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Emily Dowd

University of Richmond

An Intervention in Stereotype Threat: Does Gender-Affirming Literature Reduce Female Vulnerability in Mathematics?

By

Emily Dowd

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Psychology Department

University of Richmond, Richmond VA

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Faculty Advisor: Dr. Jane Berry

Abstract

The current study examined whether the presentation of gender-affirming literature, in the form of information about the University of Richmond's Women, Gender, and Sexuality Studies (WGSS) program, mitigated female stereotype threat in the domain of mathematics. A pilot study tested 10 male and 10 female college-aged participants to determine whether a derogatory beer commercial produced the threat effect in women; results were inconclusive. A follow-up study used threat methods derived from previous research and information about the WGSS program at Richmond for the intervention manipulation. Results from 30 female college students indicated insufficient threat and a nonsignificant positive increase in performance following the intervention. Further research is needed to establish the supportive nature of gender-affirming literature.

An Intervention in Stereotype Threat: Does Gender-Affirming Literature Reduce Female Vulnerability in Mathematics?

The women's liberation movement has undergone a long and tortuous path in America. Although hiring practices, wage discrimination, and other forms of injustice are more carefully regulated in modern society, prevailing notions of female roles create a more subtle menace in the form of stereotype threat. Stereotype threat proposes that as members of a group are presented with a negative stereotype about themselves, they become preoccupied with the fear of reinforcing said stereotype (Steele, 1997). This threat produces many negative outcomes, such as decreased working memory capacity and underperformance in the stigmatized field (Schmader & Johns, 2003).

The current research intends to address the significance of stereotype threat in relation to gender disparities in science, technology, engineering, and mathematics (STEM) fields. When assessing ability distributions across sex, previous research has found a higher percentage of males at both the higher and lower end of the spectrum – this has been attributed to not merely brain structure, but rather a range of sociocultural influences, including early experiences and educational policies (Halpern et al., 2007). Further reviews of national education results dating back to 1988 have found no significant differences between males and females in mathematic performance (Lindberg, Hyde, Petersen, & Linn, 2010). Despite these findings, there is still a marked gender gap in STEM occupations, with women making up 11% of professionals in engineering and 29% of professionals in the physical sciences (National Science Board, 2006). One possible factor behind such pronounced gender disparities involves the social messages implied in STEM areas; namely, women are stereotyped as not biologically suited to these particular fields, and those who defy that stereotype are viewed as ‘unfeminine.’ These and other stereotypes may create a considerable threat that hinders female participation in the STEM fields.

Manifestations of Stereotype Threat

Past research has demonstrated that stereotype threat reaches across gender and racial boundaries (Steele, 1997). By distributing very difficult Graduate Records Examinations (GRE) problems to college men and women majoring in mathematics, Steele (1997) demonstrated that women underperform in the stereotyped field despite possessing comparable academic qualifications. Similarly, when researchers presented students with GRE problems described as ‘ability- and intellectually-diagnostic’, African Americans of equivalent aptitude performed poorly in comparison to Caucasian counterparts (Steele). Steele claims that discrimination against women in male-dominated fields such as math and science, as well as against African Americans in academics, creates this threat and results in both underperformance and decreased self-confidence in these areas. As members of the group fear promoting and supporting a stereotype, they lose the motivation to identify with and achieve in the prejudiced domain; this has resulted in the underrepresentation of women in math and science fields, in addition to racial gaps in standardized and I.Q. testing (Steele, 1997; McKay, Doverspike, Bowen-Hilton, & Martin, 2002).

Stereotype threat also affects cognitive and physiological functioning. When women were faced with stereotype threat in the form of false negative feedback on a difficult GRE math task, they exhibited increased aggression levels, increasingly unhealthy eating habits, risky decision making, and decreased attentional control as compared to non-threatened women (Inzlicht & Kang, 2010). Evidently, stereotype threat extends beyond the immediate consequences of impaired self-confidence and performance and can spill over into unrelated domains. As responding to stereotype threat depletes reserves of self-control, individuals are more inclined to experience negative effects in subsequent behaviors (Inzlicht & Kang, 2010).

While stereotype threat generally produces negative behavioral outcomes, the presentation of said threat can also provoke an opposite, positive reaction in stereotyped groups. Hoyt, Johnson, Murphy, and Skinnell (2010) examined stereotypes of females in leadership roles across explicit and implicit boundaries. When exposed to a blatant threat (explicit condition), such as a derogatory article about a lack of women in upper-level business positions, women were more likely to display reactance, or an emotional reaction that strengthens the urge to contradict stereotypes, and take on a subsequent task involving leadership. However, when Hoyt et al. implemented a more implicit threat, such as manipulating the male-to-female ratio in participant groups, threatened women were subsequently more likely than non-threatened women to take a background role in a leadership task scenario. The current study employed both explicit and implicit manipulations of stereotype threat to examine its effects on math problem-solving ability and math self-efficacy in college women. It was expected that a combination of explicit and implicit components of stereotype threat would create vulnerability and not reactance in women.

Reducing Stereotype Threat

Proposed methods of reducing stereotype threat include building self-efficacy, or confidence in a specific field, through improved teacher-student relationships (Steele, 1997). Increases in self-efficacy have been correlated with improved performance across a variety of domains (Stajkovic & Luthans, 1998; Multon, Brown, & Lent, 1991). By improving academic relationships, it is theorized that authorities can create a safer environment in which stereotype threat is reduced. A pilot study using questionnaires and correlational methods was conducted at the University of Richmond (Dowd & Berry, 2010). I assessed the nature of mentoring relationships in college students and faculty members, with a focus on how these relationships affect academic self-efficacy. Analyses showed that students seem to prefer a mentor of the same sex, as indicated by a $\chi^2(1) = 3.37$, $p = .067$. This suggests a positive association between student and mentor gender; although nonsignificant, it is trending in the correct direction. This might support the theory that mentoring of women by women will lead to increased participation of women in fields such as math and science where high-performing women may be stigmatized (Nielsen, Marschke, Sheff, & Rankin, 2005). Furthermore, the perceived effectiveness of mentoring was positively correlated with academic self-efficacy, $r = .31$, $p < .05$, suggesting that strong mentoring relationships increase academic confidence. The results from this preliminary investigation of sex differences in academic achievement and self-efficacy provided a conceptual bridge to the current study.

