While women have closed the gender gap in many science and engineering fields, math-intensive fields continue to lack representation of women. One potential cause is stereotype threat. Previous research has shown that the presentation of negative stereotypes regarding women and math can negatively influence women’s math performance and intent to pursue math-related careers. The present research further examined the impact of stereotype threat on women in regards to mathematics performance, major and career choice, and intentions to seek tutoring. The study builds on previous research by manipulating stereotype threat both explicitly and implicitly. In addition, the moderating role of stigma consciousness (awareness of stereotypes) and feedback post-math-performance was examined. It was expected that women’s math performance and likelihood of pursuing a math-related major and/or career would decrease when presented with stereotypes both explicitly and implicitly. It was also expected that stigma consciousness and negative feedback would strengthen the negative effect of stereotype threat for women. Participants consisted of 116 female undergraduate students from the University of Wisconsin Oshkosh. Participants were randomly assigned to one of three conditions: explicit stereotype threat, implicit stereotype threat, or low threat. Following manipulation of stereotype threat, participants completed a math test and were given randomly assigned feedback (either positive or negative). Finally, participants filled out questionnaires regarding their level of awareness of stigmas related to them, their comfort in pursuing a major and/or career in a math-intensive field, and their intentions to seek math-related tutoring. In the present research, stereotype threat did not impact math performance, choosing a math-intensive major, or tutoring. Stereotype threat did negatively impact women’s comfort in choosing a math-intensive career. When presented with an implicit and explicit stereotype threat, women reported low levels of comfort towards choosing a math-intensive career. However, stigma consciousness and negative feedback did not intensify the effect. The current study’s findings were inconsistent with literature showing how stereotype threat negatively impacts women’s math performance. However, they were consistent with research demonstrating the negative impact stereotype threat can have in terms of women’s career-related choices. Results from this study have implications for women intending to pursue a life in a math-intensive field, grade school educators, and college educators. Understanding how stereotypes and negative feedback can affect women and deter them from pursuing a career or major in a math-intensive field, is one step in solving the issue.
THREAT LEVEL MIDNIGHT: STEREOTYPE THREAT’S NEGATIVE IMPACT ON WOMEN’S CAREER AND MAJOR CHOICES

by

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A Thesis Submitted
In Partial Fulfillment of the Requirements
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Master of Science

Cognitive and Affective Psychology

at

The University of Wisconsin Oshkosh
Oshkosh WI 54901-8621

July 2017
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STEM (science, technology, engineering, and math) fields play a major role in our everyday life. STEM training allows for innovation and advancement in crucial topics such as, but not limited to, innovative research, creation of environment-friendly machines, biological discoveries, and road designs. The influence of STEM is everywhere. Although STEM fields are ubiquitous in our everyday life, women are underrepresented in STEM-related careers. For example, while women occupy approximately 58% of social science careers and 48% of biological and medical science careers, the rate of women in computer and mathematical sciences is only 25%, with engineering even lower (13%; NSF, n.d. Science & Engineering Indicators, 2014). Computer science and mathematics make up the largest portion of the four components of STEM (Beede, Julian, Langdon, Mckittrick, Khan, & Doms, 2011), which indicates that women are least represented in the fields that hold the most occupations. Those STEM fields with the lowest percentage of women (i.e., math, computer science, engineering, and physics) are also the fields that require the most math, leading some researchers to suggest that it is really math-intensive STEM fields that contain few women (Ceci, Ginther, Kahn, & Williams, 2014, but see AAAS, 2016 for examples of non-math-intensive fields outside of STEM which also have low rates of women).

**Stereotype Threat**
One possible explanation for the underrepresentation of women in math-intensive STEM fields could be stereotypes connected to women and mathematics. Specifically, in the United States, there is an inaccurate belief that women underperform compared to men in math-related tasks. Although false (Hyde, Lindberg, Linn, Ellis, & Williams, 2008), this stereotype has persisted (Hill, Corbett, & Rose, 2010). Contrary to the belief that women are more motivated when presented with a negative stereotype, performance by the stereotyped individual actually decreases (Boucher, Rydell, & Murphy, 2015). This underperformance is thought to be a result of stereotype threat. Stereotype threat is a psychological state that occurs when awareness of a self-relevant negative stereotype leads to worries about confirming the stereotype (Steele, 1997; Steele & Aronson, 1995). Theoretically, if someone is presented with a negative stereotype prior to a task related to that stereotype, said person will be less likely to perform well on the task. Anxiety about confirming the negative stereotype impedes the person's ability to perform at their full potential (Steele & Aronson, 1995). More specifically, thinking about the stereotype while completing the math task causes the person to focus resources on more than just the presented task, thus reducing their performance. This process is supported by cognitive load theory (Sweller, 1988). Therefore, if a woman is presented with the stereotype that women are not good at math before completing a math task in class, for example, she will be more likely to underperform regardless of her knowledge and skills in math.

Steele (1995) is credited with experimentally confirming the presence of stereotype threat in a study he conducted with black male college students and white male college students. He presented the participants with a miniature golf task. He began by
explaining that the task was to reflect athletic ability. This was done in order to induce the U.S. stereotype that white men are less athletic than black men. The results indicated that the white men performed significantly worse than the black men when confronted with this stereotype. However, when the task was presented as a reflection of academic ability, and thus inducing the U.S. stereotype that white men are better academically than black men, the white men performed significantly better than the black men. Together, these results provided evidence that stereotype threat has an effect on the performance of those being threatened. In this case, the stereotype wasn’t presented directly to the participant (e.g., the white men were not told explicitly that they were expected to perform worse than black men athletically). Rather, the participants were already aware of it. Since stereotypes are everywhere, or “in the air” as described by Steele (2010), the potential for negative impacts on those being stereotyped, including women in math-intensive STEM fields, looms large.

Stereotype threat effects have also been supported by many laboratory studies of women and mathematics. In these cases, researchers experimentally produce a reduction in women’s math performance in the face of stereotype threat. Spencer, Steele, and Quinn (1999) manipulated stereotype threat in a sample of mathematically-talented, college-aged women and men and measured the effect threat had on women’s math performance. Half of the male and female participants were provided with information stating that there were clear gender differences in math performance on the math test (gender relevant condition). The other half of participants were provided with information stating the test had never shown gender differences (gender irrelevant condition). The gender irrelevant
condition indicates a no stereotype threat condition and the gender relevant condition indicates a high stereotype threat condition. Spencer and colleagues found that men and women performed equally well in the gender irrelevant (no stereotype threat) condition. However, women in the gender relevant (stereotype threat) condition performed significantly worse than men in the gender relevant condition and both men and women in the gender irrelevant condition. Not only did stereotype threat affect women’s math performance in comparison to women who did not receive any threat, but stereotype threat also diminished women’s math performance in comparison to men (Spencer et al., 1999).

Another study, conducted by Fogliati and Bussey (2013), also found effects of stereotype threat on a math test using a sample of women and men. Men and women college students were exposed to either an explicit stereotype threat condition (participants were told men generally performed better than women) or no stereotype threat (participants were told men and women generally performed equally well) prior to completing a math test. Results indicated that women who were exposed to the stereotype threat performed significantly worse on the math test compared to those women who were not exposed to stereotype threat. Also, women in both conditions scored significantly worse than men. Franceschini, Galli, Chiesi, and Primi (2014) confirmed the effects of stereotype threat on women’s math performance by implementing a stereotype threat condition (female participants were told women are less able than men) compared to a stereotype lift condition (participants were told women are more able than men). Women in the stereotype threat condition performed significantly worse on the math test
than the women in the stereotype lift condition. These findings suggest that explicit stereotypes play an important role in women’s math performance.

The findings that women underperform on math tests when presented with a stereotype threat have been replicated using different, and sometimes more implicit, implementations of stereotype threat as well. Brown and Pinel (2003) used implicit stereotype threat in comparison to low stereotype threat to demonstrate the effect of stereotype threat on women’s math performance. In this study, undergraduate female participants read subtle information discussing that there were clear gender differences in the performance on the math test but not explicitly stating in which direction. They found that women who were presented with the stereotype threat performed worse overall than women in the non-threat condition. For all of the above studies, stereotype threat conditions (whether implicit or explicit) reduced women’s math performance when compared to a low threat condition. Although many studies have tested both implicit and explicit stereotype threat conditions in comparison to a low stereotype threat condition, previous research has yet to compare explicit stereotype threat implementation to implicit stereotype threat implementation in the same study. It is apparent that both conditions negatively impact women’s math performance, but the magnitude of the effect that each condition produces has not been directly compared.

