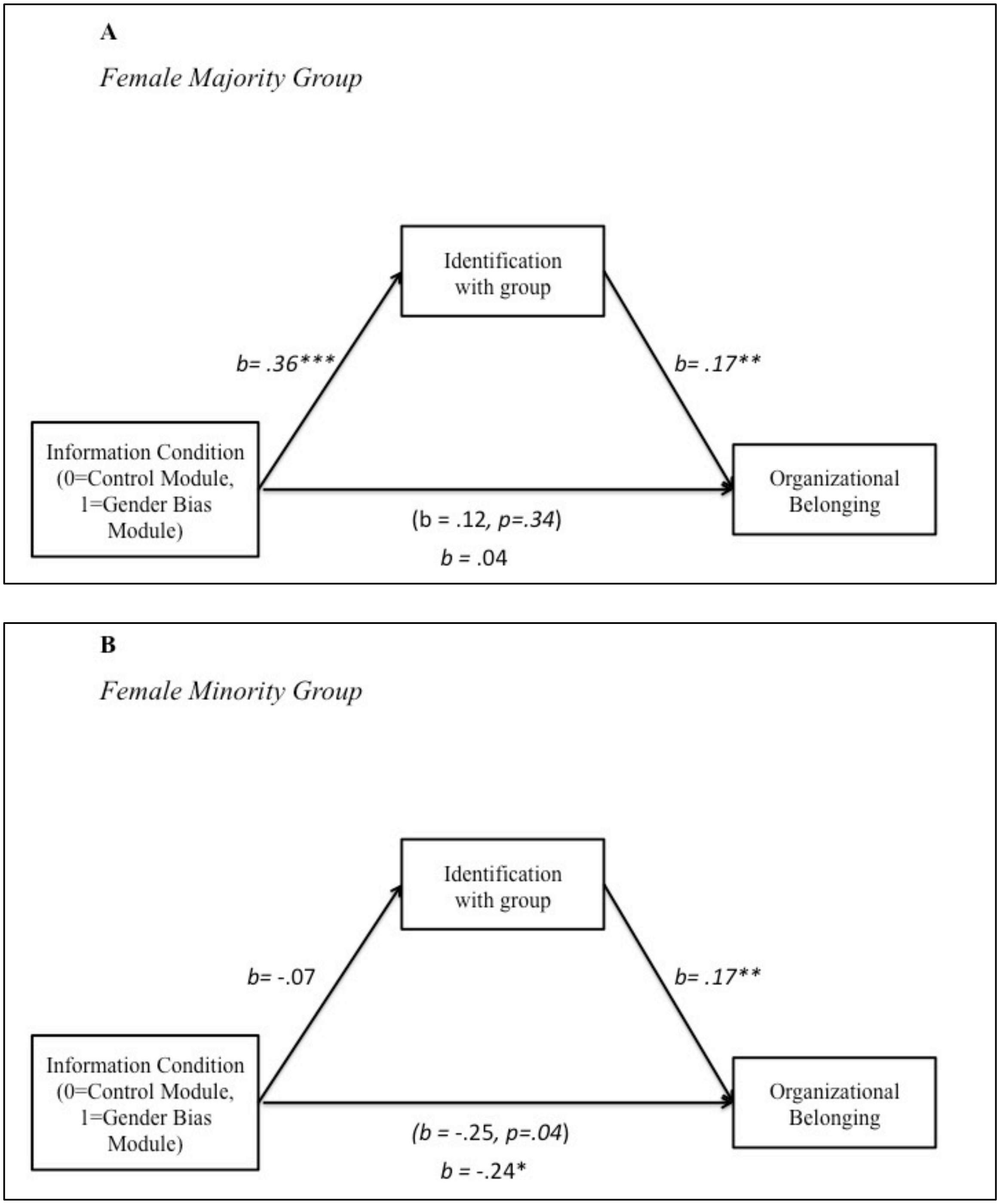


Figure 3. Moderated Mediation Model Predicting Stereotype Threat

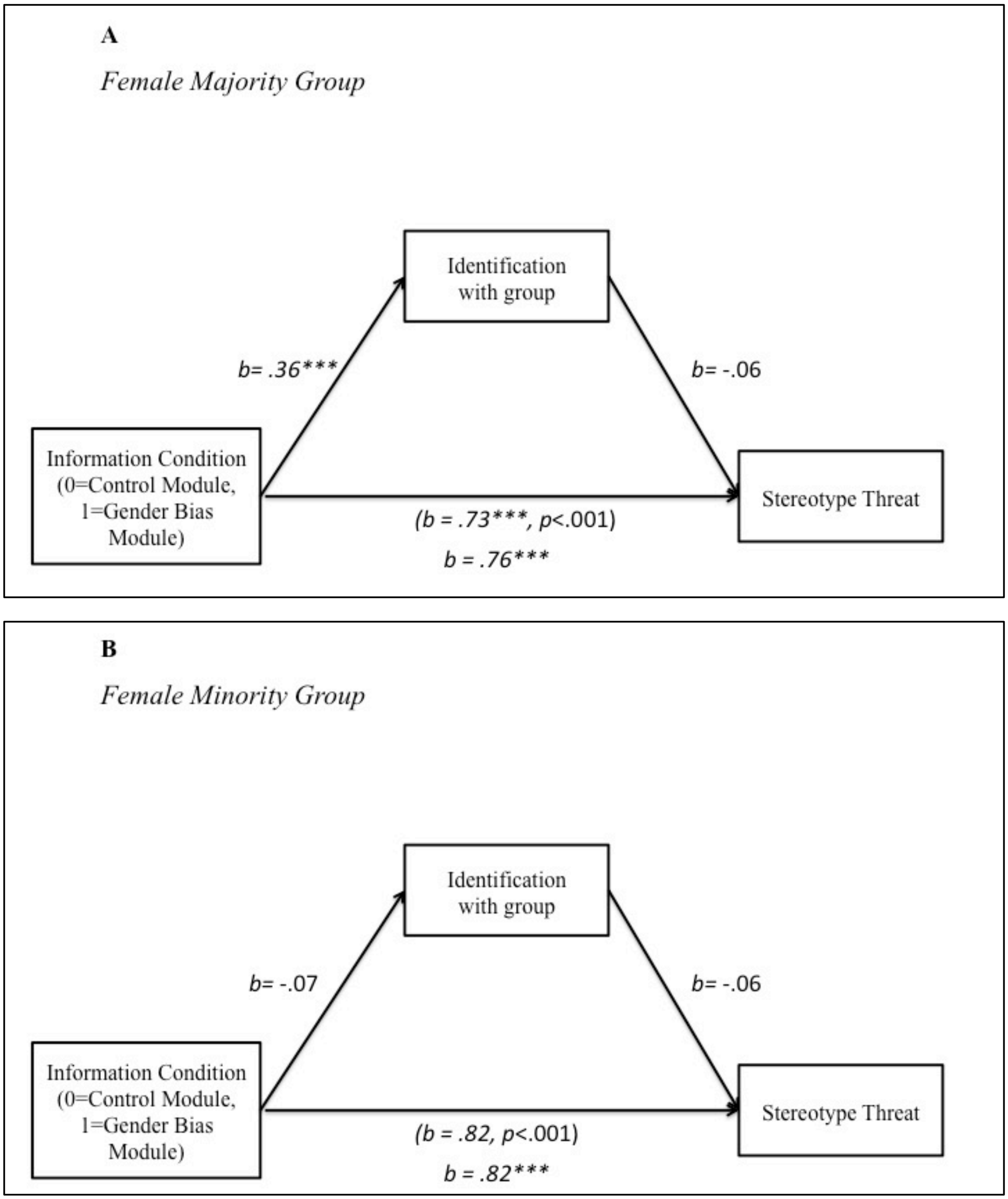
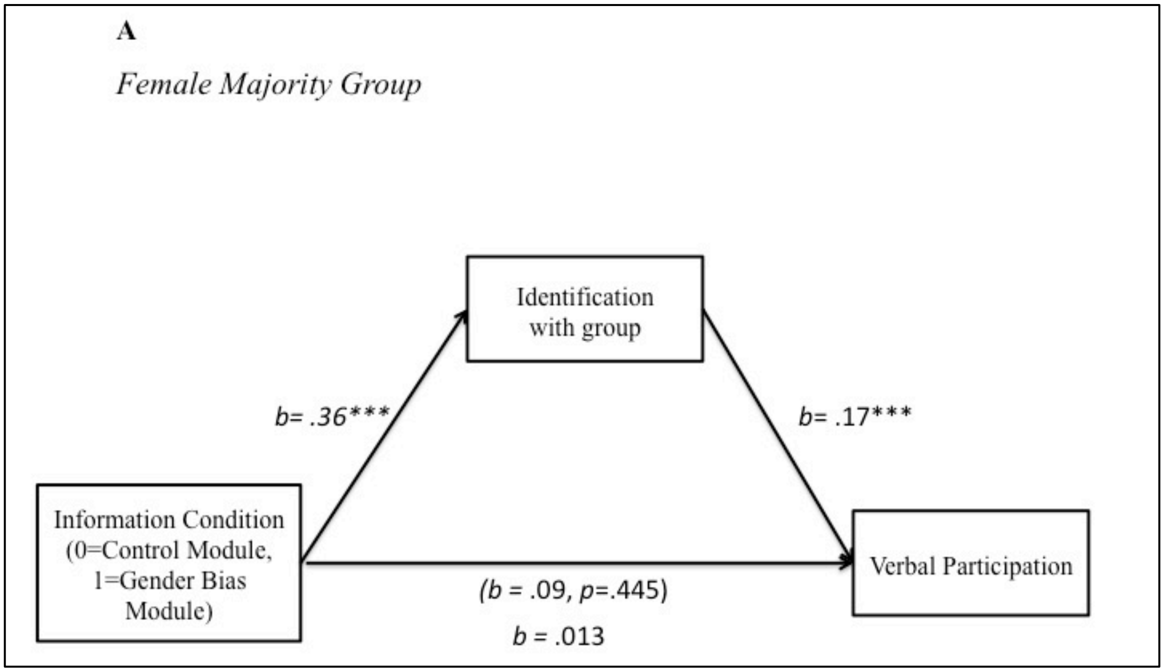