Another method for reducing stereotype threat involves improving identity safety (Davies, Spencer, & Steele, 2005). An experiment on negative female stereotypes in leadership had women view television commercials, such as an ad for a local college that presented a female applicant as a vapid blond, which affirmed inferior roles for women. This caused them to be less likely than non-threatened women to take on a leadership role in a subsequent task. However, a statement that affirmed equal gender capability in leadership roles reduced the effects of stereotype threat in a comparable female participant pool. Through the promotion of positive identity environments that assert equal abilities between the sexes, women can more ably resist threatening stereotypes that prime for lesser gender roles (Davies et al.). The current study expanded upon this experiment by promoting identity safety through educational literature on a Women, Gender, and Sexuality Studies (WGSS) program and a Women in Living and Learning (WILL) program at the university from which participants were drawn.

Research Overview and Hypotheses

The current study applied previous findings on stereotype threat in mathematical and scientific fields to college women. Research on female undergraduates in male-dominated domains, such as engineering, computer science, and mathematics, found that these women were more likely to report discrimination, greater feelings of intellectual vulnerability, and a desire to change majors (Steele, James, & Barnett, 2002). A pilot study applied the experimental method of Davies et al. (2005) in determining how a threatening video, specifically a beer commercial, affects math self-efficacy and performance in women. It was hypothesized that women who view a threatening commercial prior to a math task will report lower levels of self-efficacy and will perform worse than women who do not view a threatening commercial. Overall, math self-efficacy should be highly correlated with math performance regardless of threat manipulation.

The primary study, also on female stereotype threat in mathematics, assessed the effect of an intervention involving gender-affirming literature on reported math self-efficacy and math performance. It was hypothesized that female participants who are presented with positive literature derived from the WGSS and WILL programs after stereotype threat will experience reduced threat and subsequently report higher math self-efficacy and perform better on a math task.

Method – Pilot Study

Participants

Ten male and ten female participants were recruited at the University of Richmond. The age range was 18-23 years, with a mean age of 20. The ethnic composition of participants was 70% Caucasian, 15% African American, 10% Hispanic, and 5% Asian. Participants were recruited by posting flyers in academic buildings and sending out campus-wide e-mail announcements. Participants were offered $10 as compensation for taking part in a 45 minute study. The experiment was described as a 'short-term memory' study, as mentioning the use of stereotype threat could prime participants and affect results. Both the experimental and control trials included consent forms and a debriefing of information. In order to ensure confidentiality, each participant's data packet was assigned a random number and kept separate from the consent form.

Materials

All participants completed a general questionnaire reporting demographic information, Scholastic Aptitude Test (SAT) Math scores, and previous math courses (see Appendix 1). The experimental, threat-inducing beer commercial was a 30-second Heineken advertisement which portrayed an attractive female figure that robotically provided beer through a keg dispenser. Researchers chose this commercial due to its promotion of negative gender stereotypes, specifically the passive and beautiful female. The control commercial was a Budweiser advertisement, also 30 seconds in length, which centered on the Budweiser Clydesdale and presented no gender stereotypes. A short survey on the beer commercials provided distracter marketing questions about the product, such as "How persuasive was the ad?" and "How likely are you to buy this product?" (see Appendix 2).

The Math Attitudes and Perceptions Scales (see Appendixes 3 and 4), the Math Task Self-efficacy Scale (see Appendix 5), and the Math Performance measure (see Appendix 6) were all derived from previous research (Pajares, 1996). The Math Attitudes Scale included questions such as “I get really uptight during math tests” and “I have usually been at ease in math courses” – these were rated on a 1-5 Likert scale, 1 being “strongly disagree” and 5 being “strongly agree”. The Math Perceptions Scale included questions such as “I am quite good at mathematics” and “Mathematics makes me feel inadequate” – these were rated on a 1-8 Likert scale, 1 being “Definitely false” and 8 being “Definitely true.” The Math Task Self-efficacy scale asked participants to rate how confident they were that they would be able to solve each of the specific math problems that were later presented in the Math Performance task. Confidence ratings were made on a scale of 0-100%. The math performance measure included 18 questions such as “ABOUT how many times larger than 614,360 is 30,668,000?” and “$3\ {}^{4}/_{5} - {}^{1}/_{2} =$ _____” (see Appendix 6).

Procedure

Participants were randomly assigned to either the experimental or the control group, with 5 men and 5 women in each level. We hypothesized that the effect of the threat would be present in women but not men; therefore, male participants were included to test relative effects between experimental and control groups. Sessions were held in single-sex groups of up to 3 people, with only male or female participants in each trial. Participants completed the general questionnaire before viewing either the experimental or control commercial. In order to avoid conscious priming, participants were informed that this commercial was presented in order to assess product marketability. After completing the marketing survey questions, participants completed the Math Attitudes and Perceptions Scales.

In order to ensure that participants would not attempt to solve the math problems while completing the Math Task Self-efficacy Scale, the instructor then led the group by reading the questions aloud from a PowerPoint slide presentation. Participants viewed each question for as long as the instructor took to read it, and then had eight seconds to rate their confidence at solving each problem correctly. After participants had provided their confidence ratings for each of the math problems, they were then given 20 minutes to solve as many of the 18 problems as possible. A single piece of scrap paper was provided, and participants were not allowed to use a calculator. After the 20 minute time period ended, the instructor debriefed the participants as to the purpose of the study.