**Impact of Stereotype Threat on Career Choice**

Not only has it been shown that stereotype threat affects women’s immediate math performance, studies have also found that threat affects women’s preference in
career choices. In a study conducted by Davies, Spencer, Quinn, and Gerhardstein (2002), stereotype threat was manipulated through television commercials. The dependent variables were math performance, preference of answering verbal or math questions, and educational and vocational aspirations. Results indicated that women exposed to stereotype threat (i.e., viewing of gender-stereotyped commercials) performed worse on the math test, chose to answer verbal questions over mathematics questions, and most importantly indicated less interest in quantitative professional domains in which they risked being negatively stereotyped. These were all in comparison to women who did not view gender-stereotypical commercials and men in both conditions. Another study conducted by Deemer, Thoman, Chase, and Smith (2014) involving women students in physics and chemistry, further suggests that stereotype threat may be an example of a barrier to the development of science careers. The researchers measured threat elicited by gender stereotypes experienced by students in physics and chemistry labs using a questionnaire. Men and women indicated whether they felt that gender played a role in their ability to perform in the science lab. Participants also completed a confidence in science learning questionnaire, items on intended research involvement, and questions regarding their plans to pursue a career in science. Those women who felt their gender affected their class performance were more likely to choose a career outside of science compared to women who did not feel their gender affected their class performance (Deemer et al., 2014). Non-experimental studies like Deemer and colleagues’ add evidence that gender-related stereotypes (and therefore stereotype threat) could be a contributing factor to the math-related career choices of women.
Moderators of Stereotype Threat

There are factors that can moderate the impact of stereotype threat on women’s math performance. One such factor is gender identity. Schmader (2002) used the Gender Identity Scale (GIS) to assess how important gender roles were to men and women college students. Schmader (2002) found similar gender identity scores, indicating that both women and men found gender to be an important aspect of their lives. However, Schmader (2002) showed that when a math task was presented as being representative of women’s math abilities, gender identity impacted the threat and performance relationship for women. Specifically, women who identified strongly with their gender were more negatively influenced by the threat condition and performed worse than women who did not rate being female as central to their lives. Gender identity did not, however, dilute the main effect of stereotype threat. Women presented with a stereotype threat, regardless of their GIS scores, performed worse than men.

Another moderator of stereotype threat is stigma consciousness. Stigma consciousness is how chronically aware stereotyped individuals are of their stigmatized status (Pinel, 1999). According to stereotype threat theory (Steele, 1997; Steele & Aronson, 1995) if a woman is highly aware of the stereotype that women underperform men in math, she will be more likely to identify with that threat causing it to have a larger impact on her. On the other hand, if a woman has never been affected by the stereotype and/or is unaware of said stereotype, the threat will show less of an impact on her performance. Steele (1997) states that for stereotype threat to occur, stigmatized individuals must experience concern about being judged stereotypically. Therefore, there
is no threat if there is no concern. Brown and Pinel (2003) used a stigma consciousness measure developed by Pinel (1999) to examine the level of awareness women had of stereotypes that affect them and the extent to which one identifies with their stigmatized status. Their study involved high stigma-conscious female undergraduates and low stigma-conscious female undergraduates who were randomly placed in either a high stereotype threat condition or a low stereotype threat condition. Those in the high stereotype condition read that the study provided factors that explain why men and women performed so differently on standardized math tests. This created a subtle (implicit) stereotype threat by not explicitly stating that men outperformed women on the math test. The low stereotype threat condition provided a brief explanation of the math test stating that it had been shown to be completely free of gender biases. After reading the passage, participants completed a math test. Brown and Pinel (2003) used a math identification questionnaire (MIQ) prior to the study to screen out individuals who did not find math to play an important role in their life. This allowed them to identify who would not find a math test in a psychology study important or worth dedicated effort. As hypothesized, the results indicated that stigma consciousness and stereotype threat interacted to impact women’s math performance. High stigma-conscious participants in the high stereotype threat condition scored significantly worse on the math test than the low stigma-conscious participants in the high stereotype threat condition and both high and low stigma-conscious participants in the low threat condition. The findings support the strong moderation of stigma consciousness on the stereotype threat-math performance relationship.
Finally, performance feedback (e.g., exam grades) has also been shown to moderate the relationship between stereotype threat and math performance. Fogliati and Bussey (2013) examined the impact of feedback in their study on stereotype threat. Regardless of participants’ performance on the math test in their study, they were assigned to either receive negative feedback (fictitious low scaled score) or positive feedback (fictitious high scaled score). Negative feedback negatively impacted women's motivation to increase their math abilities by attending tutoring sessions in comparison to positive feedback. These results demonstrate that feedback following test performance strengthened the impact of the stereotype threat on women’s choice to discontinue working with mathematics.

Present Research

In summary, research suggests that stereotype threat affects women’s math performance. In addition, factors such as stigma consciousness and performance feedback strengthen the effect of stereotype threat. The current study will assess the effect of stereotype threat on college women’s math performance and their comfort pursuing a major or career in a math-intensive field. Specifically, this study will build on the findings of Fogliati and Bussey (2013) and Brown and Pinel (2003) by using an implicit and explicit stereotype threat condition and by including a measure of major/career choice and motivation to seek tutoring. It is anticipated that both implicit and explicit conditions will elicit stereotype threat, confirming that one does not need to be presented with a direct stereotype to be negatively impacted by it. The current study will also use
the stigma consciousness questionnaire (Brown & Pinel, 2003) to confirm the moderating impact of stigma consciousness with both implicit and explicit stereotype threat conditions. Finally, the current study will examine the impact of test performance feedback on future major/career choice and motivation to seek tutoring.

Overview of Hypotheses

**Hypothesis 1a.** I expect to find a main effect of stereotype threat on math performance. Women placed in the high stereotype threat condition (whether implicit or explicit) will perform worse on the mathematics test than women placed in the low stereotype threat condition.

**Hypothesis 1b.** I expect to find that stigma consciousness moderates the relationship between stereotype threat and math test performance with those higher in stigma consciousness being more negatively impacted by high stereotype threat than those lower in stigma consciousness. In addition, participants higher in stigma consciousness but placed in the low stereotype threat condition will be impacted by the stereotype less than those in the high stereotype threat conditions. However, theses participants will be impacted more than those lower in stigma consciousness and in the low threat condition.

**Hypothesis 2a.** I expect to find a main effect of stereotype threat on major/career choice and motivation to pursue tutoring, whereby participants who are placed in a high stereotype threat condition (implicit or explicit) will be less likely to pursue a
major/career in a math-intensive field or be motivated to pursue tutoring compared to those placed in the low stereotype threat condition.

**Hypothesis 2b.** I expect to find that stigma consciousness moderates the relationship between stereotype threat and participants’ major/career choice and interest in tutoring with those higher in stigma consciousness being more negatively impacted by high stereotype threat than those lower in stigma consciousness. Therefore, participants higher in stigma consciousness and in either high stereotype threat condition will be less likely to pursue a major/career in a math-intensive field and would be less inclined to seek tutoring than those in a low stereotype threat condition. In addition, participants higher in stigma consciousness but placed in the low stereotype threat condition will be negatively impacted by the stereotype less than those in the high stereotype threat conditions but impacted more than those lower in stigma consciousness and placed in the low threat condition.

**Hypothesis 2c.** I expect to find that false feedback on the math test moderates the relationship between stereotype threat and participants’ major/career choice and interest in tutoring with those who receive negative feedback being more negatively impacted by stereotype threat than those who receive positive feedback. Therefore, participants who are placed in either high stereotype threat condition and receive negative feedback will be less likely to pursue a major/career in a math-intensive field and would be less inclined to seek tutoring. In addition, participants who receive negative feedback but are placed in the low stereotype threat condition will be impacted by the stereotype less than those in
the high stereotype threat conditions but impacted more than those who receive positive feedback and are placed in the low stereotype threat condition.

**Hypothesis 3.** I expect to find a three-way interaction between stigma consciousness, stereotype threat, and feedback. Participants who rate higher in stigma consciousness, are placed in either high stereotype threat condition (explicit or implicit), and receive negative feedback will be least likely to pursue a career in a math-intensive field or be interested in tutoring compared to those lower in stigma consciousness, in the low stereotype threat condition, and who receive positive feedback.

**Exploratory research question.** Previous research has demonstrated negative impacts of both explicit and implicit exposure to stereotypes. However, previous studies have not compared the two threat conditions in the same sample. This study will explore whether exposure to explicit or implicit stereotypes have a greater impact on participants’ math test performance, major/career choice, and interest in pursuing tutoring.
Method

Participants

One hundred forty one participants were recruited via the University of Wisconsin Oshkosh participant pool and received class credit in exchange for their participation. Participants consisted of female undergraduate students derived from introductory psychology classes. Men were excluded from recruitment and those who did not identify as female were excluded from analyses. The latter resulted in the exclusion of one participant which left a sample size of 140 female-identified students. Similar to Brown and Pinel (2003), the Math Identification Questionnaire (MIQ) was also used as an exclusion criterion. If participants scored below the 20th percentile on the MIQ, they were excluded from analyses. This resulted in the exclusion of 24 participants. The final sample size for analyses therefore included 116 participants.

