

**Stereotype Threat: Effects on Math Performance of Latina and White Female Students**

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### **Abstract**

Stereotype threat has been extensively documented to be affecting performance across different fields. One major area of concern has been academic performance across different ages and ethnical groups. This study investigated the effects of stereotype threat on female Hispanic college students' math performance compared to those of White female students. Participants were administered a general college-level math test after being induced a stereotype threat condition and completed self-reports on their stress level and self-efficacy. Math performance of those induced a stereotype threat was not significantly different from those of the control (no stereotype) group for both White and Latinx students. Self-efficacy and stress levels were consistent across the stereotype conditions as well. These results diverge from previous findings and suggest that the effects of stereotype threat on White and Latinx women's math performances are less pronounced than has been previously documented. Potential experiment issues and solutions are discussed.

*Keywords:* Stereotype threat, female, White, Hispanic, math performance

### **Stereotype Threat: Effects on Math Performance of Latinx and White Female Students**

Stereotype threat involves a person being subject to negative stereotypical connotations and implications tied to the group with which they belong (Steele & Aronson, 1995). It is the threat that a person may be treated according to such associated negative stereotypes and potentially self-fulfill those assumptions. As demonstrated by Steele and Aronson (1995), these stereotype threats can be activated when a concerned group is placed into a stereotype-related situation such as when African-American students were asked to take academic standardized tests under the stereotype that Black students tend to perform worse academically compared to White students. This threat not only affects academic performances of stereotyped groups with regards to academics but also performance with regards to other domains as well (Armenta, 2010; Yeung & von Hippel, 2008).

A particular branch of stereotype threat literature has been oriented towards the factors that moderate stereotype threat. Ethnicity has been found to be a significant moderating factor over the years (Armenta, 2010; Steele & Aronson, 1995). Armenta's (2010) study on Asian and Latino university students investigated the potential gap in performance in a math exam given the stereotype that Asian students typically perform better in Math compared to Latino students. The results found that the stereotype was fulfilled for students who strongly identify to their ethnicity. In other words, strongly ethnically-identifying Asian students performed significantly better in the math exam than students strongly identifying as Latino. The same results were not found for those who did not strongly identify to their ethnicity.

Along with the sense of belonging, another potential mediating factor of stereotype threat is the various situational cues that may trigger any stereotype-relevant information (Spencer et al., 2016). One such cue could be the numeric imbalance between two distinct ethnic/racial groups in a particular setting as documented by Murphy and colleagues (2007). They investigated the potential stereotype threat women in Math, Science and Engineering fields experienced due to the common situations of numerical gender imbalance. Half of the women in the study were exposed to conference videos showing such imbalance while those in the control group were shown videos with a balanced gender ratio. Results showed that women from the experimental group showed more signs of stereotype threat such as a diminished desire to participate in the conference. Other examples of potential situational cues could be an instructor's race or gender, a verbal comment, or a combination of cues that trigger the stereotype threat.

Among these situational cues lies the performance test which has been extensively evaluated to reliably engender stereotype threat among people from groups who are negatively stereotyped (Steel & Aronson, 1995; Spencer et al., 1999, Spencer et al, 2016). Despite these intellectual tests being prevalent in stereotype threat research, a majority of them have only been related either to either gender or ethnic stereotypes (O'Brien & Crandall, 2003; Galdi et al., 2014). A growing yet still relatively small portion of investigations have been to examine the interaction and intersectionality between factors such as gender and race (Neal-Jackson, 2020).

The present study was aimed to examine whether stereotype threat was impacted by multiple social identities in Latina college students compared to White, female students. We tested students appropriating themselves to one of these groups in a general, college-level math test after assigning them their stereotype threat condition. As previous literature has already

extensively tested that stereotype threat can have the potential to cause underperformance through inherent possible threats on self-integrity and belonging, due to pressure to succeed, and as a result of priming, this study used priming to specifically target female students who belong to the ethnic minority in their academic context (Spencer et al., 2016). There is missing data consolidating the relating to female, Hispanic students that are surely affected by stereotype threat. White female students have been included as a control to better understand whether ethnicity affects the amount of stereotype threat felt by the students that were expressed through their self-report responses.