Results – Pilot Study

Self-reported math self-efficacy was highly correlated with number of problems correctly solved, $r = .72$, $p = .001$ (see Figure 1). Women presented with the threatening video reported slightly higher self-efficacy (M = 80% confidence, SD = 5.91) than women presented with the control video (M = 80% confidence, SD = 19.99), but this was nonsignificant. Likewise, women presented with the threatening video performed better on the math task of 18 questions (M = 12.67 questions correct, SD = 1.63) than women presented with the control video (M = 9.50 questions correct, SD = 5.74), but this was nonsignificant (see Figure 2). Male participants showed similar trends, with the threatened condition reporting higher self-efficacy and higher performance.

Discussion – Pilot Study

The hypothesis that math self-efficacy is highly correlated with math performance was supported. However, the hypothesis that women who view a threatening commercial prior to a math task would report lower levels of self-efficacy and would perform worse than women who do not view a threatening commercial was not supported. To the contrary, women in the experimental group demonstrated higher levels of both math self-efficacy and math performance. These results do not support previous research by Davies et al. (2005), which found that stereotype threat presented through video creates sufficient vulnerability in women and has a negative impact on their likelihood to accept a subsequent leadership task.

Several limitations within the pilot study can account for these results. A small sample size of 20 participants, only 10 of which were female, restricts the reliability of the data. The Heineken beer commercial may also have presented too explicit a threat. Previous research has demonstrated that, when presented with a single explicit stereotype threat, women are more likely to display reactance and perform more positively in the discriminated field (Hoyt et al., 2010). As a result of the chosen commercial, the experimental group may have experienced the threat too explicitly and gained positive resolve from the stereotype. Furthermore, analysis of the testing environments revealed that the primary female control group was tested by a male experimenter. Past experiments have shown that the presence of an assertive male as instructor can produce sufficient implicit threat and decrease performance (Hoyt et al., 2010; Steele et al., 2002).

While additional pilot studies may have determined a more implicitly threatening commercial, project resources did not allow for the gradual development of a valid and reliable threat manipulation. In order to apply the gender-affirming literature as an intervention, the primary study used an implicit form of stereotype threat supported by published research (Hoyt et al., 2010; Steele et al., 2002). Also, researchers shortened the allowed time limit for the math task in order to increase task difficulty and optimize the probability of obtaining group differences (Steele, 1997).

Method – Primary Study

Participants

30 female students were recruited from the University of Richmond. The age range was 18-23 years, with a mean age of 20 years. The ethnic composition of participants was 47% Caucasian, 23% Asian, 13% Hispanic, 7% African American, and 10% of mixed race. Participants were offered $10 for taking part in a 45 minute study. The experiment was again described as a 'short-term memory' study to avoid priming. Researchers recruited participants in the same manner as the pilot study and followed equivalent protocol for confidentiality. Both the experimental and control trials included consent forms and a debriefing of information.

Materials

All participants completed the general questionnaire used in the pilot study (see Appendix 1). As a minor change, researchers asked the question concerning previous math courses at the end of the study in a supplemental questionnaire, so as to avoid priming participants with positive or negative memories of mathematics. The Math Attitudes and Perceptions Scales (see Appendices 3 and 4), the Math Task Self-Efficacy Scale (see Appendix 5), and the Math Performance measure (see Appendix 6) were all included in this phase of the experiment. Items from the Math Task Self-Efficacy Scale and the Math Performance questionnaire were divided in half to create two equivalent forms of each measure. This was done in order to assess participant reactions before and after the intervention. As a result, two 9-item questionnaires were created and administered to participants.

In order to create the gender-affirming manipulation, researchers utilized a current events article detailing the lack of leadership and lower academic standings of female students at Princeton University and Duke University (Stevens, 2011). This was juxtaposed with information about the University of Richmond, in which the Dean of female students stated that women's self-confidence increases while attending Richmond. The article highlights the WGSS program and WILL program, including a summary of the relevant coursework and faculty. A concluding section details how the WILL program has become nationally recognized and implemented at a variety of other universities, including Duke University (see Appendix 7). A second current events article about the University of Richmond basketball team was also given in order to decrease suspicion about the purpose of the intervention. The articles were equal in length at roughly 1½ typed pages.

Procedure

Participants were randomly assigned to either the experimental or the control group, with 15 women in each level. Sessions were held in groups of 5 or fewer participants. In order to create the stereotype threat, experimental trials comprised three components: they were run by a male instructor, a male confederate sat in with the participants, and the instructions for the first set of self-efficacy and performance questions included a threatening statement about women's math abilities.

After completing the general questionnaire, participants were verbally led through the first half of the Math Task Self-efficacy Scale by the instructor in the same manner as the pilot study. For the experimental group, a threatening statement was included in the instructions and read out loud: "95% of college men and 65% of college women can solve all of these problems in 5 minutes or less." The control group instructions included a counterpart, non-gendered statement: "80% of college students can solve all of these problems in 5 minutes or less." The instructor read out loud each of the nine questions from a PowerPoint slide and allowed participants eight seconds to rate their confidence at solving each problem correctly. After participants had provided their confidence ratings for each of the math problems, they were given five minutes to solve as many of the nine problems as possible. A single piece of scrap paper was provided, and participants were not allowed to use a calculator. During the testing period, the male confederate finished well before the time limit and attempted to convey this information to the group by loudly dropping the writing utensil, sighing, stretching, and making quiet comments to the instructor such as "That wasn't too bad." After the first performance task was completed, participants were given three minutes to read each of the two current event articles.