Figure 4. Moderated Mediation Model Predicting Verbal Participation



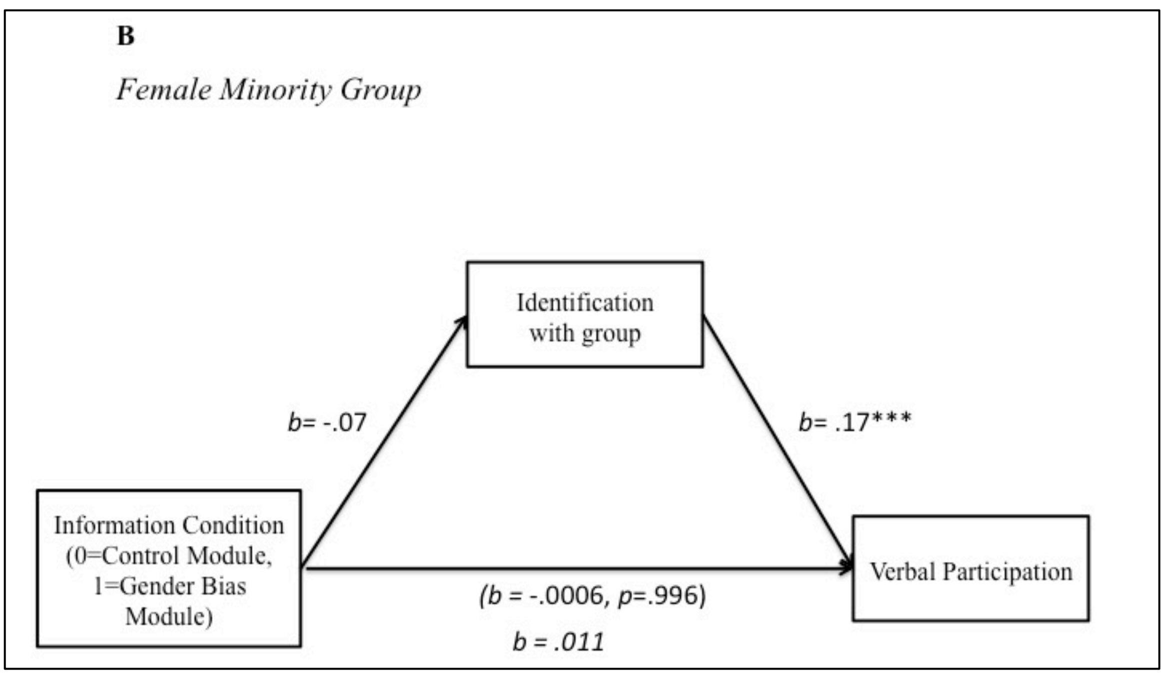


Figure 5. The Interactive Effect of Information Condition and Gender Composition on Organizational Belonging