All the different groups received similar method of priming. As done by O'Brien and Crandall (2002), the students were primed by a specific statement claiming the legitimacy of the test they were taking in showing either diminished or increased results for students of the same ethnicity as the test taker. We predicted that Latina students primed to have feelings of stereotype threat would perform worse than white female students. We also predicted that Latina students would feel more stressed than White students due to the pressure to not fulfill the negative stereotype related to their gender and ethnicity. With regards to the self-report questions, we hypothesized that students who were intended to feel threatened would express more feelings of stress and less self-confidence than those who were not threatened.

## **Method**

### **Participants**

A total of 40 female college students ( $M_{age} = 20.27$  years,  $SD = .93$ ) took part in the study. Half of them identified as Latina and the other half as White. Each participant was

randomly assigned to either the Stereotype Threat group ( $n = 18$ ) or No threat group ( $n = 22$ ). The participants were recruited electronically via email after confirming their identification of their ethnicity and volunteered to take part in the study. All the participants have signed their informed consent to participate in the study. The Institutional Review Board at Gettysburg College approved the experiment.

### **Measures**

All the testing was done on paper and pencil through distributed, individual test packets. We used a general college-level math test that comprised five multiple choice questions to evaluate the math performance of the students. The math questions were samples from practice problems for the Graduate Record Examination test. To gather information on their mental state, we measured their stress level through the Perceived Stress Scale (Cohen et al., 1983). Additionally, their Apprehension levels were measured through Evaluation Apprehension Measure (Richmond et al., 2001). A self-report general self-efficacy questionnaire was also administered to them. There were eleven statements the participants had to rate on a 5-point scale from 1 = *strongly disagree* to 5 = *strongly agree*. Lastly, the participants were also asked to rate their confidence levels on two questions using a 5-point scale rating from 1 = *Not confident at all* to 5 = *Extremely confident*.

### **Procedure**

Each participant was preassigned into their groups. After signing their consent forms, participants were assigned a seat and administered the test packet individually. According to their Stereotype threat condition, the participant was presented with a priming statement about

the following math test they were about to take. Those in the Stereotype threat group had the statement claim that previous research has confirmed that women belonging to their ethnicity were found to perform worse than other social groups. Those in the No threat group had the statement confirm that those belonging to their ethnicity performed better than other social groups. After reading the statement, they had to write a response to the statement to confirm that they read it as a manipulation check. Their responses allowed for latter judgment on whether the participants got primed as intended.

The participants then signaled that they were ready and were given 7 minutes to complete the math test. Once the allotted time was over, the participants were asked to move on to the next part of the packet. They were instructed to complete the stress test questionnaire, followed by the self-efficacy survey, and reported their confidence level. Lastly, the participants filled in their demographic information before being debriefed on the purpose of the experiment and the necessary priming component.

## **Results**

### *Priming and Manipulation*

All 40 of the participants have shown that they read and understood their respective statements despite a few of the written responses being ambiguous on whether the manipulation induced the solicited feelings to the participants. All the data from the 40 participants were included in the analysis.

### *Math Performance*

A 2 Ethnicity (Latina, White) x 2 Threat Condition (Stereotype threat, No threat) between-subjects Analysis of Variance (ANOVA) was conducted on the amount of correct

responses the students got in the math test. The ethnicity x threat Condition interaction,  $F(1, 36) = .250, p > .05, \eta_p^2 = .007$ , was not significant (See Figure 1). There was no significant main effect of ethnicity,  $F(1, 36) = 1.14$ . In contrary to expectations and previous research results, there was also no significant main effect of stereotype,  $F(1, 36) = .048$ . Surprisingly, the participant population performed poorly on the test ( $M = .85, SD = 1.00$ ). (See discussion section for further exploration on the issue.)