After the two articles were read by participants, the instructor administered the second half of the Math Task Self-efficacy Scale, following the same instructional procedures as for the first half. For this set of problems, there were no statements regarding gender differences in percentages of male and female college students' success rates at completing the problems. Participants again had eight seconds to rate their confidence at solving each problem. Upon conclusion of the self-efficacy measure, participants had five minutes to complete as many of the nine problems as possible. The male confederate displayed similar behavior during this task by finishing quickly and remaining noticeably relaxed. At the end of this five-minute time period, participants completed the Math Attitudes and Perceptions Scales as well as a supplemental questionnaire detailing previous math courses. The instructor then asked participants to report the percentage mentioned earlier in the trial as a manipulation check. A debriefing session at the end of the study explained the true motives of the researchers.

Results – Primary Study

All performance measures adopted from Pajares (1996) yielded significant reliability, with Cronbach's alpha ranging from .88 to .92. Self-reported math self-efficacy scores were highly correlated with related measures of mathematics, including SAT Math scores, math problem-solving abilities, and attitudes and perceptions towards mathematics. These intercorrelations are reported in Table 1.

Prior to the first math task, women in the experimental condition reported lower levels of self-efficacy (*M* = 84% confidence, *SD* = 14.30) than women in the control condition (*M* = 86% confidence, *SD* = 11.02). Prior to the second math task, women in the experimental condition reported higher levels of self-efficacy (*M* = 74% confidence, *SD* = 19.28) than women in the control condition (*M* = 73% confidence, *SD* = 14.86). We conducted a 2(Group: experimental, control) x 2(Time: math self-efficacy time 1, math self-efficacy time 2) mixed analysis of variance. Results indicated a significant main effect for Time, $F(1,28) = 32.21$, $p=.001$. Overall, self-efficacy showed a significant decrease from the first to the second math task in both conditions ($p < .001$). The effects for Group and the interaction of Group x Time were nonsignificant, $p > .05$ (see Figure 3).

Performance results on both the first and second math task were analyzed and scored as proportion correct, with an equation equaling:

$$\text{proportion correct} = {}^{\text{\# of questions correct}} / {}_{\text{\# of questions attempted}}$$

Women in the experimental group scored higher (*M* = .68 units, *SD* = .21) than women in the control group (*M* = .63 units, *SD* = .23) on the first set of math problems. Following the presentation of gender-affirming literature, women in the experimental group completed more math problems correctly (*M* = .79 units, *SD* = .22) than women in the control group (*M* = .76 units, *SD* = .19), $p = .04$ when merely considering change across the math tasks. We conducted a 2(Group: experimental, control) x 2(Time: math scores time 1, math scores time 2) mixed analysis of variance. Results indicated a significant main effect for Time, $F(1,27) = 4.44$, $p = .045$. The effects for Group and the interaction of Group x Time were nonsignificant, $p > .05$ (see Figure 4).

Discussion – Primary Study

Our hypothesis that the stereotype threat manipulation would result in lowered math self-efficacy and lowered performance on the first math task in an experimental group of women was not supported. The hypothesis that an intervention composed of gender-affirming literature would increase experimental participants' math self-efficacy on the second task was not supported. The hypothesis that experimental participants will demonstrate increased math performance on a second task following the intervention was marginally supported; however, the increase in performance cannot be attributed solely to the intervention because there was not a significant difference between the experimental and control groups on the second math task. The manipulation was not effective, thus we cannot form any definite conclusions about the effects of the intervention.

Our findings do not support the results of previous stereotype threat research. Spencer, Steele, and Quinn (1999) demonstrated that when a test is described as producing gender differences and threat is high, women substantially underperform on a math task as compared to equally qualified men. Past research has also show that the presentation of stereotype threat through a difficult GRE math task causes women to attempt fewer problems (Rivardo, Rhodes, Camaione, & Legg, 2011). In addition, the presentation of an identity-safe environment has previously been shown to mitigate stereotype threat and boost female aspirations for leadership roles (Davies et al., 2005). Our results do not follow such trends.

There are several possible reasons for our findings. Namely, the math test may not have been difficult enough to produce the threat effect intended by experimenters. Past research stresses the importance of a difficult task in order to invoke in female participants a limitation of their abilities (Steele, 1997). Furthermore, the participant sample did not report a high percentage of majors in the mathematics or science fields. This hinders an important facet of stereotype threat: individuals must strongly identify with the domain in question and worry that a failure to perform will threaten a relevant personal characteristic (Steele, 1997). As few of our participants were part of this in-group, the stereotype threat may have applied to them in a very limited sense. Although participants did not declare majors in mathematics, there were a high reported number of math courses completed; this may have given them the information necessary for performance while eliminating the threat of identifying oneself with a stereotyped field. Furthermore, the male confederate was not uniform across all trial sessions; therefore, women in the experimental condition may have received minimal threat depending on which session they attended.

Future research on interventions involving gender-affirming literature must first establish an effective manipulation of stereotype threat with reliable and valid measures of stereotype threat. While Davies et al. (2005) successfully utilized commercials to produce stereotype threat, the current study found it very difficult to locate a stereotypical advertisement that did not use humor. Advertisements that include both sexism and humor are perceived as more acceptable and less offensive, thus producing minimal threat (Groza & Cuesta, unpublished). As a result, prospective studies will require pilot trials in order to ensure that the selected manipulation, commercially presented or otherwise, produces the desired stereotype threat.

Research derived from our findings should also examine the effect of long-term gender affirmation on math attitudes and perceptions. As math attitudes and perceptions are highly correlated with math performance, a change in these opinions has the potential to positively affect performance in the relevant domain. The University of Richmond has strong support in place for female students, both through WGSS and WILL programming and through the implementation of the Westhampton College system, which allows women the unique opportunity of a female-run student government within a co-educational university. As noted in the literature provided to participants, women's self-esteem generally increases during their time at Richmond (see Appendix 7). These factors may empower women generally and make them a more resistant population to stereotype threat.

Conclusion

Due to the non-effective manipulation of stereotype threat, it is not possible to form firm conclusions about an intervention based in gender-affirming literature. However, the potential of this intervention remains viable. Research on the interaction of stereotype threat and gender affirmation presents an opportunity to close the gender gap and promote inclusion of women in STEM fields.

