Gender Salience and Math Performance: The Effects of Priming and Group Composition on Stereotype Threat

Researcher C and D

Tulane University

Abstract

Although the number of women involved in science, technology, engineering, and mathematics (STEM) careers is on the rise, the majority of STEM workers are male. It is plausible that the gender-math stereotype serves as a contributing factor. This study's purpose will be to investigate the effects of the gender-math stereotype on math performance in female college students. Participants will be randomly assigned to different group gender compositions and priming conditions and will be given a math test. It is hypothesized that participants in conditions that induce gender salience will have lower math scores. The participant pool will consist of 150 female Tulane University students. Findings will illuminate potential factors contributing to the STEM gender gap.

Gender Salience and Math Performance: The Effects of Priming and Group Composition on Stereotype Threat

In recent years, women have become more involved in science, technology, engineering, and mathematics (STEM) careers. However, according to the United States Census Bureau (2013), large disparities in STEM involvement by sex still exist. Research has found that this problem is evident in college students: women are not only less likely to pursue a STEM degree at the beginning of their college career, but are also less likely to obtain a STEM degree. This pattern may be partially responsible for the underrepresentation of women in these positions. In fact, in 2011, only a quarter of American STEM professionals were women (United States Census Bureau, 2013). Increased female STEM involvement could not only reduce the gender wage gap by creating better paying jobs for women, but could also make the American economy stronger with the creation of a more competitive workforce. On the whole, it is possible that decreasing the STEM gender gap could also help to promote equality among women and men as they work side by side to solve real-world scientific problems.

Considering the magnitude of the current STEM gender gap, it is plausible that the gender-math stereotype serves as a contributing factor. There is a large body of research that has focused on stereotype threat, which occurs when a person has anxiety that they will confirm a negative stereotype of their group. Research on stereotype threat has illuminated the effects of gender salience on math performance in women. Gender salience refers to the importance a woman may place on her role as a minority in a given situation.

Methodologically, many studies have used either priming or different group gender compositions as variables that influence stereotype threat. Results from these studies are mixed. For example, some studies have found that women perform worse on math exams when they are

threatened with an ability-based stereotype (Johnson, Barnard-Brak, Saxon, & Johnson, 2012; Thoman, White, Yamawaki, & Koishi, 2008). Conversely, a recent study that used priming to induce gender-math stereotype threats found no evidence of its effects on math performance in female participants (Tine & Gotlieb, 2013). Studies like this that show no link between stereotype threat and math performance may demonstrate a bias towards publishing studies that support stereotype threat and not publishing studies that have not found significant stereotype threat results (Tine & Gotlieb, 2013, p. 367-368).

Changing the group gender composition is also a common method for inducing the gender-math stereotype. For example, there have been multiple studies that found that placing women in groups in which they are outnumbered by men negatively impacts their math performance. This negative effect increases proportionally with the number of men in the testing environment (Inzlicht & Ben-Zeev, 2000; Inzlicht & Ben-Zeev, 2003).

This experiment will use both methods to test the effects of the math-gender stereotype on math performance in college women. The priming aspect of the experiment includes three levels in which women are prompted with a brief statement. Participants in the experimental condition will be prompted with statements claiming that women are better at math than men or men are better at math than women. Those in the neutral group will read an article discussing funding for math departments on college campuses. After participants read the statements, they will be given a twenty question standardized math examination in a room with a group. Group gender composition will also be manipulated. Some groups will include mostly women and other groups will include mostly men. It is expected that women who are in the mostly female group will perform better than those in the mostly male group. It is also expected that women will perform the best when they are prompted with the statement that women are better at math.

Conversely, it is expected that women will perform worse when they are prompted with the statement that men are better at math.

Hypotheses

Hypothesis 1

H_0. Group composition will not be associated with math performance.

H_1. Group composition will be associated with math performance.

Hypothesis 2

H_0. Priming will not be associated with math performance.

H_1. Priming will be associated with math performance.

Method

Participants

The proposed sample will consist of female college students from Tulane University in New Orleans. The participant pool will consist of 150 students, who will register for the study via the Psychology Research Participation System, Sona. As such, it is expected that virtually all students will be enrolled in a psychology class. Considering the demographic features of the Tulane population, it is also expected that the sample will be racially and socioeconomically homogeneous. Specifically, the majority of students will be Caucasian and relatively affluent. This particular sample will be used because participants are readily available, making the experiment highly feasible.

Procedures

Before participants are able to partake in the experiment, they will complete a simple math test to ensure that they function at a normal level. This precaution is meant to control for disabilities or giftedness. Female participants will be randomly assigned to different group

compositions consisting of five participants each. These group compositions constitute the following: majority female (four females to one male) and majority male (four males to one female). Male confederates will be randomly assigned to each of the groups. Furthermore, participants in these groups will be randomly assigned to different priming conditions. The priming conditions will each consist of reading a short article before being tested. There will be three priming conditions. The first priming condition will include an article stating that, contrary to the gender-math stereotype, women tend to perform better than men on the following math examination. The second priming condition will include an article stating that men perform better on math examinations. The neutral condition will include an article discussing funding for math departments on college campuses.

The math test will consist of twenty standardized, college-level multiple choice math questions. Participants will be given two blank sheets of scratch paper on which to perform arithmetic calculations. All participants will be given an hour to complete the examination.

Measures

Math test. This variable is designed to assess math performance. Math performance is expected to vary depending on the type of group composition and priming condition. The math test will consist of twenty standardized multiple choice questions. The test items are designed for college level students. Participants will be given an hour to complete the exam. Based on expected results, it is hypothesized that high scores will range from sixteen to twenty, while low scores will range from zero to twelve.