### *Emotional and Mental State*

A 2 Ethnicity x 2 Threat Condition between-subjects ANOVA was conducted on the level apprehension score of the students felt with respect to taking the Math test. There was no significant ethnicity x stereotype threat interaction,  $F(1, 36) = .055$  (See Table 1). There was no significant main effect of ethnicity,  $F(1, 36) = .86$ , nor was there a significant main effect of stereotype,  $F(1, 36) = .105$ . The students taking part in the study all seemed to have the same, high levels of stress.

Another 2 Ethnicity x 2 Threat Condition between-subjects ANOVA was conducted on self-efficacy scores participants received from the questionnaire. There was no significant ethnicity x stereotype threat interaction,  $F(1, 36) = 1.56$ . There was no significant main effect of Stereotype condition,  $F(1, 36) = .537$ , and a no significant main effect of ethnicity,  $F(1, 36) = .389$ . The participants as a whole scored relatively close (about one standard deviation) to the median score of 27.5 (out of 55) points ( $M = 34.75, SD = 6.69$ ). (*Could a t-test or a z-test have been relevant to conduct in this case if we had information on a more general population of self-efficacy scores ? I.e., is it okay to use general data on a specific test to compare with that of our own studies?*)



### Discussion

The students, whether Latina or White, did not seem to express the general stereotype threat differences that have been typically shown in the long literature of stereotype threat. Both those primed with stereotype threat and those unthreatened performed below the expectations. They all seemed to show high levels of apprehension and average levels of self-efficacy.

Steele and Aronson's (1995) initial results on stereotype threats, even though general in nature of the sample population, already established that stereotype threats affected intellectual performance as a by product of the ethnicity of a minority population which engenders situations leading to stereotype threat. More relatively recently in the literature, among others, O'Brien and Crandall's study (2002) on the effects of stereotype threat and arousal on women's mathematical performance further solidified that such effects on performance remain present across genders. Due to all the robust literature on stereotype threat and the diverging data from the present study, the circumstances suffice for additional levels of investigation as to why the results diverge so much from previous studies.

The first weakness in the design arises in the fact that the priming statement manipulation check was an open question with no clear guideline on what exactly the participants were supposed to reflect on with the statement set for them. Since it was left open, the participants had the open opportunity answer to such a great extent that it was difficult to accurately and consistently judge whether the priming actually worked as intended and as was done in previously mentioned studies.

Another equally major issue lie in the way the participants' mathematical skills were evaluated. Even though the sample problems used were tested prior to the study, there was a lack of time that led to the questions being overly complicated for normal college students despite the

fact that the questions were sampled from GRE practice tests. This almost certainly contributed to the floor effect in the math performance scores that rendered the data to be unreliable and unviable for extrapolation and inference to the general population.

On top of those issues lie the common limitation of the small sample size of 40 which contributes the lack of statistical power and the insignificant results that derive from it. Even with the scale of the study, more time and resources should have been taken to get more participants who more strongly appropriate themselves to the ethnic groups relevant to the research question. With more participants, the study would have had more participant bandwidth in case of doubt on priming and manipulation check for some samples.

Fundamentally, the research question explored in this study is a legitimate one and should be re-conducted the appropriate way as it is a relevant research topic today. With better tested mathematic problems, clearer procedures and instructions for the participants, and more time for better a more robust participant recruiting, there is a great potential for a future study on this question to yield interesting results.

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**Table 1***Mean Apprehension Scores across Ethnicity and Threat conditions.*

Ethnicity	Apprehension score	
	Stereotype threat	No threat
Latina	72.77 (14.96)	73.18 (15.13)
White	67.44 (12.67)	75.00 (20.38)

**Figure 1**

*Mathematical Performance Scores (Number of correct answers) across Ethnicity and Threat condition.*