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Table 1. Correlations between math self-efficacy and related variables.

Measure	*1*	*2*	*3*	*4*	*5*
1. Math Self-Efficacy	—	.58**	.52**	.56**	.43**
2. Math Perceptions		—	.90**	.79**	.68**
3. Math Attitudes		.	—	.77**	.59**
4. SAT Math Scores				—	.57**
5. Math Performance					—

Note: All correlations were significant at the p < .01 level (1-tailed).

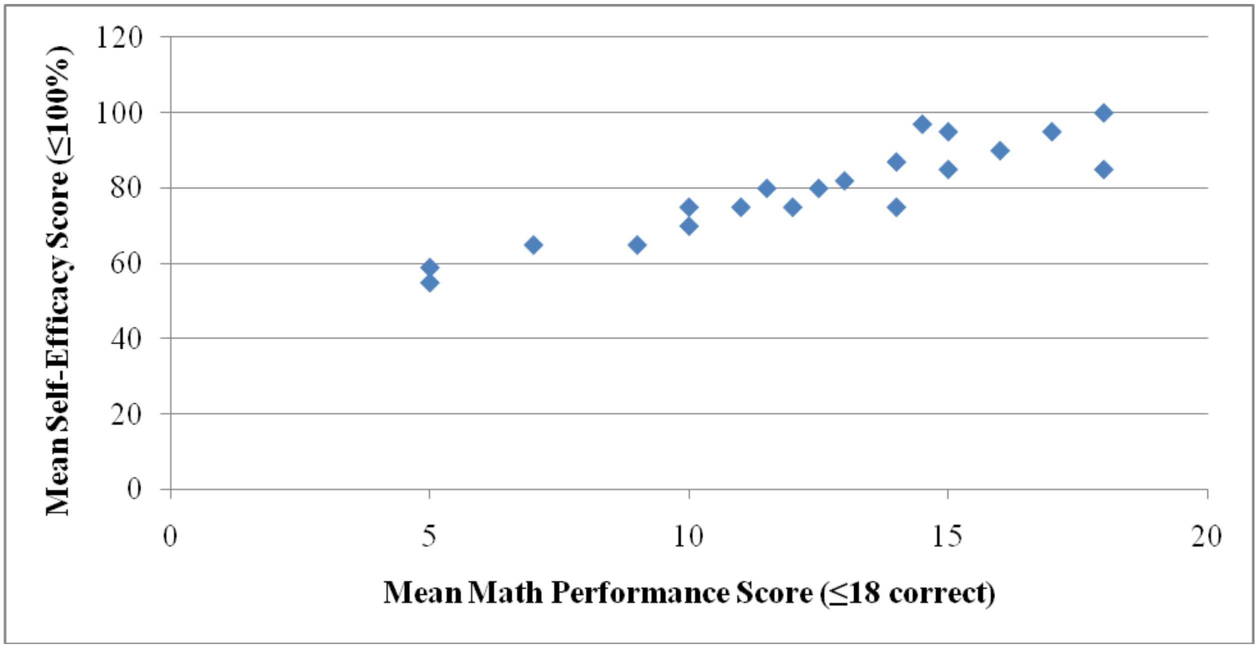

Figure 1. Correlation between math self-efficacy and math performance (r = .72, p = .001) in pilot study.

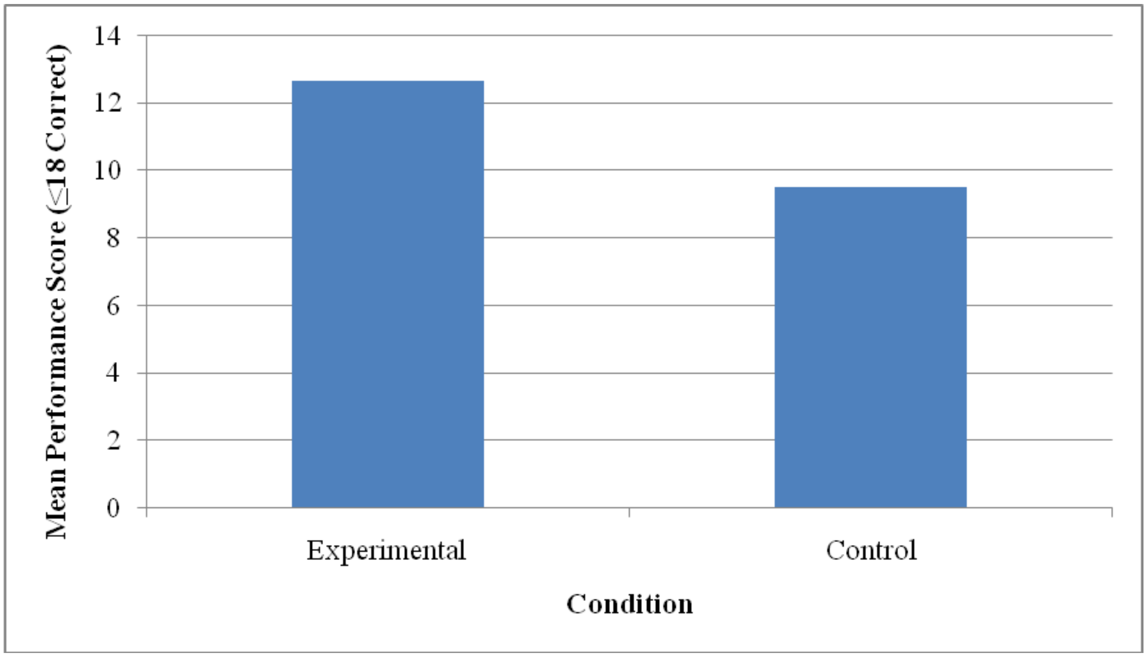

Figure 2. Mean math performance scores by experimental and control groups in pilot study.