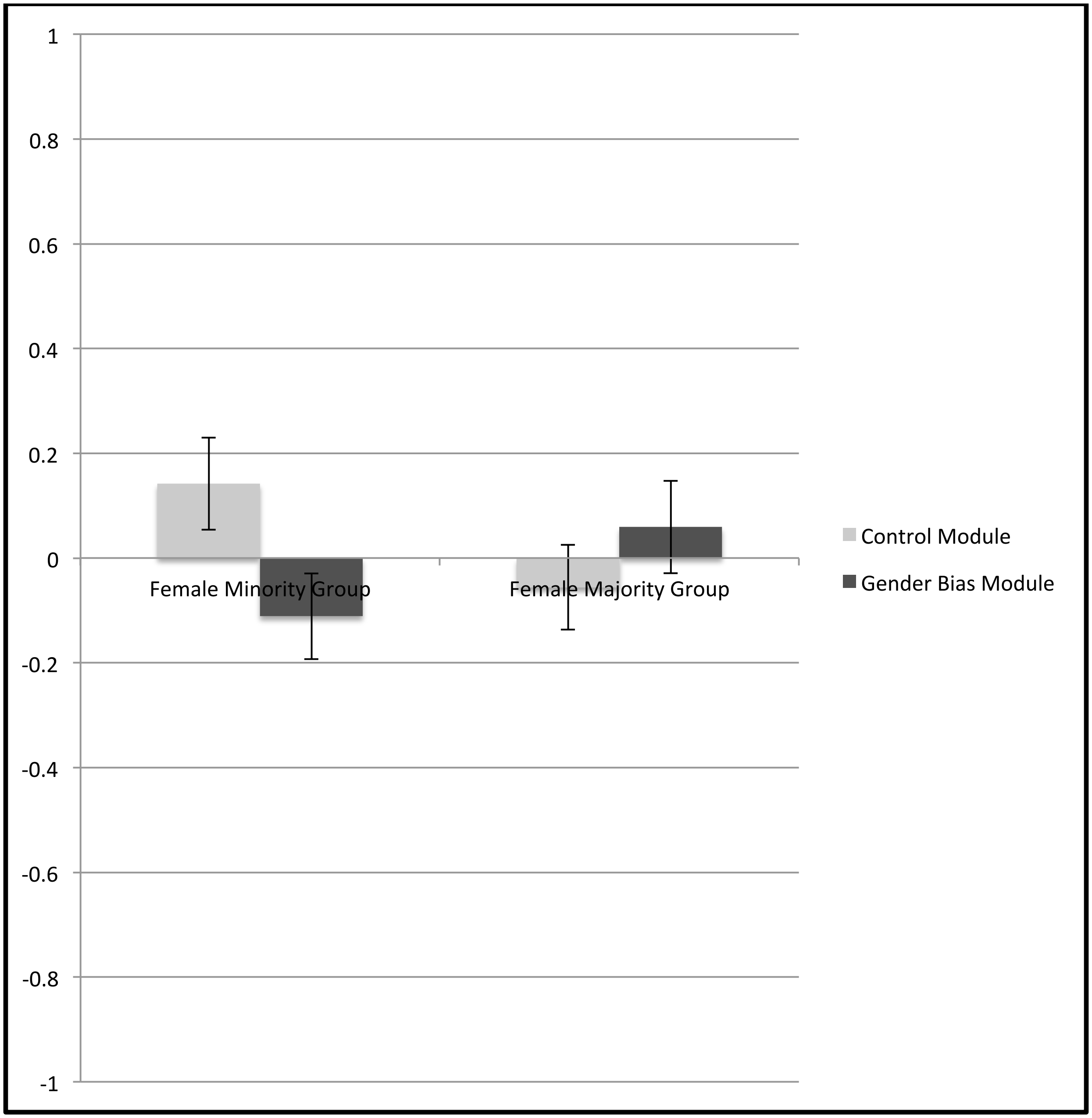


Figure 6. The Interactive Effect of Information Condition and Gender Composition on Identification with Group

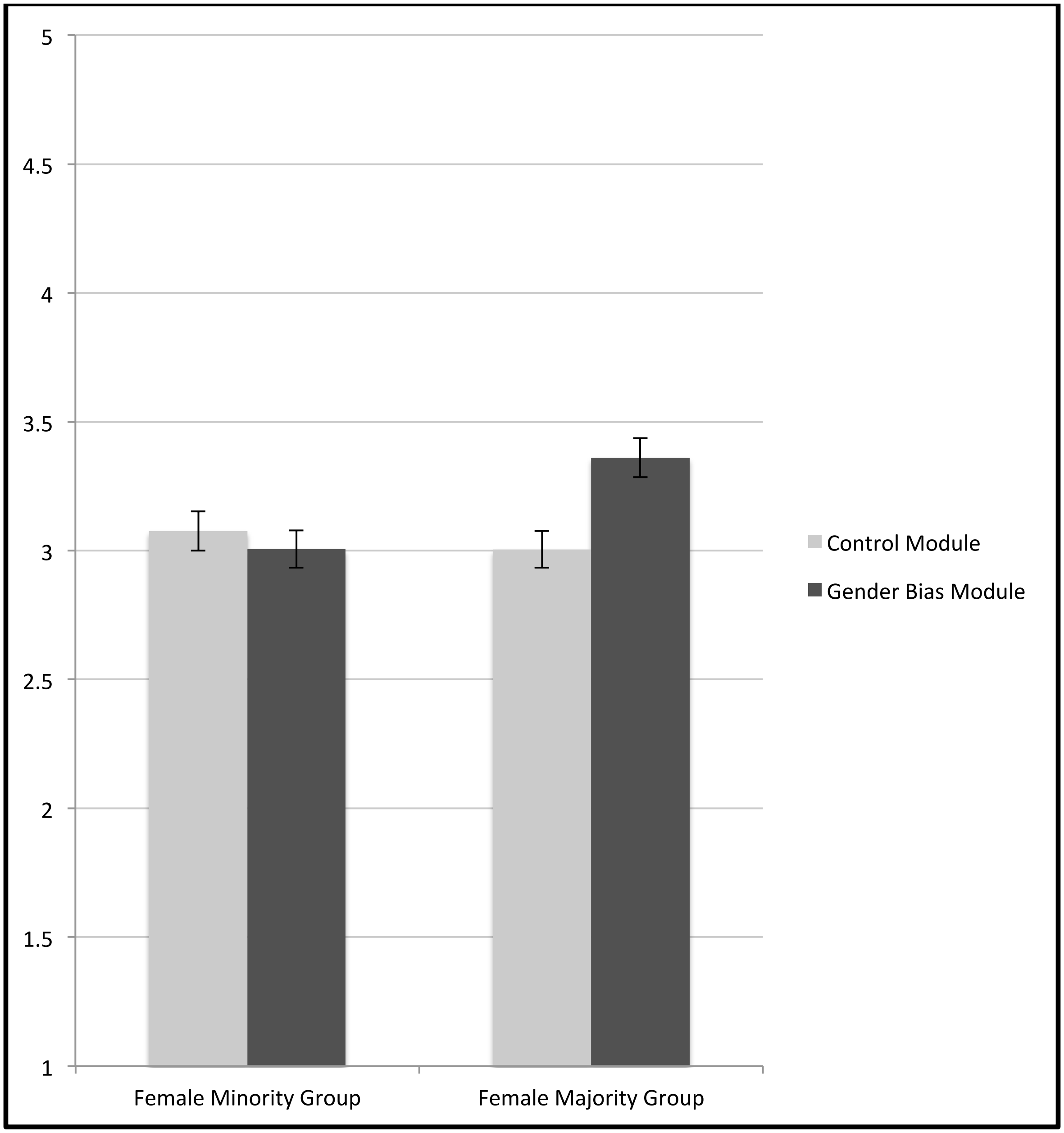


Figure 7. Conceptual Parallel Mediation Model Predicting Organizational Belonging