Within the final sample (\(n = 116\)), the age range was 18 to 27 years with a mean age of 18.91 (\(SD =1.34\)). Of the 116 participants, 85 (73.3%) were in their first year of college. The remaining participants were in their second year (21.6%), and third year (5.2%). The majority of participants identified as European American/White (75.9%). The remaining participants identified as Asian American/Asian (8.6%), Hispanic American/Latino/a (5.2%), African American/Black (4.3%), and multiple races (6.1%). Students reported a total of 22 different declared or anticipated majors with eight (5.7%) reporting they were undecided. Out of the 22 different majors, a generous 59 students (41.8%) reported they either would declare or had declared a Nursing major. Other
frequently reported majors included Biology (9.9%), Psychology (6.4%), Education (5.7%), and Business (5.0%). Out of the final 116 participants, nine participants stated that they had already declared a math intensive major so they were not included in the analyses involving the Major Choice Questionnaire. That resulted in a sample of 107 participants for all Major Choice Questionnaire analyses. However, these nine participants were included in all other analyses. Participant demographics and questionnaire scores can be found in Table 1.
Table 1: Participant Demographics and Average Scores on Math Identification Questionnaire, Gender Identity Scale, & Stigma Consciousness Questionnaire

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<td>19-33</td>
</tr>
<tr>
<td>GIS$^c$</td>
<td>18.81 (3.83)</td>
<td>7-27</td>
</tr>
<tr>
<td>SCQ$^d$</td>
<td>43.36 (7.50)</td>
<td>18-66</td>
</tr>
</tbody>
</table>

$^a$Math Test (scale ranges from 1-20)  
$^b$MIQ: Math Identification Questionnaire (scale ranges from 7-35)  
$^c$GIS: Gender Identity Scale (scale ranges from 4-28)  
$^d$SCQ: Stigma Consciousness Questionnaire (scale ranges from 10-70)

Materials

**Participant Information Form.** Participants completed an information form (Appendix A) with common demographic questions as well as questions regarding previous math experience. Participants were asked about time since their last math course and their ACT score, if applicable.
**MIQ.** Participants completed a Math Identification Questionnaire (MIQ; Brown and Josephs, 1997; Appendix B). This is a 5-item survey about the extent to which one identifies with mathematics. Participants rated questions on a 7-point scale from *strongly disagree* (1) to *strongly agree* (7). An example item from the questionnaire is “My math abilities are very important to me.” Scores remained continuous and those participants who scored below the 20th percentile were excluded from analyses ($n = 24$). This five-item scale has been used in studies measuring general identification with mathematics (e.g., Brown & Josephs, 1997), gender differences related to stereotype relevance (e.g., Brown & Josephs, 1997), and stereotype threat (e.g., Brown & Pinel, 2003). The scale has good internal reliability in established studies ($\alpha = .82$; Brown & Josephs, 1997) with the current study providing moderate internal reliability ($\alpha = .65$).

**GIS.** The Gender Identity Scale (Brown & Pinel, 2003; Luhtanen & Crocker, 1992) assesses the extent to which one identifies with their gender (Appendix C). This scale is a subscale from Luhtanen and Crocker’s (1992) Collective Self-Esteem scale. The GIS was adapted for Brown and Pinel’s (2003) study to reflect the group membership of women specifically when looking at stigma related to stereotype threat. The original scale from Luhtanen and Crocker (1992) used group membership in general. The GIS is a 4-item scale with an example item being “Being a woman is an important reflection of who I am.” Participants answered using a 7-point scale with *strongly disagree* (1) and *strongly agree* (7) with the option of choosing *not applicable, I do not define as a woman* (8). For the purposes of this study, the measure was used solely for excluding those who did not identify as a woman. Participants who answered all
questions with “Not applicable: I do not define as a woman” were excluded from final analyses ($n = 1$).

**SCQ.** The third measure was the Stigma Consciousness Questionnaire (SCQ; Appendix D). This questionnaire, which was developed by Pinel (1999), includes 10-items reflecting the amount of awareness women have of their stigmatized status and the stereotypes connected with being a woman. An example question included on the SCQ is “Stereotypes about women have not affected me personally” (reverse coded). Participants respond on a scale from *strongly disagree* (1) to *strongly agree* (7). Higher scores are interpreted as higher awareness of relevant stigmas. The SCQ had a moderately high Cronbach’s alpha of .72 in Pinel’s developmental studies of the questionnaire (Pinel, 1999). The scale has also been used in studies of stereotype threat (Brown & Pinel, 2003) and individual differences of risk and resiliency in sexual minority health (Figueroa, & Zoccola, 2015; $\alpha = .86$). The scale’s reliability was moderately high in the current study as well ($\alpha = .75$).

**Mathematics Test.** Participants were asked to complete a math test which consisted of 20 multiple choice items (Appendix E). The questions were derived from practice exams based on the mathematics portion of the American College Testing (www.act.org). Each question included four possible answers and scores were calculated by taking the sum of all correct answers. The math test was piloted with college-aged students who took the exam in the allotted 20 minutes and responded to a question about the level of difficulty and the inclusion of math concepts. All pilot participants completed the math test in the required 20 minutes with the exception of one who did not complete
the final two questions. Scores ranged from 9 to 18 (out of 20). Two high school teachers who administer the ACT were also contacted when determining the difficulty of the test. Both deemed the test an appropriate level for students who have taken high school math courses.

**Major Choice.** The major choice measure was developed for the purpose of this study and was used to identify how comfortable participants would feel declaring a math-intensive major (Appendix F). The questionnaire began with two questions asking participants if they had already declared a math-intensive major and how comfortable they felt in that major on a 7-point scale with responses ranging from *not comfortable at all* (1) to *very comfortable* (7). If participants had not already declared a math-intensive major, they also answered two questions pertaining to how comfortable they would feel pursuing a career in a math-intensive major on a 7-point scale with *not comfortable at all* (1) to *very comfortable* (7). The scale had a moderately high Cronbach’s alpha of .82.

**Career Choice.** A similar measure was developed to identify how comfortable participants would feel pursuing a math-intensive career (Appendix F). The scale consisted of three questions with an example question being “I would feel comfortable pursuing a career that would require me to have strong mathematical abilities.” Participants responded on a 7-point scale from *strongly disagree* (1) to *strongly agree* (7). The scale had a moderately high Cronbach’s alpha of .77.

**Motivation to Pursue Tutoring.** The final measure was also developed for the purposes of this study and was used to identify whether participants would be motivated to pursue tutoring (Appendix F). Participants rated their level of agreement on two items
using a 7-point scale from not at all likely (1) to very likely (7). The measure had a moderately high Cronbach’s alpha of .80.

Procedure

Participants were recruited via an online software program used by the Psychology Department and asked to report to the computer lab for an hour-long study. In each session, one to two participants arrived to the lab and were asked to sit at a computer away from the other participant (leaving at least two computers in between). Informed consent (Appendix J) was signed prior to beginning the experiment. Participants were then asked to follow the directions on the computer and to raise their hand if there were any questions or concerns. Please reference Figure 1 for a full diagram of the procedure.

First, participants were randomly assigned to one of three conditions. Each condition provided a narrative that contained a cover story. The cover story stated that the math test they were about to take was for the development of a placement test for the University of Wisconsin Oshkosh. Similar to Fogliati and Bussey (2013), a third of the participants ($n = 46$) were randomly assigned to an explicit stereotype threat condition. In that condition, students were provided with a narrative that explicitly stated that the math test they were about to complete typically resulted in men significantly outperforming women (Appendix G). Similar to Brown & Pinel (2003), a third of the participants ($n =$
Figure 1: Diagram of Procedure.
were randomly assigned to an implicit stereotype condition where the narrative presented provided a subtle form of the stereotype threat, stating that men and women tended to perform very differently on the math test they were about to complete (Appendix H). The final third of participants (n = 34) were randomly assigned to a low stereotype threat condition where they received a narrative stating that gender did not impact math performance on the test to follow (Appendix I). Given that stereotypes about women and math are “in the air” (Steele, 1997), it was expected that the last condition would elicit low, versus no, stereotype threat. Asian Americans, who are also subjected to the stereotype that they are good at math, were spread evenly throughout the three stereotype threat conditions.

After reading the narrative, each participant completed the same 20 question multiple choice mathematics test. They were provided with a calculator and scratch paper to help assist with their work. Participants were allowed 20 minutes to complete the test. When participants finished their math test, they were randomly assigned to receive either positive feedback (“you performed better than average”) or negative feedback (“you performed below average”) regardless of their actual performance on the test.

Following the randomly assigned feedback, participants completed a number of questions related to the cover story (Appendix K). These included questions such as “Do you believe the math test you have just taken is a good representation of all math subjects?” and “Do you believe the math test provided questions at an appropriate level for high school students to complete successfully?” Given the nature of the questions, this task served as a check that the cover story was believable. Participants then completed
the major/career choice and motivation to pursue tutoring measures. Following those measures, a series of questionnaires were presented including the SCQ, the GIS, and the MIQ along with other more common demographic items such as race/ethnicity, age, and math history.

A deception and manipulation check (Appendix L) was then performed to probe for any suspicion regarding the true intentions of the study and to test participants’ attention to and memory of the manipulation. The check included questions such as, “Do you remember what was said in the instructions about gender differences in scores on the math test you have taken?” This question also allowed the researcher to ensure that the participant read and understood the narrative including the stereotype threat. The manipulation check was performed individually on the computer. Finally, participants were asked to please wait quietly until all participants were finished to receive further instructions from the researcher. When all participants were finished, the researcher gave a group debriefing (Appendix M) to ensure that all deception was clarified. Participants were also provided with an individual debriefing statement (Appendix N). In the debriefing, it was noted that the feedback included false information about their math performance and the initial narrative about the mathematics test also included false information. Participants were thanked and provided with positive, encouraging information regarding successful women in STEM fields.
Data Analysis

Hierarchical multiple regression was used to test the main effect of stereotype threat on math performance as well as on major/career choice and motivation to pursue tutoring. It was also used to test the three 2-way interactions (hypothesis 1b, 2b, and 2c) and the one 3-way interaction (hypothesis 3). The hierarchical multiple regression consisted of three steps. First, main effects were assessed. Any two-way interactions were then entered on the second step. The third step included the three-way interaction between stigma consciousness, stereotype threat, and feedback, on likeliness to pursue a career/major in math and motivation to pursue tutoring.
Results

One hundred sixteen female undergraduate students participated in a study of how stereotype threat and negative performance feedback can impact math performance and women’s comfort in pursuing a future in a math-intensive STEM field.