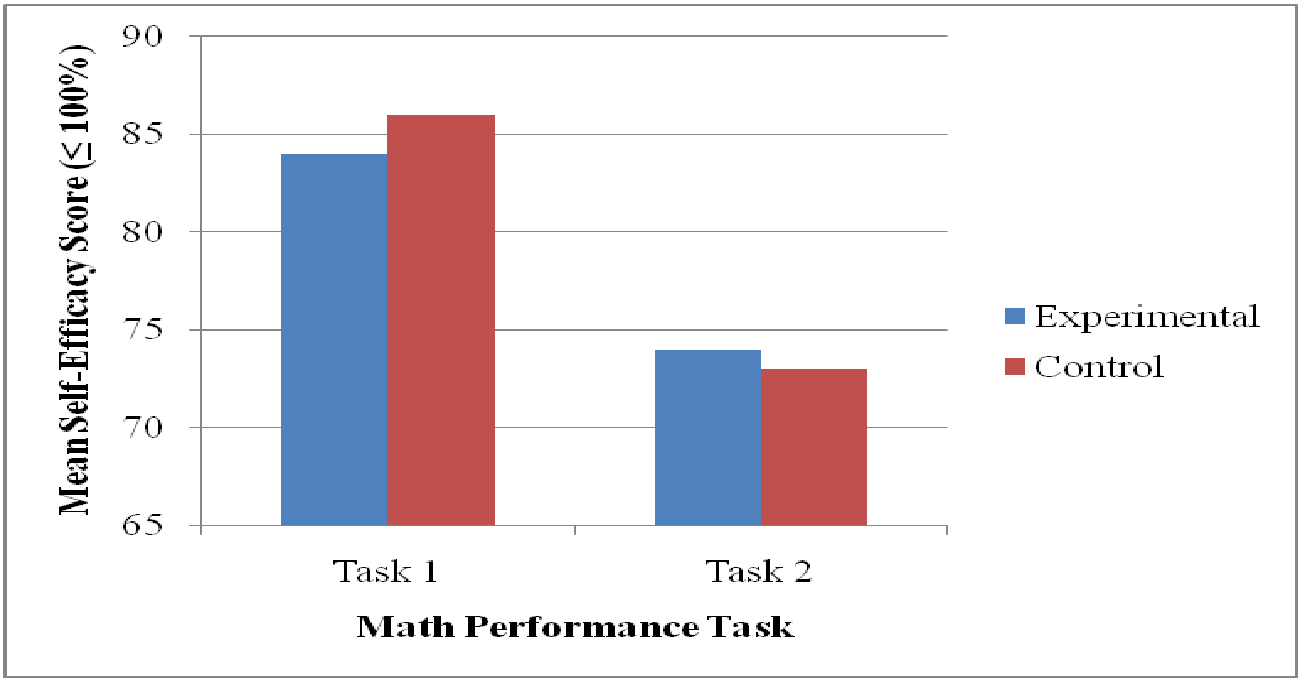

Figure 3. Mean self-efficacy scores on math tasks by experimental and control groups before and after intervention manipulation in primary study.

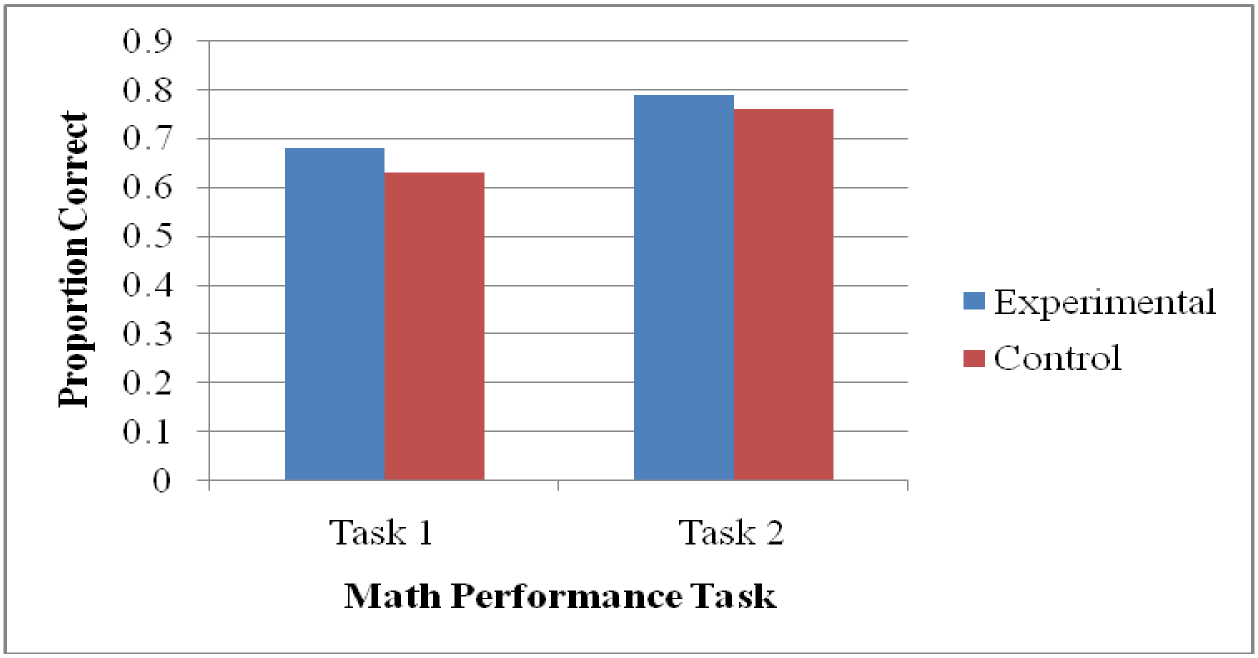

Figure 4. Mean proportion correct on math tasks by experimental and control groups before and after intervention manipulation in primary study.