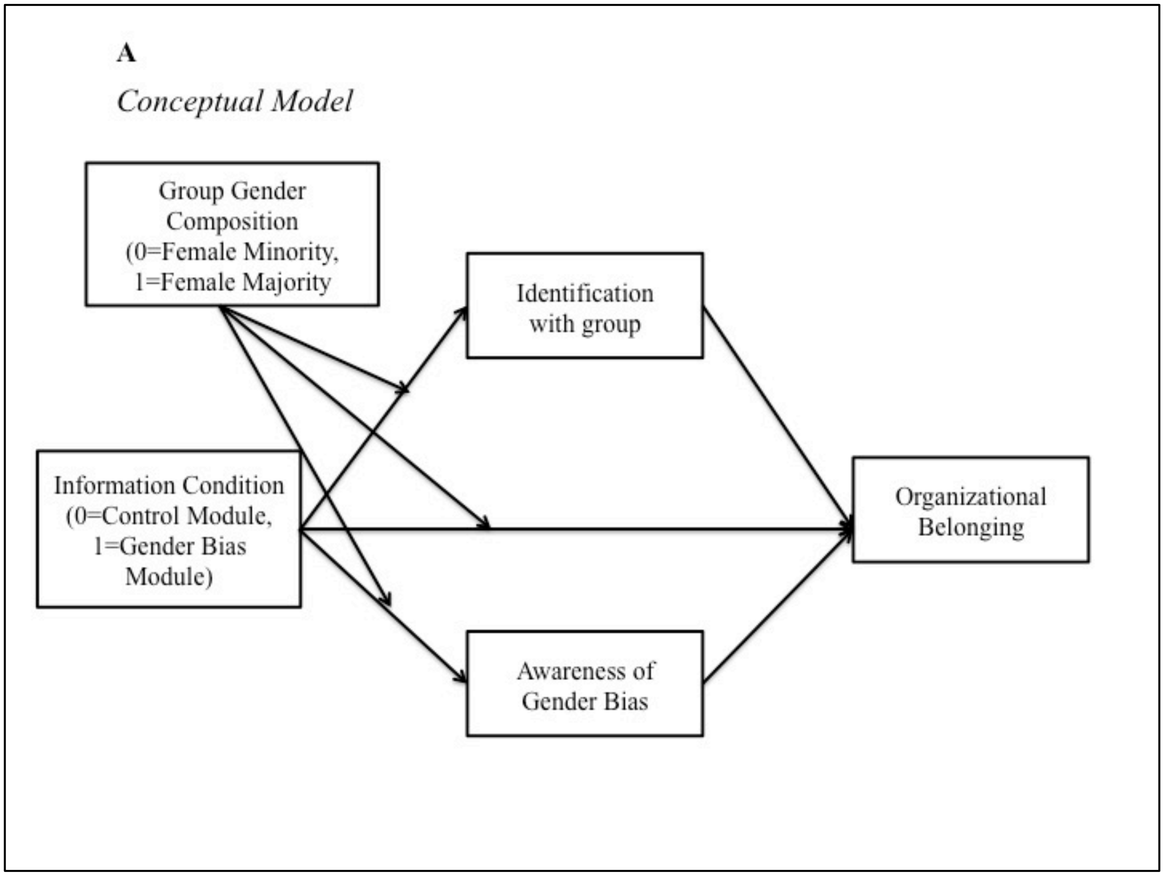
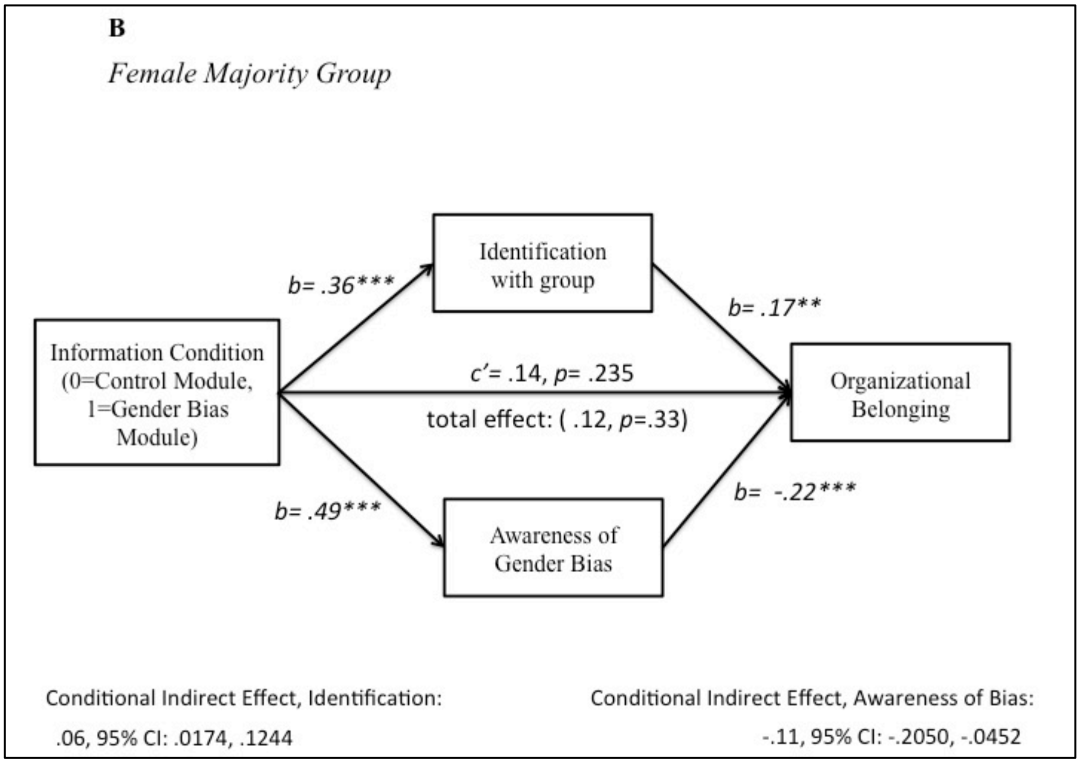
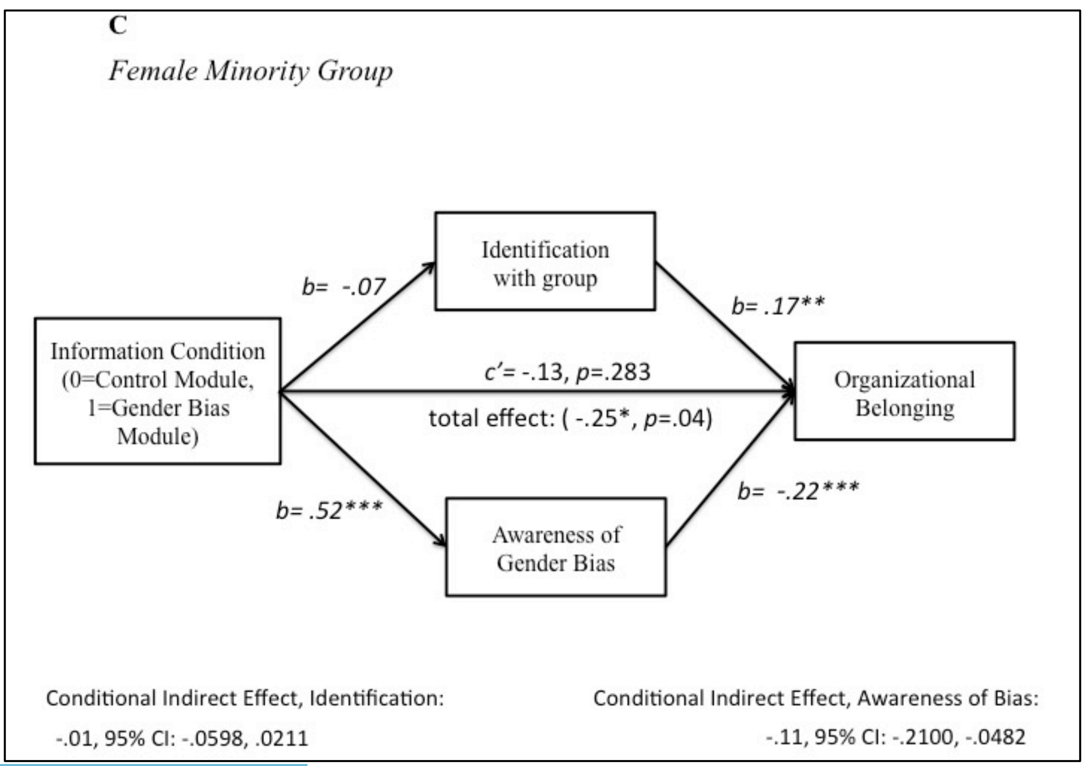


Figure 8. Moderated Parallel Mediation Model Predicting Organizational Belonging





MATERIALS

Impressions of the Company

INSTRUCTIONS: Now imagine you were an employee at LabTech. We are going to ask you some questions working at this company.

Stereotype Threat Measure

INSTRUCTIONS: Imagine you worked at this company. Please indicate the degree to which you agree or disagree with each statement.

1 Strongly Disagree	2 Slightly Disagree	3 Neither Agree Nor Disagree	4 Slightly Agree	5 Strongly Agree

1. At this company, I would often feel that people's evaluations of my performance would be affected by my gender.
2. At this company, I would worry that people will draw conclusions about my competence based on my gender group.
3. At this company, I would worry that people will draw conclusions about me, based on what they think about my gender group.
4. At this company, I would worry that other people will draw conclusions about me based on stereotypes about my gender.
5. At this company, I would worry that people will draw conclusions about my gender based on the performance of other people in my gender group.

Organizational Belonging Measure

INSTRUCTIONS: Imagine you worked at this company. Please indicate the degree to which you agree or disagree with each statement.

1 Strongly Disagree	2 Slightly Disagree	3 Neither Agree Nor Disagree	4 Slightly Agree	5 Strongly Agree

Social Fit

1. People in this company would like me.
2. People in this company would be a lot like me.
3. I would belong at this company.

Trust and Comfort at Company

4. I think I would like to work at a place like this company
5. I think I could "be myself" at this company.
6. I think I would be treated fairly by my colleagues at this company.
7. I think I would trust the management to treat me fairly at this company.
8. I think that my values and the values of this company are very similar.
9. I think that this company's environment would inspire me to do the very best job that I can.

Organizational Attraction

10. For me, this company would be a good place to work.
11. I would not be interested in this company except as a last resort (R).
12. This company would be attractive to me as a place for employment.
13. I would be interested in learning more about this company.
14. A job at this company would be very appealing to me.