Stereotype Threat and Math Performance

A hierarchical multiple regression was run to test all hypotheses related to stereotype threat and participants’ final math scores. For a complete table of results, please reference Table 2. Inconsistent with hypothesis 1a, the model was not significant, $R^2 = .00$, $F(2, 112) = .11$, $p = .90$. Neither high explicit stereotype threat, $\beta = .00$, $t(41) = .00$, $p = .99$, nor high implicit stereotype threat, $\beta = -.04$, $t(32) = -.39$, $p = .70$, were significant individual predictors of math scores. In addition, stigma consciousness did not moderate the relationship between stereotype threat and math scores (hypothesis 1b); the addition of the two interaction terms did not significantly improving the model, $\Delta R^2 = .00$, $\Delta F = .01$. Neither explicit stereotype threat X stigma consciousness, $\beta = .08$, $t(41) = -.63$, $p = .53$, nor implicit stereotype threat X stigma consciousness, $\beta = .02$, $t(32) = .19$, $p = .86$, were significant predictors. Overall, the 116 participants had a mean score of 11.41 out of 20 correct, or 57.05%, $(SD = 3.15)$ on the mathematics test. Participants in the low threat condition ($M = 11.54$, $SD = 3.26$) scored slightly higher on the math test than those in the high explicit condition ($M = 11.44$, $SD = 3.36$) and the high implicit condition ($M = 11.25$, $SD = 2.84$).
Table 2: Hierarchical Multiple Regression of Stereotype Threat and Stigma Consciousness on Mathematics Test Scores

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Models 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>B</td>
<td>β</td>
</tr>
<tr>
<td>(CONSTANT)</td>
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<td>.54</td>
</tr>
<tr>
<td>Explicit ST</td>
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<td>Implicit ST</td>
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<td>.75</td>
</tr>
<tr>
<td>SC</td>
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<td></td>
</tr>
<tr>
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<tr>
<td>Implicit ST X SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>ΔR²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dependent Variable: Scores on Mathematic Test
(CONSTANT): Low Stereotype Threat
Coding: Low Stereotype Threat = 0, Explicit Stereotype Threat = 1, Implicit Stereotype Threat = 2
ST: Stereotype Threat
SC: Stigma Consciousness – Higher Number = Higher in Stigma Consciousness
*p < .05

Stereotype Threat and Major Choice

Major Choice was broken into two parts for the study. First, participants were to indicate whether they had already declared a math-intensive major. If they reported that they did, they responded to the question “I am comfortable with my current math-intensive major” (on a scale from strongly disagree (1) to strongly agree (7)). Out of the
116 female participants that completed the study, 9 participants (7.8%) indicated that they had already declared a math-intensive major. Out of those 9, the average rating of comfort was a 4.6 out of a potential 7 with two participants reporting that they were not comfortable at all in their current major. Participants with math-intensive majors were excluded from this portion of the analyses because they did not answer the second set of questions about their major choice, leaving 107 participants. The remaining participants were asked to rate how comfortable they would be pursuing a math-intensive major regardless of their own major.

A hierarchical multiple regression was used to test whether stereotype threat had an impact on comfort levels of choosing a math-intensive major. In the first step, the model including explicit stereotype threat and implicit stereotype threat, was not significant, $R^2= .04, F(2, 103) = 2.27, p = .11$, even though implicit stereotype threat was a significant individual predictor, $\beta = -.53, t(29) = -2.01, p < .05$. This finding was inconsistent with hypothesis 2a in that women who received a stereotype threat were not less comfortable pursuing a major.

A hierarchical multiple regression was also run to test whether stigma consciousness or feedback moderated the relationship between stereotype threat and comfort in pursuing a math-intensive major. Inconsistent with hypothesis 2c, adding feedback to the model did not increase the variance explained, $\Delta R^2= .00, \Delta F(4, 102) = .11, p = .21$ and neither interaction term (implicit stereotype threat X feedback nor explicit stereotype threat X feedback) were significant individual predictors. When adding the interaction term stigma consciousness to the model, there was also no
significant improvement in variance explained, $\Delta R^2 = .01$, $\Delta F(4, 102) = .29$, $p = .31$ and neither explicit stereotype X stigma consciousness nor implicit stereotype threat X stigma consciousness were significant individual predictors. In the next step, the addition of stigma consciousness and feedback (i.e., a 3-way interaction) did not result in a significant improvement of the model, $\Delta R^2 = .03$, $\Delta F(6, 100) = 1.30$, $p = .52$. Results indicated that neither feedback nor stigma consciousness moderated the relationship between stereotype threat and major choice which was inconsistent with hypotheses 2b, 2c and 3.

Participants in the low threat condition ($M = 1.85$, $SD = .92$) scored slightly higher on the major choice questionnaire than those in the high explicit condition ($M = 1.50$, $SD = .92$) and the high implicit condition ($M = 1.40$, $SD = .66$). Note that the low means indicate that regardless of stereotype presented, participants reported not feeling comfortable pursuing a major in a math-intensive field (i.e., overall $M = 1.58$ on a scale from 1 - 7). For a complete table of regression results for stereotype threat and major choice, please reference Table 3.
Table 3: Hierarchical Multiple Regression of Stereotype Threat, False Feedback, and Stigma Consciousness on Women’s Comfort Choosing a Math-intensive Major

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Models 2 &amp; 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (SE)</td>
<td>β</td>
<td>B (SE)</td>
</tr>
<tr>
<td>(CONSTANT)</td>
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<td>.15</td>
<td></td>
</tr>
<tr>
<td>Explicit ST</td>
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<td>.20</td>
<td>-.20</td>
</tr>
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<td>Implicit ST</td>
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<td>.21</td>
<td>-.23*</td>
</tr>
<tr>
<td>FB</td>
<td></td>
<td>.05</td>
<td>.17</td>
</tr>
<tr>
<td>SC</td>
<td></td>
<td>-.06</td>
<td>.11</td>
</tr>
<tr>
<td>Explicit ST X FB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Implicit ST X FB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explicit ST X SC</td>
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</tr>
<tr>
<td>Implicit ST X SC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Explicit ST X FB X SC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Implicit ST X FB X SC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
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<td>.04</td>
<td>.04/.05</td>
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</tr>
<tr>
<td>F</td>
<td>2.27</td>
<td>1.54/1.22</td>
<td>.82</td>
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</tbody>
</table>

Dependent Variable: Major Choice
(CONSTANT): Low Stereotype Threat
ST: Stereotype Threat - Low Stereotype Threat = 0, Explicit Stereotype Threat = 1, Implicit Stereotype Threat = 2
FB: Feedback – Positive Feedback = 0, Negative Feedback = 1
SC: Stigma Consciousness - Higher Number = Higher in Stigma Consciousness
*p < .05
Stereotype Threat and Career Choice

Participants were also asked about their comfort pursuing math-intensive careers. In this case, participants who had already chosen a math-intensive major were included in the analyses. A hierarchical multiple regression was run to test whether stereotype threat had an impact on women’s comfort in pursuing a math-intensive career. The overall model showed significance, $R^2 = .07$, $F(2, 112) = 4.01$, $p < .05$, with explicit stereotype threat, $\beta = -.30$, $t(41) = -2.77$, $p < .05$, and implicit stereotype threat $\beta = -.21$, $t(32) = -1.99$, $p < .05$, being significant individual predictors of willingness to pursue a math-intensive career. This suggests that receiving an explicit or implicit stereotype threat decreased willingness to pursue a career by .30 and .21 respectively, in comparison to low stereotype threat, which was consistent with hypothesis 2a. Of note, although those who were told that there were no gender differences in math performance reported being more comfortable pursuing a math-intensive career than those who received a stereotype threat condition, they still reported low levels of comfort overall ($M = 2.20$ out of a possible 7.00). In addition, the total variance explained by the model, while statistically significant, was small.

A hierarchical multiple regression was run to test the moderating impact of feedback and stigma consciousness (2-way interactions) on the relationship between stereotype threat and career choice. When adding feedback and stigma consciousness to the model, change in variance was not significant, $\Delta R^2 = .01$, $\Delta F(4, 110) = .36$, $p = .06$, and none of the interaction terms (feedback X explicit stereotype threat, feedback X
implicit stereotype threat, explicit stereotype threat X stigma consciousness or implicit stereotype threat X stigma consciousness) were significant individual predictors.

In the final step, the addition of feedback with stigma consciousness (3-way interaction) also did not result in a significant improvement of the model, $\Delta R^2 = .05$, $\Delta F(6, 108) = 3.03, p = .09$ though there was a significant 3-way interaction with implicit stereotype threat, feedback, and stigma consciousness significantly predicting low levels of comfort in choosing a math-intensive career, $\beta = -.32$, $t(32) = -2.44$, $p < .05$.