Appendix 1

General Questionnaire

1. Date of Birth: ____

2. Sex: *M* *F*

3. Ethnic Background: (optional)

a. White or Caucasian
b. Black or African-American (not of Hispanic origin)
c. Hispanic
d. Asian
e. Other: ____

4. Highest Education Achieved:

a. Less than High School Diploma
b. High School Diploma (or equivalent)
c. Some College
d. Associate's Degree (or 2 years of college)
e. Bachelor's Degree
f. Graduate or Professional Degree

5. Primary major in college (if applicable): _________________________

Secondary major (if applicable): _______________________________

Tertiary major (if applicable): _________________________________

5a. If you have not yet declared a major/s, what do you plan on?

____

6. Major concentration in college (if applicable): ____________________

7. Primary minor in college (if applicable): _________________________

Secondary minor (if applicable): _______________________________

7a. If you have not yet declared a minor/s, what do you plan on?

____

8. Planned Occupation: ____

9. SAT Math Score (if unsure, estimate): _______ Verbal Score (if unsure, estimate): _________ Writing Score (if unsure, estimate): _________

10. Place a checkmark next to all math courses you have taken in high school and/or college. Circle HS and/or C for all that apply.

HS C ____ Algebra I

HS C ____ Algebra II

HS C ____ Geometry

HS C ____ Trigonometry

HS C ____ Pre-Calculus

HS C ____ Calculus

HS C ____ Advanced Placement Calculus AB (or I)

HS C ____ Advanced Placement Calculus BC (or II)

HS C ____ Symbolic Logic

HS C ____ Statistics

HS C ____ Computer Science

HS C ____ Other (please explain: _____________________________)

Appendix 2

Advertisement Questions

1. What was the product? ____

2. How likely are you to buy this product? Please circle your response.

0	**1**	**2**	**3**	**4**	**5**
Not Likely At All					*Extremely Likely*

3. How persuasive was the ad? Please circle your response.

0	**1**	**2**	**3**	**4**	**5**
Not Persuasive At All					*Extremely Persuasive*

4. How likely are the following groups to buy this product? Please use the scale from question 2.

4a. African Americans?	**0**	**1**	**2**	**3**	**4**	**5**
4b. Asian Americans?	**0**	**1**	**2**	**3**	**4**	**5**
4c. Euro-Americans?	**0**	**1**	**2**	**3**	**4**	**5**
4d. Latinos/Hispanics?	**0**	**1**	**2**	**3**	**4**	**5**
4e. males?	**0**	**1**	**2**	**3**	**4**	**5**
4f. females?	**0**	**1**	**2**	**3**	**4**	**5**
4g. Republicans?	**0**	**1**	**2**	**3**	**4**	**5**
4h. Democrats?	**0**	**1**	**2**	**3**	**4**	**5**

5. What do you remember most about this ad? Why did you remember it?

Appendix 3

Math Attitudes Scale

PLEASE DO NOT LEAVE ANY ITEM BLANK.

Directions: Please use the following scale to respond to the following questions. Circle the appropriate response.

Scale: 1 - **Strongly disagree** 2 – **Disagree** 3 – **Undecided** 4 – **Agree** 5 - **Strongly agree**

	SD	**D**	**U**	**A**	**SA**
1. It wouldn't bother me at all to take more math courses.	1	2	3	4	5
2. I have usually been at ease during math tests.	1	2	3	4	5
3. I have usually been at ease in math courses.	1	2	3	4	5
4. I usually don't worry about my ability to solve math problems.	1	2	3	4	5
5. I almost never get uptight while taking math tests.	1	2	3	4	5
6. I get really uptight during math tests.	1	2	3	4	5
7. I get a sinking feeling when I think of trying hard math problems.	1	2	3	4	5
8. My mind goes blank and I am unable to think clearly when doing mathematics.	1	2	3	4	5
9. Mathematics makes me feel uncomfortable and nervous.	1	2	3	4	5
10. Mathematics makes me feel uneasy and confused.	1	2	3	4	5

Appendix 4

Math Perceptions Scale

Directions: Please use the following scale to respond to the following questions.

Scale: 1 - **Definitely false** 2 – **False** 3 - **Mostly false** 4 - **More false than true**

5 – **More true than false** 6 – **Mostly true** 7 – **True** 8 – **Definitely true**

	DF							DT
1. I find many mathematical problems interesting and challenging.	1	2	3	4	5	6	7	8
2. I have hesitated to take courses that involve mathematics.	1	2	3	4	5	6	7	8
3. I have generally done better in mathematics courses than in other courses.	1	2	3	4	5	6	7	8
4. Mathematics makes me feel inadequate.	1	2	3	4	5	6	7	8
5. I am quite good at mathematics.	1	2	3	4	5	6	7	8
6. I have trouble understanding anything that is based upon mathematics.	1	2	3	4	5	6	7	8
7. I have always done well in mathematics classes.	1	2	3	4	5	6	7	8
8. I never do well on tests that require mathematical reasoning.	1	2	3	4	5	6	7	8
9. At school, my friends come to me for help in mathematics.	1	2	3	4	5	6	7	8
10. I have never been very excited about mathematics.	1	2	3	4	5	6	7	8

Appendix 5

Math Self-Efficacy Scale

Please use the following scale:

0%	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
Not at all Confident										***Completely Confident***

1.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
2.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
3.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
4.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
5.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
6.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
7.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
8.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
9.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
10.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
11.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
12.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
13.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
14.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
15.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
16.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
17.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*
18.	*0%*	*10*	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100%*

Appendix 6

Math Performance Scale

Directions: Please solve the following 18 questions and write the answers to the right of the question. DO NOT USE A CALCULATOR. One piece of scrap paper is allowed. There is a 20 minute time limit. You may not ask questions during this portion of the experiment.