Identification with Group Measure

INSTRUCTIONS: Now that you have finished reading the vignettes, please indicate the degree to which you agree or disagree with each statement regarding your group members.

1 Strongly Disagree	2 Slightly Disagree	3 Neither Agree Nor Disagree	4 Slightly Agree	5 Strongly Agree

1. The people in my group seem similar to me.
2. I identify with the people in my group.
3. I relate to the people in my group.

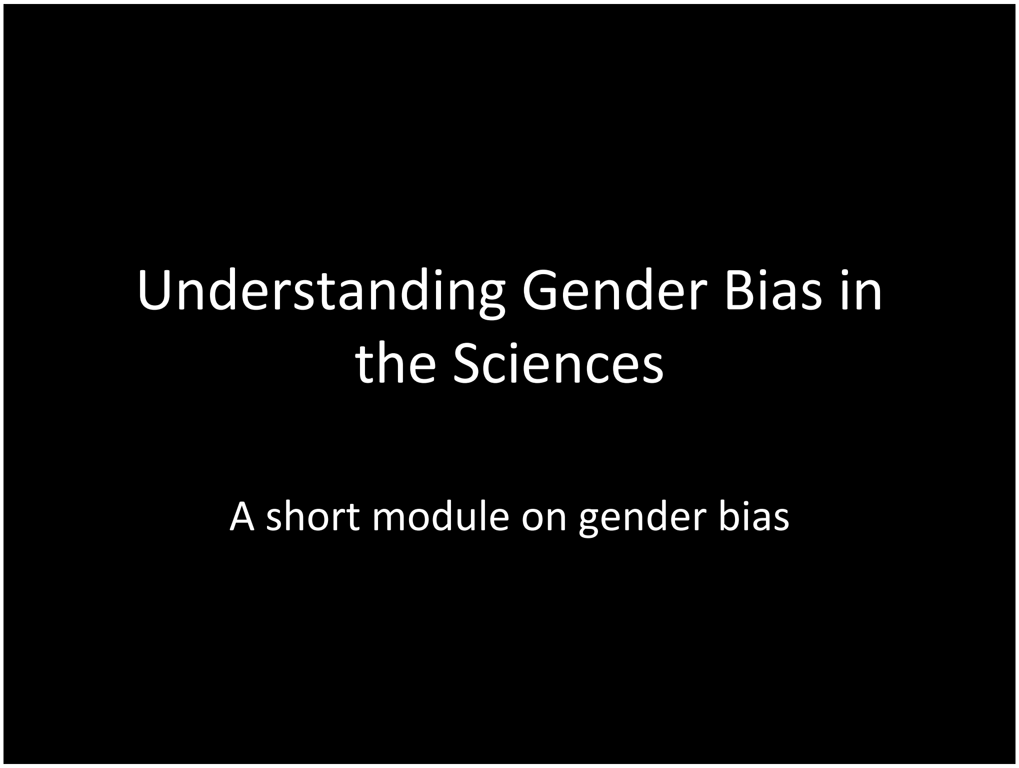
Trust with Group Measure

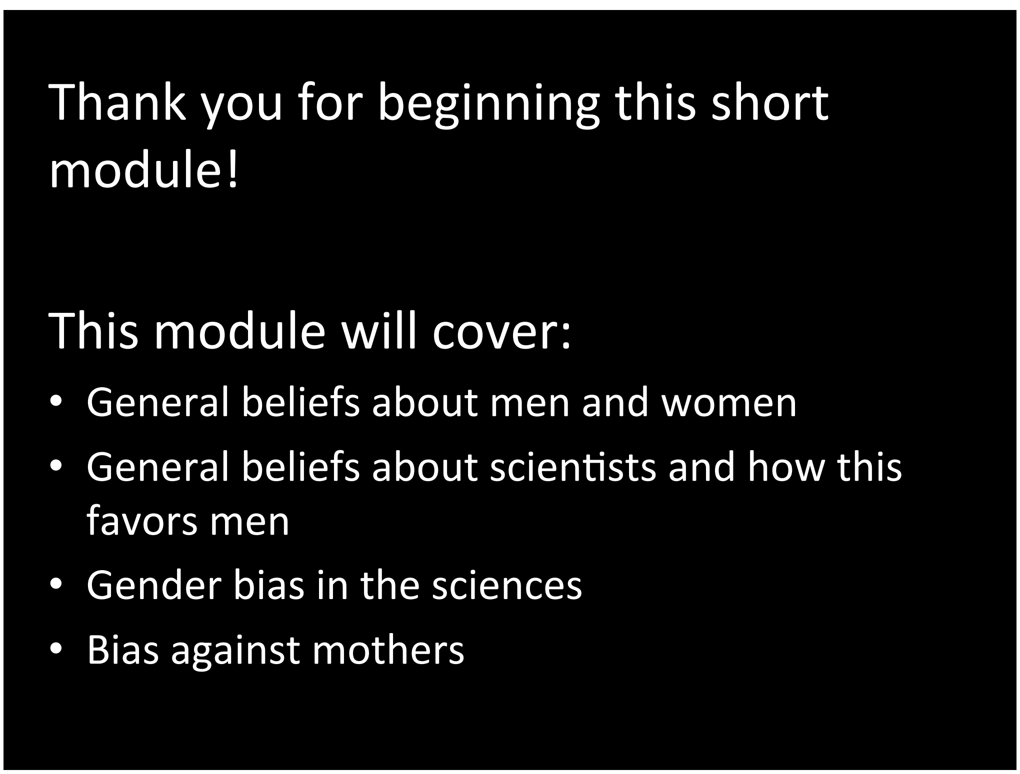
INSTRUCTIONS: Now that you have viewed the module and vignettes together with your group, please indicate the degree to which you agree or disagree with each statement regarding your perceptions with your group.

1 Strongly Disagree	2 Slightly Disagree	3 Neither Agree Nor Disagree	4 Slightly Agree	5 Strongly Agree

1. I expect that members of my group would show a great deal of integrity
2. I expect that I would be able to rely on people in our group
3. I expect that the people in my group would be very trustworthy overall.
4. I expect that we would be usually considerate of one another's feelings in my group.
5. I expect that the people in my group would be friendly.
6. I expect that we would have confidence in one another in my group

Gender Bias Module





You will also read about the experiences of men and women who work in the sciences

All the information in this module is based on scientific research.

The source for each slide will be in the right hand corner.

Source: SOURCES WILL BE LISTED HERE!

GENERAL BELIEFS ABOUT MEN AND WOMEN

The are general beliefs in our society about how men and women act.

- Women are believed to be nice and warm
- Men are believed to be assertive and go getters

These general beliefs also dictate how men and women ***should*** act.

- Women ***should*** be nice and not aggressive
- Men ***should*** be aggressive and not modest

Source: Moss-Racusin et al. (2010) *Psychology of Men and Masculinity*; Rudman and Glick (1999), *Journal of Personality and Social Psychology*

People dislike and are less likely to hire assertive women.

- One study showed participants a video of either an assertive woman or an assertive man applicant.
- Participants rated the assertive woman applicant as having ***lower social skills*** and ***as less hirable*** than the man applicant..

Source: Rudman and Glick (1999), *Journal of Personality and Social Psychology*

HOW THESE GENERAL BELIEFS NEGATIVELY AFFECT WOMEN IN THE SCIENCES

Sarah Evans, who has been working at a biomedical company for 5 years:

"I was worried when I first started working for my company that people would just see me as a nice younger woman. I didn't want to appear timid or like a push over. So during meetings I never shied away from stating my opinions. I would talk-up and try to act really confident in my beliefs. This is how all the successful men acted in my company and so I figured I should act similarly. But my behavior was not very well received. My manager suggested I might want to speak less during meetings and, (he actually said this) act 'nicer.' A colleague told me I tend to come off as a bit aggressive and as a 'know it all.' I want to act confident, but I also want to be liked. It's difficult."