Similar to major choice, participants in the low threat condition ($M = 2.75, SD = 1.16$) reported higher levels of comfort pursuing a math-intensive career than those in the high explicit condition ($M = 2.04, SD = 1.08$) and the high implicit condition ($M = 2.20, SD = 1.25$). For a complete table of results regarding the impact of stereotype threat on career choice, please reference Table 4.
Table 4: Hierarchical Multiple Regression of Stereotype Threat, False Feedback, and Stigma Consciousness on Women’s Comfort Choosing a Math-intensive Career

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Models 2 &amp; 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>B</td>
<td>B</td>
<td>B</td>
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<td>-0.21*</td>
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<tr>
<td>FB</td>
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<td>-0.11</td>
<td>0.22</td>
<td>-0.05</td>
</tr>
<tr>
<td>SC</td>
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<td>0.15</td>
<td>-0.09</td>
</tr>
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<td>0.44</td>
<td>0.05</td>
</tr>
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<tr>
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<td>0.07/0.08</td>
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<td>0.05</td>
</tr>
<tr>
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<td>2.74/2.30</td>
<td>1.30</td>
<td>1.69</td>
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</table>

Dependent Variable: Career Choice
(CONSTANT): Low Stereotype Threat
ST: Stereotype Threat - Low Stereotype Threat = 0, Explicit Stereotype Threat = 1, Implicit Stereotype Threat = 2
FB: Feedback – Positive Feedback = 0, Negative Feedback = 1
SC: Stigma Consciousness - Higher Number = Higher in Stigma Consciousness
*p < .05
Stereotype Threat and Tutoring Intentions

Finally, participants were asked about their intentions to seek assistance from tutoring. The overall model was not significant, $R^2 = .03$ $F(2, 112) = 1.41$, $p = .25$, and neither high explicit stereotype threat, $\beta = .14$, $t(41) = 1.29$, $p = .20$, nor high implicit stereotype threat, $\beta = .18$, $t(32) = 1.60$, $p = .11$, were individual predictors of intentions to seek tutoring. In hypotheses 2a-2c and 3, it was expected that those in the high stereotype threat conditions would be less likely to pursue tutoring. However, results indicated that regardless of condition, women reported moderately high levels of intent to seek tutoring (average score of 4.70 on a scale of 1-7).

A hierarchical multiple regression was run to test whether feedback or stigma consciousness moderated the relationship between stereotype threat and tutoring. When adding the two to the model, change in variance explained from model to model was not significant, $\Delta R^2 = .00$, $\Delta F(4, 110) = .20$, $p = .51$, and none of the interaction variables (explicit stereotype threat X feedback, implicit stereotype threat X feedback, explicit stereotype threat X stigma consciousness, or implicit stereotype threat X stigma consciousness) were significant predictors.

In the next step, the addition of stigma consciousness with feedback (i.e., a 3-way interaction) did not result in a significant improvement of the model, $\Delta R^2 = .05$ $\Delta F(6, 108) = 2.84$, $p = .48$. Taken together, inconsistent with hypotheses 2a-3, stereotype threat did not predict intentions to seek tutoring, nor was the relationship moderated by feedback or stigma consciousness.
In total, participants in the low threat condition ($M = 4.34, SD = 1.40$) scored slightly lower on their interest in joining tutoring sessions than those in the high explicit condition ($M = 4.83, SD = 1.47$) and the high implicit condition ($M = 4.92, SD = 1.69$). For a complete table of results regarding the impact of stereotype threat on intentions to seek tutoring, please reference Table 5.
Table 5: Hierarchical Multiple Regression of Stereotype Threat, False Feedback, and Stigma Consciousness on Women’s Intentions to Seek Tutoring

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Models 2 &amp; 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B</strong></td>
<td><strong>B</strong></td>
<td><strong>β</strong></td>
<td><strong>B</strong></td>
</tr>
<tr>
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<tr>
<td>FB</td>
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<tr>
<td>R²</td>
<td>.03</td>
<td>.03/.03</td>
<td>.04</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.00/.00</td>
<td>.01</td>
<td>.05</td>
</tr>
<tr>
<td>F</td>
<td>1.41</td>
<td>1.05/.83</td>
<td>.48</td>
</tr>
</tbody>
</table>

Dependent Variable: Intentions to Seek Tutoring
(Constant): Low Stereotype Threat
ST: Stereotype Threat - Low Stereotype Threat = 0, Explicit Stereotype Threat = 1, Implicit Stereotype Threat = 2
FB: Feedback – Positive Feedback = 0, Negative Feedback = 1
SC: Stigma Consciousness - Higher Number = Higher in Stigma Consciousness
*p < .05
Exploratory Analyses

To analyze the exploratory research question if implicit or explicit stereotype threat had a larger negative impact, beta coefficients and significant effects were explored using the hierarchical multiple regression results. Results indicated that implicit stereotype threat elicited the most effects from analyses, but only produced small beta coefficients (-.21, -.23, and -.33). Explicit stereotype threat only resulted in one main effect also producing a small beta coefficient (-.28). Although it may seem as if implicit stereotype threat had a larger impact, beta coefficients indicated that implicit stereotype threat and explicit stereotype threat were not that different.

To further explore the potential direct impact of both feedback and stigma consciousness, a regression analysis was run. There were not any significant main effects of stigma consciousness on math performance, major choice, or intentions to seek tutoring ($\beta$’s -.15 - .05, $p$’s > .05). There also were not any main effects of feedback on major choice, or intentions to seek tutoring ($\beta$’s -.01 - .06, $p$’s > .05). However, there were main effects of stigma consciousness and feedback on career choice that did not produce any individual predictors.

Cover Story and Manipulation Check

To remain consistent with the cover story, participants responded to questions about whether the mathematics test was an appropriate level of difficulty and about its use as a placement test. When asked if participants felt that the test included all facets of math, 58.6% said yes and 41.4% responded no. When asked if they felt as if the questions
being asked were at an appropriate level for high school students, 93.1% said yes and 6.9% said no. To expand on this information, participants were asked to rate the difficulty of the mathematics test. Out of the 116 participants, 74 (63.8%) reported the test to be an appropriate level of difficulty despite the fact that the average overall performance on the test was relatively low ($M = 57.05\%$). The remaining participants rated the math test as follows: 11 (9.5%) rated it as easy, 30 (25.9%) rated it difficult, and 1 participant (.9 %) rated it as too difficult. In addition, participants reported on the feedback they received after completing the mathematics test. Out of the 116 participants, 75 (64.7%) reported they felt the feedback to be an accurate depiction of their performance with 41 (35.3%) reporting that they did not feel as if it was accurate. Out of the 41 participants who felt their feedback was inaccurate, approximately half (20) actually received accurate feedback and the remaining participants (21) were correct in assuming that their feedback was inaccurate.

Participants completed the study by answering questions about the intentions of the study and their memory of the manipulation. When asked if the intentions of the study were clear to the participant, 99 (85.3%) stated that the intentions were clear and 17 (14.7%) answered that they were not clear with the most common reason being that they were confused about the gender questionnaires and how they relate to math. Participants were also asked a multiple choice question about what passage was included in their cover story. They were given the following options: men score better than women, women score better than men, men and women score significantly different than one another, gender differences were not mentioned, or I do not remember (Appendix L). Out
of the 116 participants, 42 participants (36.2%) responded that gender differences were not mentioned in the narrative and 35 (30.2%) reported that they did not remember.
Discussion

The present research analyzed the impact of stereotype threat on women’s math performance and comfort with math-intensive fields. Undergraduate college women were presented with a stereotypical statement about gender and math, asked to take a mathematics test, and complete a series of questionnaires. Previous research on stereotype threat has found that when presented with the false stereotype that women perform worse than men in math, women tend to score lower on math related tasks in comparison to women who are not presented with the stereotype, and men in all conditions (e.g., Fogliati & Bussey, 2013; Spencer et al., 1999). The present research generally did not find support for this effect. Stereotype threat did not have the expected negative impact on women’s math performance, comfort in choosing a math-intensive major, or intentions to seek tutoring. Those participants in the two high stereotype threat conditions (implicit and explicit) did not score significantly worse on the math test than those in the low threat condition, and did not differ in their interest in math-related majors or tutoring.

Although there was a general lack of expected significant findings in the present research, there was a significant result that fell consistent with presented hypotheses. There was a main effect of explicit stereotype threat and implicit threat on comforts of choosing a math-intensive career, consistent with Deemer and colleagues (2014). Specifically, women who received the threat explicitly or implicitly reported that they were less comfortable in pursuing a career in a math-intensive field. These findings
suggest that women’s choices can be negatively impacted when presented with an explicit or implicit stereotype threat, and support the notion that the manipulation worked, at least with one dependent variable.

Although main effects were found when looking at comforts to pursue a career in a math-intensive field, no other significant results were found. One possibility is that the stereotype threat manipulation did not create a strong enough effect for some of the dependent variables. A manipulation check was administered at the end of the study asking participants to report which passage was included in the narrative they read before the math test. Two thirds of the participants reported that gender differences were not mentioned or that they did not remember the manipulation at all. Because the majority of the study is based off the implementation of the stereotype threat, this high number of people with inaccurate memory poses a potential problem. If those in a high stereotype threat condition did not read carefully the passage that included the stereotype, it would be as if they were in the low threat condition. If this were the case, then the current research would not find any differences between conditions. With that said, there was a significant effect of stereotype threat on the career choice measure (dependent variable) suggesting that the manipulation likely worked in at least one case.

The lack of the stereotype threat and math performance finding could also be due to a Type II error. For example, it may be that the alternative hypothesis is being rejected because of lack of power. The sample consisted of 116 female participants split into three conditions. The low threat condition had 35 women, the high implicit condition had 36 women, and the high explicit condition had 45 women. It is possible that the effect was
not large enough to find with this number of participants per condition. However, previous research (e.g., Brown & Pinel, 2003, Fogliati & Bussey, 2013, and Spencer, et al., 1999) has shown moderate to large effect sizes with a similar sample size. Also, a power analysis was run to determine an appropriate sample size prior to data collection. The analysis suggested that 100 participants would be sufficient for the previously established effect sizes. To help explore whether a larger sample size might have resulted in a significant effect, the effect of stereotype threat on math scores was examined with the two high stereotype threat conditions combined. However, the main effect was still not found with the larger sample size suggesting that in the present research, the effect was not there, at least not for math performance.