1. In a certain triangle, the shortest side is 6 inches. The longest side is twice as long as the shortest side, and the third side is 3.4 inches shorter than the longest side. What is the sum of the three sides in inches?

2. ABOUT how many times larger than 614,360 is 30,668,000?

3. There are three numbers. The second is twice the first and the first is one-third of the other number. Their sum is 48. Find the largest number.

4. Five points are on a line. T is next to G. K is next to H. C is next to T. H is next to G. Determine the positions of the points along the line.

5. If $y = 9 + {}^{x}/_{5}$, find x when y = 10.

6. A baseball player got two hits for three times at bat. This could be represented by $\frac{2}{3}$. Which decimal would most closely represent this?

7. If P = M + N, then which of the following will be true?

I. N = P - M

II. P - N = M

III. N + M = P

8. The hands of a clock form an obtuse angle at ____ o'clock.

9. Bridget buys a packet containing 9-cent and 13-cent stamps for $2.65. If there are 25 stamps in the packet, how many are 13-cent stamps?

10. On a certain map, $^{7}/_{8}$ inch represents 200 miles. How far apart are two towns whose distance apart on the map is 3 $^{1}/_{2}$ inches?

11. Fred's bill for some household supplies was $13.64. If he paid for the items with a $20 bill, how much change should he receive?

12. Some people suggest that the following formula be used to determine the average weight for boys between the ages of 1 and 7: W = 17 + 5A where W is the weight in pounds and A is the boy's age in years. According to this formula, for each year older a boy gets, should his weight become more or less, and by how much?

13. Five spelling tests are to be given to Mary's class. Each test has a value of 25 points. Mary's average for the first four tests is 15. What is the highest possible average she can have on all five tests?

14. 3 $^{4}/_{5}$ - $^{1}/_{2}$ = _____

15. In an auditorium, the chairs are usually arranged so that there are x rows and y seats in a row. For a popular speaker, an extra row is added, and an extra seat is added to every row. Thus, there are x + 1 rows and y + 1 seats in each row, and there will be (x + 1) and (y + 1) seats in the auditorium. Multiply (x + 1) (y + 1).

16. A ferris wheel measures 80 feet in circumference. The distance on the circle between two of the seats is 10 feet. Find the measure in degrees of the central angle SOT whose rays support the two seats.

17. Set up the problem to be done to find the number asked for in the expression "six less than twice 4 $^{5}/_{6}$".

18. Two triangles are similar. Thus, the corresponding sides are proportional, and AC / BC = XZ / YZ. If AC = 1.7, BC = 2, and XZ = 5.1, find YZ.

Appendix 7

Article #1

Presidential committee makes recommendations to strengthen student leadership

A presidential committee at Princeton University has issued a report discussing how women at Princeton do not run for traditional student government roles; they also fall behind men academically. Duke University saw similar issues with undergraduate women when they did research for the Duke Women¹s Initiative project in 2003.

However, these trends are not evident at the University of Richmond. Dr. Juliette Landphair, dean of Richmond's college for undergraduate women, stated, "I believe strongly that having Westhampton College embedded in our institution has a lot to do with it – research shows having a structure in place where women are at the center matters a great deal. For instance, unlike many traditionally-coed schools (including Princeton), the rated self confidence of our women increases rather than decreases during their time at UR."

Another supportive structure in place at the University of Richmond is the Women, Gender and Sexuality Studies department. WGSS is an interdisciplinary program that incorporates both a body of information and frameworks for analysis. Introductory coursework focuses on the history and social and political meanings and ramifications of the concepts of gender and sexuality, as well as on the history of political movements that developed and mobilized these concepts. At the advanced level, students develop competency in contemporary social critique, basic feminist and queer theory, and research skills appropriate to their area of emphasis.

WGSS courses are open to all students regardless of major or gender. Students may take any of these courses to broaden their academic program, or they may elect a Women, Gender and Sexuality Studies major or minor.

Students studying Women, Gender and Sexuality Studies can go on to pursue advanced studies at the graduate level. Others find that the program is the perfect preparation for careers in business, law or international studies. Understanding the challenges women and sexual minorities have faced and continue to face changes the way students look at all topics, regardless of discipline.

The Women, Gender and Sexuality Studies faculty is drawn from virtually every academic discipline represented on Richmond's campus; consequently, teaching styles vary tremendously, and students have the opportunity to work with professors who best fit their own learning styles. All WGSS faculty encourage students to think critically and perform critical assessments of the world around them. All the department's courses emphasize class discussion and promote active engagement with contemporary issues.

Over their course of study, students are encouraged and enabled to develop their own positions on current academic and social issues, to cultivate their own voices in their speaking and writing, and to test theoretical assumptions by applying them to real life situations.

WILL Program

The WGSS department also offers the Women in Living and Learning Program. WILL is a nationally recognized program for women interested in exploring gender and diversity issues both in and out of the classroom. Students strengthen their leadership skills as they actively work to create a more equitable world.

In response to calls from individuals around the country interested in creating a WILL-like program at their colleges and universities, WILL faculty/staff developed and held replication workshops and consulted individually with those interested in replicating WILL. The program has also worked with several high schools interested in implementing a WILL model for younger women. The sessions, whether group or individual, are designed to help participants tailor the program to suit their particular needs.

The college and universities listed below have worked with the University of Richmond WILL program and have implemented WILL-like programs on their campuses. These include:

- Duke University – Baldwin Scholars Program
- Winona State University – WILL Program (Women Initiative for Learning and Leadership)
- University of Michigan, Dearborn – WILL Program (Women in Learning and Leadership)
- Tulane University – Newcomb Sexuality and Gender Alliance
- University of Maryland, Baltimore County – WILL Program (Women Involved in Learning and Leadership)
- The College of New Jersey – WILL Program (Women in Learning and Leadership)