GENERALLY BELIEFS ABOUT SCIENTISTS

There are also general beliefs in our society about how ***scientists*** should act.

- Talented and successful scientists are believed to be assertive, confident, go-getters.

These are the same general beliefs about ***men***

Women ***cannot simply act like men*** in order to be perceived as similar to a successful scientist because women will not be liked or hired.

Source: Diekman et al. (2010)), *Journal of Personality and Social Psychology;* Cejka & Eagly (1999), *Personality and Social Psychology Bulletin*

People have this perception of scientists in part because women are underrepresented in STEM disciplines.

Furthermore, our cultural representation of scientists tends to be male.

Source: Nosek & Smyth (2011) *American Educational Research Journal*; *US Department of commerce*

Children are most likely to draw a White older men as a scientists.

Even *people who value being fair* may still perceive the sciences as masculine. This view of science is so pervasive in our society it is hard to combat.

As a result, gender bias in the sciences may ***not be intentional or conscious***. Rather, it often occurs on an automatic, unconscious, or ***implicit*** level.

Source: Nosek & Smyth (2011) *American Educational Research Journal*; *US Department of commerce*

HOW BIAS AGAINST WOMEN NEGATIVELY AFFECT WOMEN IN THE SCIENCES

Diana Smith, who has been working at a an engineering company for 4 years:

"Working in the male dominated field of engineering can be uncomfortable at times. I have often felt disrespected because I'm a woman and that's really frustrating. As just one example, I once had a coworker subtly suggest I dressed too 'cute' to be taken seriously as a scientist. What does that even mean?"

Allen Davis, who has been working a various companies in the sciences 7 years:

"I've often noticed that my female colleagues are treated differently than me. This is terrible, but at my most recent company, one male colleague always came to me for help on a very technical task. Another female colleague was actually the expert on this and I felt, she could offer better assistance. When I suggested this to my male colleague, he said 'Oh, are you sure? I thought my questions were little too complicated for her.' He was clearly questioning her competence."

EVIDENCE OF GENDER BIAS IN THE SCIENCES

Men and women science faculty show a preference for male students

- Research science faculty were randomly assigned to rate a student lab manager application that was either associated with the name "**John**" or "**Jennifer**"

Source: Moss-Racusin et al. (2012) *Proceedings of the National Academy Sciences (c.f., Ceci & Williams (2015) Proceedings of the National Academy Sciences*

Even though the application was *identical*, both ***men and women*** scientists rated the applicant as more competent, more hirable, and more worthy of mentoring when it was associated with the name "**John**" then "Jennifer"

Source: Moss-Racusin et al. (2012) *Proceedings of the National Academy Sciences (c.f., Ceci & Williams (2015) Proceedings of the National Academy Sciences*

More evidence of gender bias:

- Female undergraduates majoring in STEM report higher rates of unfair treatment than male students in these disciplines or female students in other majors.
- Male professors at elite institutions are less likely to mentor female students.

Source: Sheltzer & Smith (2014) *Proceedings of the National Academy Sciences;* Steele, James, & Barnett (2002), *Psychology of Women's Quarterly*

EVIDENCE OF BIAS AGAINST MOTHERS

Biases against women may be particularly pronounced for ***mothers***.

- Compared to fathers and women without children, people view mothers ***as less ambitious***, ***less committed to their job***, and ***less competent***

Source: Moss-Racusin et al. (2012) *Proceedings of the National Academy Sciences (c.f., Ceci & Williams (2015) Proceedings of the National Academy Sciences*

To summarize!

- People have general beliefs about men and women.
- Unfortunately for women, people view scientists as having masculine traits (being assertive, go-getters).
- Women cannot simply act more “masculine” because they will not be liked or hired.
- This leads to documented bias against women in the sciences, which has perpetuated the lack of women in the sciences.

Control Module

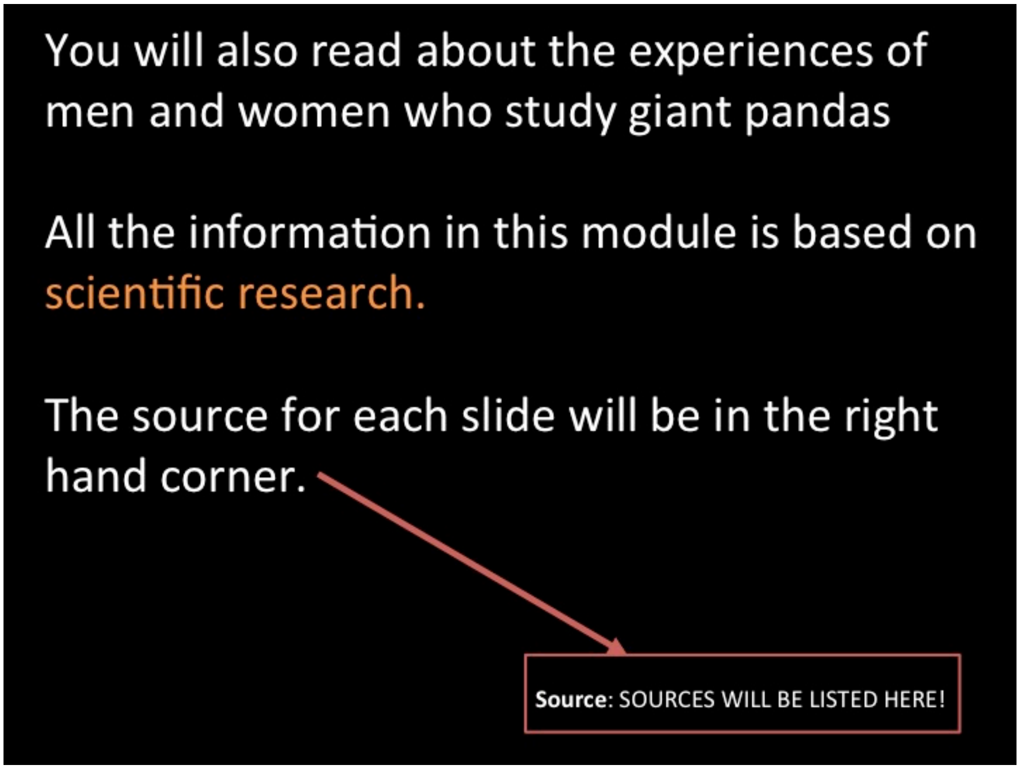
Giant Pandas: An adorable and endangered species

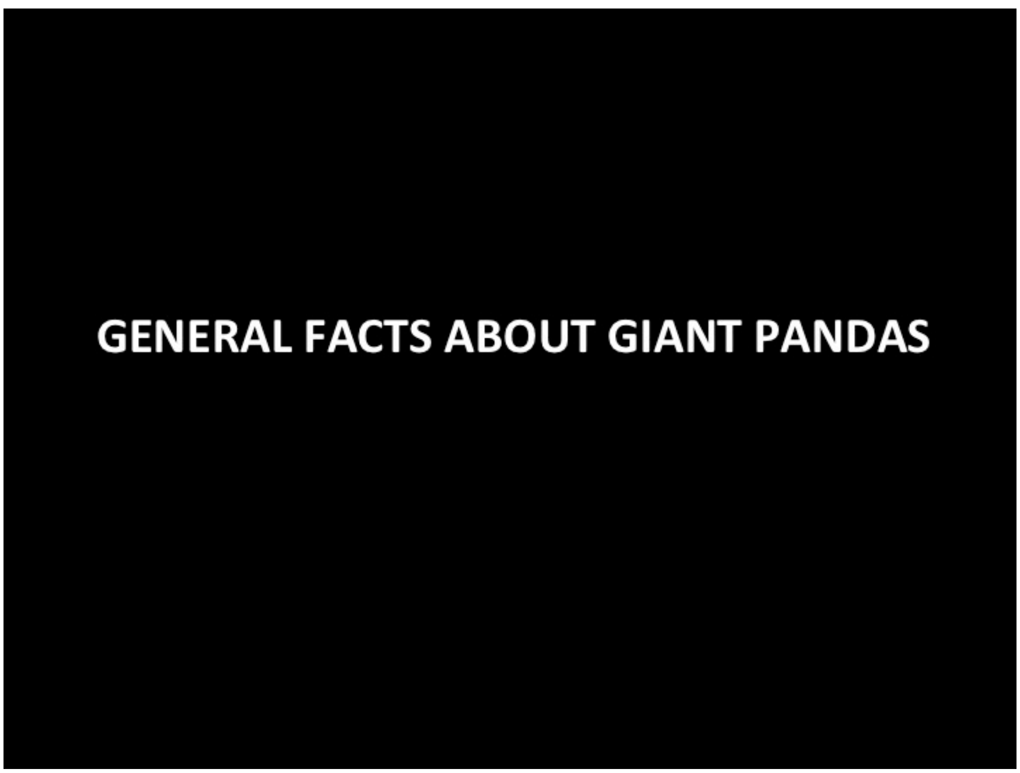
A short module on giant pandas

Thank you for beginning this short module!