Another explanation dealing with the population might have to do with the majors of the participants. Almost half of the participants (41.8%) were nursing (or potential nursing) majors. According to the Kaiser Family Foundation, in Wisconsin alone there are a total of approximately 33,192 professionally active nurses. Out of that population, only 2,325 (7%) are men leaving the nursing profession in Wisconsin to be dominated by women. As a woman, understanding that your field consists of mostly females, may alleviate some of the stress that comes along with the false stereotype that men outperform women in math. This explanation is supported by social identity theory, which refers to how a person views themselves based on group membership (Tajfel, 2010), and could be a potential explanation as to why the sample did not produce the main effect of stereotype threat on math performance. When negative stereotypes are
irrelevant (as in a female-dominated occupation), stereotype threat can be greatly reduced (Keller, 2002).

Another potential explanation for why the main effect of stereotype threat on math scores was not found could have been issues with the dependent variable (math test). The range of scores on the math test varied from 5 out of 20 (25%) to 18 out of 20 (90%) suggesting that the math test was not too easy for the participants (i.e., no ceiling effect). However, the average score was 11.41 out of 20 which is just over 50%, and lower than expected based on pilot studies of the exam. One potential cause of this low performance could have been the time limit (20 minutes) given to the participants. Out of the 116 participants, 39 (33.6%) did not complete the final two questions and 19 (16.4%) did not answer the final four or more questions, indicating that they ran out of time. While the questions themselves might have been appropriately difficult, the pressure to complete them in 20 minutes may have proven to be a hard task. If the questions were too difficult or the time limit was too restricted, participants would perform poorly on the test regardless of condition. In addition, in the present research, the majority of participants scored 11 out of 20 ($SD = 3.15$) with approximately two-thirds of participant scores ranging from 10-13. Such lack of variability in scores makes it difficult to identify differences between conditions.

In addition to the math test, manipulation of stereotype threat did not impact two of the other math-related variables including levels of comfort pursuing a math-intensive major and intentions to seek tutoring. Issues with the dependent variables may explain the lack of findings here as well. For example, although there was a wide range of scores on
the math major comfort scale, three quarters of participants reported low levels of comfort in choosing a major in a math-intensive field. A large number of study participants reporting low levels of comfort regardless of stereotype presented could indicate that the gender-related math stereotype is so prevalent that the one-time presentation of a stereotype did not impact desire or another issue is causing this overall low level of comfort. In regard to career choice, women in the low threat condition reported that they would feel more comfortable pursuing a math-intensive career than those in the high stereotype threat conditions. However, those same women (in the low threat condition) reported low levels of comfort in pursuing a math-intensive major (as low as the high stereotype threat conditions) suggesting that they would be more comfortable in a math-intensive career, but not a math-intensive major. A math-intensive major presents more immediate requirements leaving women less-comfortable to commit, while a math-intensive career would be a potential future commitment allowing them to feel more comfortable about the choice. This is consistent with research based on Social Cognitive Career Theory which shows that women tend to be less comfortable with proximal options (e.g., math-intensive majors) than with distal options (e.g., math-intensive career) in the face of stereotype threat (Lent, Brown, and Hackett, 2000).

Research is also consistent in showing that women are less comfortable in math courses and following the pathway to a math-related career than men (Deemer et. al., 2014; Thoman, Arizaga, Smith, Story, & Soncuya, 2014).

Unlike participants’ reports on their comfort in choosing a math-intensive major, reports for intentions to seek tutoring were generally high. Two-thirds of the participants
reported a high score (i.e., 9 or above out of 14; \(SD = 1.53\)). This indicates that regardless of the stereotype condition, the majority of participants were inclined to seek tutoring in math. This may be due to the sample consisting of all women. Fogliati and Bussey (2013) found that women were more likely to seek tutoring compared to men. However, unlike the findings of Fogliati and Bussey (2013), women who received negative feedback after a stereotype were not less inclined to seek tutoring than those who received positive feedback and no stereotype. Present research found that all participants, regardless of feedback, rated high on their tutoring intentions. This could be a result of the feedback participants received after completing the math test.

In regard to the impact of feedback, participants were randomly presented with either positive (“above average”) or negative (“below average”) feedback following their math test. At the end of the study, one third of participants indicated that they did not feel as if their feedback was an accurate depiction of their math performance. If the false feedback was not believable by participants, the effect feedback was supposed to elicit might not be found. Just as if one does not believe in a stereotype, if one does not believe the presented feedback, it cannot have an impact on them. However, of note, almost half of those participants who felt their feedback was inaccurate actually did receive accurate feedback (i.e., they performed below average and were told they performed below average).

Previous research has shown that those higher in stigma consciousness should also be more negatively impacted by stereotype threat (Brown & Pinel, 2003; Cadaret, Hartung, Subich, & Weigold, 2017; Fogliati & Bussey, 2013). However, in the current
study, when stigma consciousness was combined with stereotype threat, the expected negative effect on math scores, major and career choices, and tutoring intentions was generally not found. There was also no main effect of stigma consciousness with any of the dependent variables. One possible cause is the range of scores reported on the stigma consciousness questionnaire. Although there was a wide range of scores, almost half of participants fell in the middle of the scale (scoring 40-48 on a scale from 10-70) with an average score of 43.36 ($SD = 7.50$) and a mode of 48. The purpose of the stigma consciousness questionnaire was to see if those who reported higher levels of awareness of stereotypes concerning them were more negatively impacted by the stereotype threat than those who reported lower levels of stigma consciousness. However, this comparison cannot be determined if the majority of participants fell in the middle. With a restricted range, participants cannot be parsed out based on their threat condition which prevents the finding of the effect.

An exploratory research question was presented regarding the difference in impact of explicit versus implicit stereotype threat. No differences were found for the majority of analyses including scores on the mathematics test, comfort in pursuing a math-intensive major and intentions to seek tutoring, and both threat conditions produced low beta coefficients throughout. However, based on beta coefficients, explicit stereotype threat had a larger direct impact on career-choice, albeit small overall. This result suggests that further research must be done to determine if there is a significant difference between the two high stereotype threat conditions.
Future Research

While the present study added interesting contributions to the research of stereotype threat, there is more to be discovered. To determine whether the mathematics test from the present research was problematic or the manipulation itself, replication studies should be conducted. Doing an exact replication and conceptual replications by changing the mathematics test or manipulation could determine the accuracy of the findings in the present study. Piloting and using a math test with a different time limit (or no time limit) could address the potential time restriction issue. Ensuring earlier that all participants either read or hear the manipulation would be beneficial because of how important the implementation of the threat is to the research. The present study found that many participants either could not remember the manipulation or incorrectly defined it. This is an issue that needs to be addressed in future studies. Researchers could also further explore the question of which threat elicits a stronger impact by focusing primarily on the stereotype threat manipulation and ensuring that all participants understood and read the stereotype (if they were in either high stereotype threat condition).

The current study attempted to preemptively address issues dealing with sample size, however, the sample still consisted of a great deal of nursing majors. Future research could control for major or attempt to recruit a greater diversity in participants. The lack of variability in majors for the current population may also address the issue of range restriction in many of the independent and dependent variables (i.e., stigma consciousness and intentions to seek tutoring).
Conclusion

The purpose of the current study was to examine how stereotype threat can negatively impact women’s math performance, choices to pursue a major or career in a math-intensive field, and intentions to seek tutoring. In addition, stigma consciousness and false feedback were included as potential moderators of the relationship between stereotype threat and math-related factors. While the majority of findings were non-significant, results concluded with a few significant outcomes. Specifically, a main effect of implicit stereotype threat and explicit stereotype threat on women’s comfort in pursuing a math-intensive career. With the significant findings in the present research, and the extensive prior research done within the realm of women and stereotype threat, the knowledge of why women do not feel comfortable in a stereotype relevant career has increased and will undoubtedly continue to grow. By furthering the understanding of underlying causes of the underrepresentation of women in math-intensive majors and careers, future research can continue to work to change those statistics.
APPENDIX A

Participant Information Form (Demographics)
Appendix A

Participant Information Form (Demographics)

1. Age: ______

2. What year are you in school? (Check one)
   ___ 1. First Year
   ___ 2. Second Year
   ___ 3. Third Year
   ___ 4. Fourth Year
   ___ 5. Other (Please Specify) ______________________________

3. Race/Ethnicity (Check all that apply):
   ___: African American/Black
   ___: Asian American/Asian
   ___: Hispanic American/Latino (a)
   ___: Native American/American Indian
   ___: European American/White
   ___: Other (Please Specify: _____________________________)

4. What is your current or anticipated major?
   ______________________________________________________

5. How long has it been since you completed your last mathematics course (in months)?
   ____________________ . What course was it? ___________________________

6. Please indicate the score you received on the math portion of the ACT. If you don’t know, take your best guess: _____

   How confident are you that you remember your ACT math score accurately? (low, medium, high): ____________
   _______ Not Applicable: I did not take the ACT (please check if this applies to you)
APPENDIX B

Math Identification Questionnaire (MIQ)
Appendix B

Math Identification Questionnaire (MIQ)

I. For the statements below, indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements:

1-------2-------3-------4-------5-------6-------7
Strongly Disagree
Strongly Agree

_____ 1. My math abilities are very important to me.
_____ 2. Math abilities are not important to my success in school. (R)
_____ 3. If I took an IQ test of my math abilities (a test of my natural math abilities, on which studying really would not help) and I did poorly on this test, I would be very bothered.
_____ 4. I don’t care at all if other people believe that I am good at math. (R)
_____ 5. Math abilities will probably be very important to me in my future career.
APPENDIX C

Gender Identity Scale (GIS)
Appendix C

Gender Identity Scale (GIS)

II. For the following statements, please indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements. If you do not identify as a woman, please skip statements 1 - 4 and check N/A (statement 5).