Anticipated Results and Discussion

This study will be analyzed using an ANOVA procedure. It is expected that women will perform the best when they are prompted with the statement that women are better at math. It is

also expected that women who are in the mostly female group will perform better than those in the mostly male group. Conversely, it is expected that women will perform worse when they are prompted with the statement that men are better at math and when they take the test in the male majority group. Those in the neutral priming condition are expected to perform better than those in the male priming condition and worse than those in the female priming condition. These expected findings are summarized in the Appendix, which illustrates the expected average scores in each condition.

Assuming the previously proposed results hold true, it is likely that the gender-math stereotype remains a barrier to women interested in STEM careers. More specifically, group composition remains an important factor in STEM fields because men outnumber women in academic and professional settings. Moreover, if priming influences women's performance or involvement in math-related activities, it is important to consider different manners in which priming could affect women in an academic or professional setting. For example, when studying for a test or doing research for a project, a woman involved in STEM would likely come across numerous articles written by men, and few written by women. Conversely, if the proposed results do not hold true, it is possible that there is a shifting ideology regarding the gender-math stereotype.

With regards to limitations, the participant pool used for this study will be relatively homogenous. Methodologically, there will be no neutral condition for group composition, which could reduce internal validity. Moreover, psychology students may have differing math abilities as compared to those majoring in other academic areas. This difference may also affect internal validity. Finally, external validity may be considered low because female STEM workers do not

typically encounter testing environments in professional settings. Most of the work that female STEM workers engage in is collaborative, rendering the testing environment irrelevant.

References

Inzlicht, M., & Ben-Zeev, T. (2003). Do High-Achieving Female Students Underperform in Private? The Implications of Threatening Environments on Intellectual Processing. *Journal Of Educational Psychology*, 95(4), 796-805. doi:10.1037/0022-0663.95.4.796

Inzlicht, M., & Ben-Zeev, T. (2000). A threatening intellectual environment: Why females are susceptible to experiencing problem-solving deficits in the presence of males. *Psychological Science*, 11(5), 365-371. doi:10.1111/1467-9280.00272

Johnson, H. J., Barnard-Brak, L., Saxon, T. F., & Johnson, M. K. (2012). An experimental study of the effects of stereotype threat and stereotype lift on men and women's performance in mathematics. *Journal Of Experimental Education*, 80(2), 137-149. doi:10.1080/00220973.2011.567312

Landivar, L. C., (2013). *Disparities in STEM Employment by Sex, Race, and Hispanic Origin.* Retrieved from http://www.census.gov/prod/2013pubs/acs-24.pdf

Thoman, D. B., White, P. H., Yamawaki, N., & Koishi, H. (2008). Variations of gender-math stereotype content affect women's vulnerability to stereotype threat. *Sex Roles*, 58(9-10), 702-712. doi:10.1007/s11199-008-9390-x

Tine, M., & Gotlieb, R. (2013). Gender-, race-, and income-based stereotype threat: The effects of multiple stigmatized aspects of identity on math performance and working memory function. Social Psychology Of Education, 16(3), 353-376. doi:10.1007/s11218-013-9224-8

Appendix

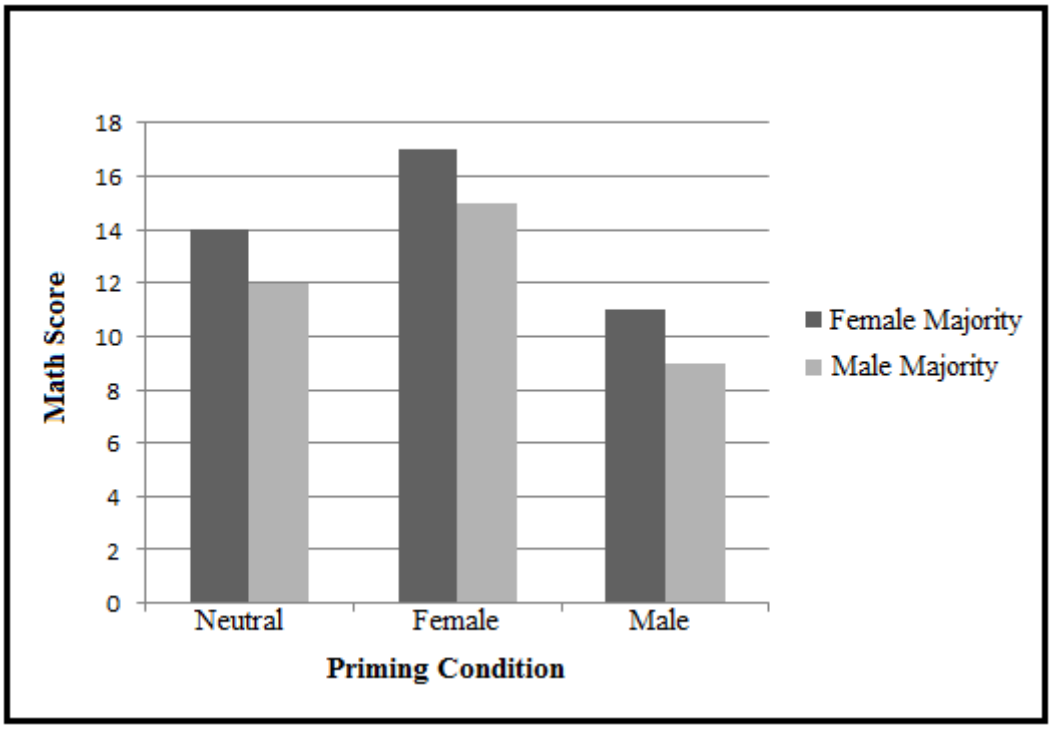

Fig. 1. The Effects of Group Composition and Priming on Tulane Female College Students