This module will cover:

- General facts about giant pandas
- The giant panda's perplexing digestive track
- Giant panda's mating issues
- The problem for giant pandas


You will also read about the experiences of men and women who study giant pandas
All the information in this module is based on scientific research.
The source for each slide will be in the right hand corner.
Source: SOURCES WILL BE LISTED HERE!

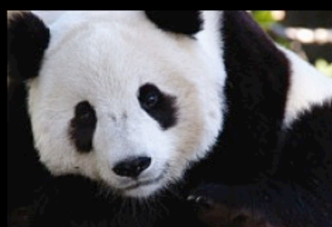

GENERAL FACTS ABOUT GIANT PANDAS

Giant Pandas are cute animals that are admired by many, but unfortunately, they are endangered and may become extinct.

- The giant panda is a black and white bear
- Scientists do not know what caused the panda's coloring, but believe it may help them camouflage into their environment.

Scientists estimate that there are only approximately 1,600 Giant Pandas

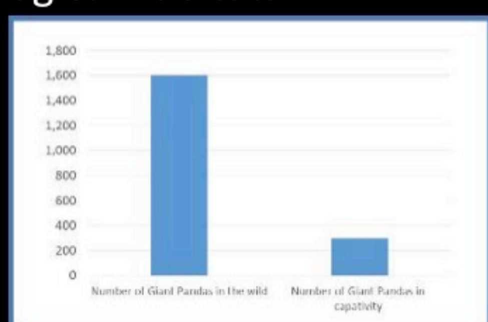
- Giant pandas live in mountains in central China
- Their habitat consists of broadleaf and coniferous forests



Source: Smithsonian National Zoological Park: http://nationalzoo.si.edu/animals/giantpandas/pandafacts/

Human involvement has changed the giant panda's habitat.

- Giant pandas once lived lowland areas, but farming and forest clearings restricted them to the mountains
- There are approximately 300 giant pandas located in zoological habitats.



A ZOOLOGIST'S PERSPECTIVE ON GIANT PANDAS

Sarah Evans, who has been working at a nationally recognized zoo for 5 years:

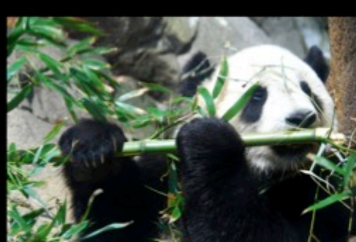
"The giant pandas are definitely one of our most popular exhibits. People see pandas as these cute and cuddly creatures. But in reality pandas are bears and can be just as dangerous. Almost everyone will never encounter a panda in real life. There are just so few left and that is really unfortunate. However, I feel really lucky that we have a panda habitat here. Many zoos are working to create beneficial environments for pandas and help them breed. It is important work given the low numbers of giant pandas."

GIANT PANDA'S PERPLEXING DIGESTIVE SYSTEM

Unfortunately there are many characteristics about giant pandas that do not bode well for their survival as a species.

- Pandas' diet consist primarily of bamboo
- However, pandas' digestive system is ideal for eating meat.

Digesting bamboo and extracting nutrients is difficult.



Source: ***Morphology of the giant panda. Systematic anatomy and organ-histology,*** Xue et al. (2015), *Microbiology*.


Scientists estimate that Giant pandas have been eating bamboo for 7 million years and eating bamboo exclusively for 2-2.5 million years.
But giant panda's digestive system does not have the characteristics we would expect given this dietary restriction.
Years in Millions
Source: Morphology of the giant panda. Systematic anatomy and organ-histology, Xue et al. (2015), Microbiology.


Giant pandas do not have elongated stomach which is beneficial for digesting plants.
Pandas teeth have evolved to be flat to better crush bamboo.
However, giant pandas have not evolved to have the proper gut microbiome to digest bamboo.
Source: Morphology of the giant panda. Systematic anatomy and organ-histology, Xue et al. (2015), Microbiology.

PANDA'S PERPLEXING DIGESTIVE SYSTEM: SCIENTISTS' PERSPECTIVE

Diana Smith, who has studies the digestive systems of giant pandas:

"The digestive system of giant pandas is very confusing. Other herbivores evolved to digest the tough outer layer of plants. It is not easy to break down plants in order to get the nutrience. However, pandas still essentially have the digestive system of a carnivore."

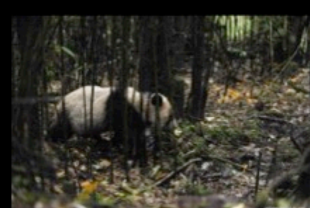
Allen Davis, who is a microbiologist:

"When researchers were first looking at the microbiomes in pandas, they assumed they would fine similar microbes as those seen in herbivores. These would help pandas break down the bamboo. But this was not the case. Pandas still have the microbes of a carnivore."

GIANT PANDA'S MATING ISSUES

Reproducing and creating more panda cubs is a challenge and part of the reason it has been difficult to repopulate the giant panda population.

- Pandas are solidary creatures. So when female pandas go in heat and leave a distinctive sent, there is the possibility a male panda will not be close by.



Source: LA Science Times:http://articles.latimes.com/2013/sep/24/science/la-sci-sn-panda-pregnancy-breeding-cubs-china-20130924; San Diego Zoo: http://animals.sandiegozoo.org/animals/giant-panda

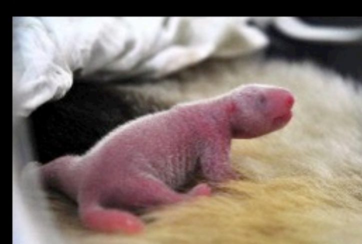
Making it even more difficult, female pandas only go into heat once a year for a couple of days.

In a zoo environment, male and female pandas can be put in the same place at the appropriate time. But even then pandas sometimes do not seem to know what to do.