1------2------3------4------5------6------7
Strongly Disagree Strongly Agree

_____ 1. Overall, being a woman has very little to do with how I feel about myself. (R)
_____ 2. Being a woman is an important reflection of who I am.
_____ 3. Identifying as a woman is unimportant to my sense of what kind of a person I am. (R)
_____ 4. In general, being a woman is an important part of my self-image.
_____ 5. N/A: I do not identify as a woman
APPENDIX D

Stigma Consciousness Questionnaire (SCQ)
Appendix D

Stigma Consciousness Questionnaire (SCQ)

III. For the following statements, please indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements:

1-------2-------3-------4-------5-------6-------7
Strongly Disagree Strongly Agree

_____ 1. Stereotypes about women have not affected me personally. (R)
_____ 2. I never worry that my behaviors will be viewed as stereotypically female. (R)
_____ 3. When interacting with men, I feel like they interpret all my behaviors in terms of fact that I am a woman.
_____ 4. Most men do not judge women on the basis of their gender. (R)
_____ 5. My being female does not influence how men act with me. (R)
_____ 6. I almost never think about the fact that I am female when I interact with men. (R)
_____ 7. My being female does not influence how people act with me. (R)
_____ 8. Most men have a lot more sexist thoughts than they actually express.
_____ 9. I often think that men are unfairly accused of being sexist.
_____ 10. Most men have a problem viewing women as equals.
APPENDIX E

Mathematics Test
Appendix E

Mathematics Test

**DIRECTIONS:** Solve each problem. Choose the correct answer and then fill in the corresponding oval. You will have 20 minutes to complete the test.

Do not linger over problems that take too much time. Solve as many as you can; then return to the others in the time you have left.

You are permitted to use a calculator on this test. You may use your calculator for any problems you choose, but some of the problems may best be done without using a calculator.

1. A car averages 27 miles per gallon. If gas costs $4.04 per gallon, which of the following is closest to how much the gas would cost for this car to travel 2,727 typical miles?

   ○ $44.44  
   ○ $109.08  
   ○ $118.80  
   ○ $408.04  
   ○ $444.40

2. What is the value of $x$ when $2x + 3 = 3x - 4$?

   ○ -7  
   ○ -1/5  
   ○ 1  
   ○ 1/5  
   ○ 7

3. What is the greatest common factor of 42, 126, and 210?

   ○ 2  
   ○ 6
4. Sales for a business were 3 million dollars more the second year than the first, and sales for the third year were double the sales for the second year. If sales for the third year were 38 million dollars, what were sales, in millions of dollars, for the first year?

- 16
- 17.5
- 20.5
- 22
- 35

5. In the figure below, ray \( \overrightarrow{EF} \) was constructed starting from rays \( \overrightarrow{ED} \) and \( \overrightarrow{EG} \). By using a compass \( D \) and \( G \) were marked equidistant from \( E \) on rays \( \overrightarrow{ED} \). The compass was then used to locate a point \( F \), distinct from \( E \), so that \( F \) is equidistant from \( D \) and \( G \). For all constructions defined by the above steps, the measures of \( \angle DEF \) and \( \angle GEF \):

- are equal.
- are NOT equal.
- sum to 30°.
- sum to 45°.
- sum to 60°.

6. Abandoned mines frequently fill with water. Before an abandoned mine can
be reopened, the water must be pumped out. The size of pump required depends on the depth of the mine. If pumping out a mine that is $D$ feet deep requires a pump that pumps a minimum of $\frac{D^2}{25} + 4D - 250$ gallons per minute, pumping out a mine that is 150 feet deep would require a pump that pumps a minimum of how many gallons per minute?

○ 362
○ 500
○ 800
○ 1,250
○ 1,750

7. The length, in inches, of a box is 3 inches less than twice its width, in inches. Which of the following gives the length, $l$ inches, in terms of the width, $w$ inches, of the box?

○ $l = \frac{1}{2}w + 3$
○ $l = w + 3$
○ $l = w - 3$
○ $l = 2w + 3$
○ $l = 2w - 3$

8. In quadrilateral $PQRS$ below, sides $PS$ and $QR$ are parallel for what value of $x$?

○ 158
○ 132
○ 120
○ 110
9. How many irrational numbers are there between 1 and 6?

○ 1  ○ 3  ○ 4  ○ 10  ○ Infinitely many

10. A typical high school student consumes 67.5 pounds of sugar per year. As part of a new nutrition plan, each member of a track team plans to lower the sugar he or she consumes by at least 20% for the coming year. Assuming each track member had consumed sugar at the level of a typical high school student and will adhere to this plan for the coming year, what is the maximum number of pounds of sugar to be consumed by each track team member in the coming year?

○ 14  ○ 44  ○ 48  ○ 54  ○ 66

11. In the standard \((x, y)\) coordinate plane below, 3 of the vertices of a rectangle are shown. Which of the following is the 4th vertex of the rectangle?
12. The *lead* of a screw is the distance that the screw advances in a straight line when the screw is turned 1 complete turn. If a screw is 2½ inches long and has a lead of ⅛ inch, how many complete turns would get it all the way into a piece of wood?

- 5
- 10
- 15
- 20
- 25

13. In the figure below, \( \angle ABC \cong \angle DFE \), \( \angle BAC \cong \angle FDE \), \( D \) and \( F \) are on \( AB \), \( AD \cong FB \), and distances in centimeters are as shown. What is the length of \( AD \), in centimeters?

- 5
- 4
- 3
- 2
14. The volume, $V$, of the right circular cone with radius $r$ and height $h$, shown below, can be found using the formula $V = \frac{1}{3} \pi r^2 h$. A cone-shaped paper cup has a volume of 142 cubic centimeters and a height of 8.5 centimeters. What is the radius, to the nearest centimeter, of the paper cup?

15. A boat departs Port Isabelle, Texas, traveling to an oil rig. The oil rig is located 9 miles east and 12 miles north of the boat’s departure point. About how many miles is the oil rig from the departure point?

16. Which of the following statements must be true whenever $n$, $a$, $b$, and $c$ are positive integers such that $n < a$, $c > a$, and $b > c$?

○ $a < n$
$b - n > a - n$

$\circ b < n$

$\circ n + b = a + c$

$\circ 2n > a + b$

17. The distribution of Jamal’s high school grades by percentage of course credits is given in the circle graph below. What is Jamal’s grade point average if each A is worth 4 points; each B, 3 points; and each C, 2 points?

- 3.0
- 3.4
- 3.6
- 3.7
- Cannot be determined from the given information

18. An industrial cleaner is manufactured using only the 3 secret ingredients A, B, and C, which are mixed in the ratio of 2:3:5, respectively, by weight. How many pounds of secret ingredient B are in a 42-pound (net weight) bucket of this cleaner?

- 4.2
- 12.6
- 14.0
- 18.0
- 21.0
19. A neighborhood recreation program serves a total of 280 children who are either 11 years old or 12 years old. The sum of the children’s ages is 3,238 years. How many 11-year-old children does the recreation program serve?

○ 55
○ 122
○ 132
○ 158
○ 208

20. Which one of the following expressions has an even integer value for all integers \( a \) and \( c \)?

○ \( 8a + 2ac \)
○ \( 3a + 3c \)
○ \( 2a + c \)
○ \( a + 2c \)
○ \( ac + a^2 \)
APPENDIX F

Major/Career/Tutoring Questionnaires
Appendix F

Major/Career/Tutoring Questionnaires

Major Choice:
Please answer the following statements regarding your major (or anticipated major). For the statements below (excluding question 1), indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements:
Math-intensive majors include, but are not limited to, physics, engineering, computer sciences, and mathematics.

1------2------3------4------5------6------7
Strongly Disagree Strongly Agree

1. I have already declared (or plan to declare) a math-intensive major. (Circle yes or no then proceed by answering the appropriate questions)
   a. Yes (please answer question 2)
   b. No (please answer questions 3 and 4)

2. If yes, I am comfortable with my math-intensive major.
3. If no, I was or would be comfortable declaring a math-intensive major.
4. I would be willing to reconsider the major I am currently involved in to pursue a math-intensive major.

Career Choice:
Please answer the following statements regarding your anticipated career. For the statements below, indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements:
Math-intensive careers include, but are not limited to, mathematicians, statisticians, computer scientists, and engineers.

1------2------3------4------5------6------7
Strongly Disagree Strongly Agree

1. I already plan to pursue a career in a math-intensive field.
2. I was or would be comfortable pursuing a career in a math-intensive field
3. If you are not planning to pursue a career in a math-intensive field, I would be willing to reconsider my future career goals and shift to pursue a math-intensive career.
Tutoring Intentions:
Please answer the following statements regarding your intentions to pursue tutoring. For the statements below, indicate the extent to which you agree or disagree with each statement by writing a number from the following scale in the blank next to the statements:

1-------2------3------4------5------6------7

Not Likely at All          Very Likely

_____ 1. How likely are you to pursue free tutoring (either one-to-one or drop-in sessions) to increase your math knowledge?
_____ 2. How likely are you to attend free scheduled math workshops provided by the Mathematics Tutoring Lab?
APPENDIX G

Explicit Stereotype Threat Narrative
Appendix G

Explicit Stereotype Threat Narrative

The math test you are about to take was designed by the University of Wisconsin Oshkosh. We are interested in assessing the difficulty of certain items with the goal of using the test for placement into math classes. Please complete each question to the best of your ability. Your scores will be used to ensure that a diversity of ability and subjects have been covered. Previous scores have indicated that men significantly outperform women.
APPENDIX H

Implicit Stereotype Threat Narrative
Appendix H

Implicit Stereotype Threat Narrative

The math test you are about to take was designed by the University of Wisconsin Oshkosh. We are interested in assessing the difficulty of certain items with the goal of using the test for placement into math classes. Please complete each question to the best of your ability. Your scores will be used to ensure that a diversity of ability and subjects have been covered. Previous scores have indicated a significant difference in how men and women perform on the test.
APPENDIX I

Low Stereotype Threat Narrative
Appendix I

Low Stereotype Threat Narrative

The math test you are about to take was designed by the University of Wisconsin Oshkosh. We are interested in assessing the difficulty of certain items with the goal of using the test for placement into math classes. Please complete each question to the best of your ability. Your scores will be used to ensure that a diversity of ability and subjects have been covered. Previous scores have indicated that men and women perform equally well on this test.
APPENDIX J

Informed Consent
Appendix J

Informed Consent

The Department supports the practice of protecting human participants in research. The following information is provided so that you can decide whether you wish to participate in the present study. Your participation is solicited but is strictly voluntary. We assure you that your name and responses will remain confidential.

If you decide to participate in this study, you will be asked to complete a few surveys and a mathematics test. The purpose of this study is to develop a mathematics placement test for the University of Wisconsin Oshkosh. We do not anticipate any risk in this study other than the discomfort related to taking a test, something students are familiar with. Although you may not benefit directly from this study, you will be increasing the researcher's' knowledge of the appropriateness of the math test for use in the University.

If you agree to participate in this study, you will be free to withdraw at any time and will still receive credit for the amount of time spent in the study. If you decide not to participate in this study, please let the researcher know and they will excuse you from the study. You do not need to tell the researcher your reasons for choosing not to participate. If you decide to withdraw from the study, any information collected from you up to that point will be destroyed. We will collect your name and student ID for credit-assignment purposes only. All study results will be recorded anonymously through an online survey system called Qualtrics. We will not release any information about you in any way or form that could identify you.

If you have any questions, please ask me or contact:
Demi Schwingle
Office CF- 006
Email: giled21@uwosh.edu

If you have any complaints about your treatment as a participant in this study, please call or write:
Chair, Institutional Review Board for
Protection of Human Participants
C/o Office of Grants and Faculty Development
University of Wisconsin Oshkosh
920-424-3215

Although the chairperson may ask you for your name, all complaints are kept in confidence.

Consent Statement: By signing the statement below, I am confirming that I am at least 18 years old and have received an explanation of the study. I agree to participate. I understand that my participation in this study is strictly voluntary, and that I may withdraw at any time.

______________________________________________________________________________
STUDENT'S PRINTED NAME   SIGNATURE   DATE
APPENDIX K

Cover Story Task
Appendix K

Cover Story Task

Please answer the following questions with regards to the math test you have just completed.

1. Do you believe the math test you have just taken reflects a good representation of all math subjects?
   ______ Yes, to the best of my knowledge the test covered all subjects.
   ______ No, I do not feel the test covered all subjects.

   If you answered No, please list the subjects you felt were not covered on the test.
   __________________________________________
   __________________________________________

2. Do you believe the math test provided questions at an appropriate level for high school students to complete successfully?
   ______ Yes
   ______ No

   If no, please explain:
   __________________________________________

3. What level of difficulty did you find the test?
   ______ Too Easy
   ______ Easy
   ______ Appropriate
   ______ Difficult
   ______ Too Difficult

4. Do you feel as if the math test would assist the University of Wisconsin Oshkosh in placing students into appropriate classes?
   ______ Yes
   ______ No

   If no, please explain. __________________________________________
   __________________________________________
   __________________________________________

__________________________
APPENDIX L

Deception and Manipulation Check
Appendix L

Deception and Manipulation Check

1. Think back to the instructions at the beginning of the math test. Which of the following sentences were included in the instructions?
   a. Men score better than women
   b. Women score better than men
   c. Men and women score significantly different than one another
   d. Men and women score equally well
   e. Gender differences were not mentioned

2. After you completed the math test, what type of feedback did you receive about your performance?
   a. Positive Feedback (You performed above average on the math test)
   b. Negative Feedback (You performed below average on the math test)

2. Do you feel as if the feedback you received regarding your score on the math test was an accurate depiction of your performance?
   _____ Yes
   _____ No

   If you answered No, please provide an explanation as to why you felt the feedback was inaccurate.

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

3. Do you feel as if the study provided a clear description of its goals and intentions?
   _____ Yes
   _____ No

   If you answered No, please explain why you feel as if the study did not provide a clear description of its intentions.

   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   ___________________
APPENDIX M

Group Debriefing Script
Appendix M

Group Debriefing Script

Thank you all for participating in this study. Throughout the study you were led to believe that you were assisting in the development of a mathematical placement study for the University of Wisconsin Oshkosh. However, you were actually participating in a study about the impact stereotype threat has on women. The study was not meant to trick you in any way, I just wanted to ensure that you would answer all questions honestly and attempt all math questions to the best of your ability.

As some of you may already know, stereotype threat is a psychological state that occurs when awareness of a self-relevant negative stereotype leads to worries about confirming the stereotype. Specifically in this study, I wanted to examine the impact of the false, negative stereotype that women tend to perform poorly on math related tasks in relation to men. I wanted to examine how that stereotype would affect your performance on the math task given to you and also how you would respond to the questions regarding future majors or careers in math-intensive fields. Some participants read that men outperform women; others read that men perform equally well as women, and some read that there was a difference in how men and women perform but no specific direction was given. Previous research suggests that when women are faced with the stereotype that women perform worse than men (or even if they read that there is a vague gender difference of some kind), they tend to perform poorly on the math test. Because stereotypes exist all around us, this may be one reason why there are fewer women in math-related fields.

Not only was the study’s purpose deceiving, but you also experienced deception in the form of performance feedback. Upon completion of the math test, you received feedback that stated you performed above average or below average, however, that feedback was random and not connected to your actual score. You were randomly assigned to receive either positive or negative feedback regardless of your actual performance on the test. The feedback had absolutely no reflection on your true math ability. This feedback was provided to you so that we could examine the relationship that feedback has with stereotype threat. In the real world, people receive feedback all the time. It is important to understand whether feedback can further influence women’s thoughts about math-related majors or careers.

Please remember that all of these effects are based on stereotypes only. In the real world, women and men perform equally well on math tests. In fact, just knowing that a stereotype is false can help women perform better. If you would like more information on my study or have any questions or concerns please feel free to ask me now. If you would prefer to do so in private or find you have questions or concerns later, please do not hesitate to email. My information is on the consent form I have handed out to you. Please also take this debriefing statement with you which explains in writing what I just said to you.

Thank you again for participating in this study. Your responses will be a significant help in my goal to further understand the impact stereotypes can have on women.
APPENDIX N

Debriefing Statement
Appendix N

Debriefing Statement

Thank you for your participation in the study. I would like to take a few minutes to tell you about the purpose of this study. The goal of this study was to look at how women perform on math questions when exposed to stereotype threat. Specifically, I am interested in how providing women with the stereotype that men perform better than women on certain math tests affect women’s ability to perform well on those tests. One third of participants read that “previous scores have indicated that men significantly outperform women”, another third read that “previous scores have indicated a significant difference in how men and women perform on the test”, and the final third of participants read that “previous scores have indicated that men and women perform equally well on this test.” Math performance will be compared across these three conditions to see if telling participants that women perform poorly actually leads them to perform poorly.

In addition, I am interested in how women who receive negative feedback on their math test performance, and are also exposed to stereotype threat, react when asked if they would pursue a major or career in math. Some participants were told they performed above average on the math test while others were told they performed below average on the math test. Major and career choice will be compared across these two conditions to see if math-related feedback impacts one’s thoughts about math-related majors.

The study was not about the development of a math placement exam. Furthermore, our purpose was not to “trick” you, but to allow you to respond naturally to the various questionnaires and answer the math questions to the best of your ability. Even though there are some misleading aspects to this study, I hope that you understand that they were included for an important reason. Are you ok with this or have any further questions about these aspects of the study?

We believe this study is important because it allows us to better understand how stereotypes can impact women’s performance on math tasks and their future career goals. With the data collected for the study, we can look further into the issue of underrepresentation of women in math-intensive fields.

All of the information that was collected today will be kept in complete confidentiality and there will be no way of identifying your responses with your identity. We are not interested in any one participant’s responses by themselves. Rather, we are interested in the general responses of all participants when they are combined together.

If you are uncomfortable in any way as a result of answering any of the questionnaire items, then please speak with me before you leave.

Your participation today was greatly appreciated and will help in furthering our understanding of stereotype threat and its effect on women’s future major/career choices.
We ask that you do not discuss this research with anyone else, at least until the end of the semester, because it could ruin the study for other participants. If you have any questions or concerns regarding your participation in this study please contact Demi Schwingle. Her contact information is listed on your copy of the consent form.
Bibliography


Learning and Individual Differences, 32, 273-277.
doi:10.1016/j.lindif.2014.03.020