Source: LA Science Times:http://articles.latimes.com/2013/sep/24/science/la-sci-sn-panda-pregnancy-breeding-cubs-china-20130924; San Diego Zoo: http://animals.sandiegozoo.org/animals/giant-panda

More facts about panda cubs:

- Sometimes female pandas will appear pregnant but this can turn out and be a false alarm.
- Panda cubs are helpless and very tiny when first born. They only weigh 3-5 ounces

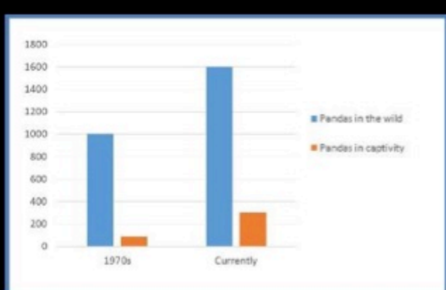


Source: LA Science Times:http://articles.latimes.com/2013/sep/24/science/la-sci-sn-panda-pregnancy-breeding-cubs-china-20130924; San Diego Zoo: http://animals.sandiegozoo.org/animals/giant-panda

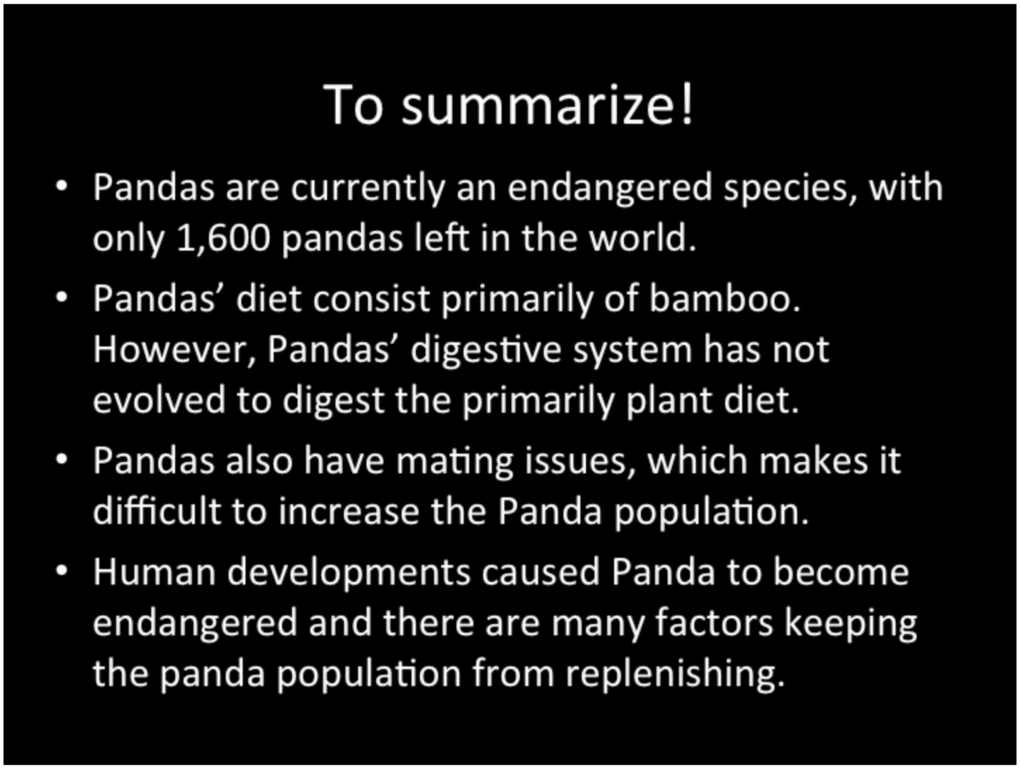
THE PROBLEM FOR GIANT PANDAS

Scientists have known that giant pandas are in danger of becoming extinct for 30 years, but the problem is not rapidly improving.

- Many of the panda's unique characteristics keep the giant panda's population from growing.
- However, human interference in the giant panda's habitat is what initially caused the decrease in giant pandas.



Source: http://wwf.panda.org/what_we_do/endangered_species/giant_panda/panda/how_many_are_left_in_the_wild_population/


To summarize!
• Pandas are currently an endangered species, with only 1,600 pandas left in the world.
• Pandas' diet consist primarily of bamboo. However, Pandas' digestive system has not evolved to digest the primarily plant diet.
• Pandas also have mating issues, which makes it difficult to increase the Panda population.
• Human developments caused Panda to become endangered and there are many factors keeping the panda population from replenishing.

Diversity Vignettes

Vignette 1

Susan, a recent graduate of Virginia Polytechnic Institute, started working for *Dynamics Technology Inc*. as a physicist a few months ago. *Dynamics Technology* is a large company located in Cleveland, specializing in designing and manufacturing magnetic field measurement instruments. Susan enjoys working for a large organization with lots of career opportunities, and is especially appreciative for being encouraged to get involved with product development and field research.

On Monday, while she was eating lunch in the cafeteria, she overhears a group of her coworkers cheerfully talking about how much fun they had last Friday at Mo'Jo's, a sports bar right next to their building. Apparently, Susan's team went out to celebrate the submission of their project proposal after work on Friday, but somehow didn't invite her to join. Disappointed, she walks to her supervisor Tom's desk after lunch, and asks him why she was not invited to obviously a team celebration. "Oh sorry," Tom explains, "We didn't think you had time to grab a drink. We thought you had a PTA meeting or something. Besides, do you even like sports?"

Vignette 2

It's 8.30 on Monday morning in San Francisco, and Lisa already drank her fourth cup of coffee of the day. This week marks her second year at *Incentee*, a start-up tech company located in Silicon Valley. She loves her job as a software design engineer, and it thrills her to be part of a team that constantly craves for innovation and excellence.

This Monday is especially exciting, and Lisa finds it difficult to contain her excitement. She has finally decided the go after the ambitious promotion to Chief Design Engineer role and formally submitted her application earlier that morning. This highly coveted and prestigious position has been vacant for over two months and more than four of her coworkers already expressed interest to get the promotion. With her tenacity and upbeat attitude, Lisa thinks she will be a highly qualified candidate.

Barely able to keep the good word to herself, Lisa could not help herself but to break the news to Steven, her best friend at *Incentee*. Steven is surprised, "Wow, look at you! I'm happy for you! Though I'm a bit surprised. Weren't you talking about wanting children the other day? That position will make it difficult for someone like you." Walking out the door, he adds, "Don't forget to have a life!".

Control Vignettes

Vignette 1

Native to central China, giant pandas have come to symbolize endangered species. Less than two thousand giant pandas live in their native habitat, while another three hundred pandas live in zoos around the world. The Smithsonian's National Zoo and Conservation Biology Institute at Washington D.C. is a leader in North America in giant panda conservation. The zoo currently houses four giant pandas and its animal care staff work diligently to ensure giant pandas are taken very good care of. Yet, despite extreme efforts on the part of an army of dedicated staff, saving pandas appear to be a tricky business. For one thing, pandas are being less than cooperative.

Lisa Scheffers, chief of the animal care staff in National Zoo, thinks giant pandas are one of the worst caregivers in the animal kingdom. “It’s incredibly difficult for pandas to get pregnant and we work very hard to provide the best conditions for them. But there is no guarantee that they will be willing to mate when the female is ovulating. Moreover, a baby cub may not be accepted by its parents; in fact, only 50% of the babies born survive because they are being abandoned by their parents. We bottle and tube feed baby cubs every two hours just to keep them alive for another day, while if a panda gives birth to twins, parents invariably abandon one of them. All these factors make it very hard to get pandas out of the endangered species category. Considering how much money is spent in reproducing a single panda cub, I strongly believe that funds should be allocated more wisely…Maybe we all should start to think about spending the money on more thriving species instead of giant pandas”

Vignette 2

A study recently published found that pandas are much more likely to mate when they're attracted to each other. Researchers let pandas choose between two possible mates using numerous indicators of attraction, indifference, or aggression. Pandas that were mutually attracted to each other have a 75% likelihood of successfully mating. Without any attraction, the probability is closer to none. Those odds improve when even one panda showed signs of attraction. While this seems like an easy solution to breeding issues, scientists still have to address the problem of genetic diversity in a small population. Researchers recommend screening prospective mates for genetics first then letting pandas choose. According to the study, they believe this could make breeding programs more successful.

The issue of cost effectiveness, however, remains non-discussed. Increasingly more resources are devoted to reproduce a single panda cub, which may or may not even survive. At birth, a typical panda cub is about the size and weight of a stick of butter. Odds for reproduction and survival are extremely slim. More recently, dedicated community activists began to question the return of this major investment on giant pandas. Does it really make financial sense to adamantly promote panda mating? Much needed financial resources can be shifted elsewhere to better benefit the society at large. Some scientists even argue that maybe, extinction of species should be allowed. “We should stop intervening in nature and let natural selection run its course”.