Does University Context Play a Role in Mitigating Threatening Race-STEM Stereotypes? Test of the Stereotype Inoculation Model

Eric D. Deemer[1], Aryn M. Dotterer[2], Stacey A. Duhon[3], Pedro A. Derosa[4,5], Seoyoung Lim[1],

Jessica R. Bowen[1], Kay Beck Howarter[1]

[1] Department of Educational Studies, Purdue University

[2] Department of Human Development and Family Studies, Utah State University

[3] College of Arts and Sciences, Grambling State University

[4] Department of Physics, Louisiana Tech University

[5]Integrated STEM Education Research Center, Louisiana Tech University

Author Note

Eric D. Deemer https://orcid.org/0000-0001-9228-6269

Aryn M. Dotterer https://orcid.org/0000-0002-4199-0165

Stacey A. Duhon https://orcid.org/0000-0002-2045-7126

Pedro A. Derosa https://orcid.org/0000-0003-0020-4460

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Correspondence concerning this article should be addressed to Eric D. Deemer, Department of Educational Studies, Purdue University, 100 North University Street, West Lafayette, IN 47907. E-mail: edeemer@purdue.edu

Abstract

The stereotype inoculation model proposes that environments primarily comprised of underrepresented ingroup members afford them protection against the inimical effects of stereotypes. We conducted a macrolevel test of this model by examining the conditional effects of university context on students' perceptions of threatening race-STEM stereotypes. Participants were 333 African American undergraduate STEM students attending both an Historically Black College/University (HBCU) and a predominantly White institution (PWI). Results of a hierarchical regression analysis indicated that HBCU students reported significantly lower identity threat than their PWI counterparts when they endorsed both mean and high levels of social identification. Identity threat and social identity were also found to be significant negative and positive predictors of STEM self-efficacy, respectively, after controlling for implicit race-STEM stereotypes and other contextual and intrapersonal factors. Implications for fostering STEM career development of African American students are discussed.

Keywords: stereotype inoculation; Historically Black Colleges and Universities; stereotype threat; social identity; implicit stereotypes

Public Significance Statement: The study results suggest that HBCUs immunize African American college students against the harmful effects of race-STEM stereotypes. Academic environments in which African American students represent a numerical majority afford protection of vocational and social identity, and as such are likely to foster persistence in STEM careers.

Does University Context Play a Role in Mitigating Threatening Race-STEM Stereotypes? Test of the Stereotype Inoculation Model

Numerous explanations have been advanced to account for the disproportionately low number of underrepresented students in STEM fields. These explanations have ranged from structural barriers such as insufficient access to pre-college academic opportunities (Wright et al., 2016) to ill-fitting pedagogical approaches by STEM instructors (Johnson, 2007). Some progress has been made in this area with regard to gender equity, as the number of women in the STEM workforce grew from nearly 1.3 million to nearly 2.0 million from 2003 to 2017 (National Science Board, 2020). However, representation among some minoritized groups such as African Americans continues to be remarkably low, as their rate of participation in the STEM workforce increased only slightly from 3.6% in 1993 to 4.8% in 2015 (National Science Board, 2018).

One factor that has received considerable attention as a potential explanation for African Americans' underrepresentation in STEM has been the influence of pernicious racial stereotypes which allege that African Americans do not possess the intellectual capacity to succeed in these fields. Stereotype threat is defined as the discomfort individuals feel when they are at risk of confirming a negative stereotype about a group with which they identify (Steele & Aronson, 1995). Importantly, stereotype threat is thought to manifest as a consequence of situational cues in the achievement environment (Steele, 1997). Such cues can range from explicitly prejudicial statements and behaviors to more subtle messages and features of the environment that signal to targets of the stereotype that they do not belong. These messages and features are more likely to be present in the environments of predominantly White institutions (PWIs) where African American students are often outnumbered and stereotypic images (e.g., pictures of White scientists in hallways) are more likely to be prevalent. Indeed, research has shown that being outnumbered in achievement settings can undermine math performance (Inzlicht & Ben-Zeev, 2000) and perpetuate stereotypes among ingroup members (Delisle, Guay, Senecal, & Larose, 2009). Among African Americans specifically, Purdie-Vaughns et al. (2008) demonstrated that being outnumbered in a corporate work setting characterized by a colorblind ideology (versus a diversity-valuing ideology) was associated with significantly lower trust in the company.

Activation of stereotype threat is also contingent on the extent to which targeted individuals identify with the social groups and task domains that are implicated by the stereotype (Steele, 1997; Steele, Spencer, & Aronson, 2002). Individuals who are highly domain-identified are theorized to be most vulnerable to negative stereotypes because how people regard themselves is often dependent upon how well they perform in areas that are meaningful to them (Crocker et al., 2003), therefore stereotypic expectations of underperformance by others in the setting may represent a threat to a target's self-esteem. Similarly, stereotypes that implicate one's social group are theorized to elicit concerns about upholding positive perceptions of the group's image and status. The influence of these identity moderators has been supported by prior research suggesting that when stigmatized students of color are highly academically identified, they tend to report lower levels of academic persistence intentions (e.g., Chang, Eagan, Lin, & Hurtado, 2011), perform worse in school (e.g., Lawrence, Marks, & Jackson, 2010; Wasserberg, 2014), and drop out of school at greater rates (e.g., Osborne & Walker, 2006) than their White counterparts. Similarly, research involving students attending Historically Black Colleges and Universities (HBCU) has shown that high Black racial identification exacerbates the negative effect of stereotype threat on academic performance (Craemer & Orey, 2017). However, other studies indicate that high social identity serves as a buffer against threat effects. For example, Davis et al. (2006) found that Black undergraduate students demonstrated higher academic performance under conditions of high stereotype threat, as compared to low threat, when they endorsed a highly internalized racial identity status. Other researchers have similarly documented the protective effects of cultural group identification (e.g., Armenta, 2010; Shih et al., 1999), thus adaptive identities are likely to negate the influence of stigmatized identities when they are activated in stereotype-relevant situations. These findings underscore the difficulty associated with identifying how and when certain intrapersonal factors interact with stereotypic cues to engender threat responses (Nguyen & Ryan, 2008). The present study aimed, in part, to examine the utility of a particular social identity variable in moderating these environmental effects.

Whereas the conditions under which identification moderates the effect of stereotype threat are not entirely clear, the outcomes associated with stereotype threat are much less ambiguous. Steele and Aronson (1995) instantiated a threat condition by simply reminding African American students of a test's meaning with regard to intellectual ability. Inducing this stereotype in a laboratory setting was sufficient to lower their test performance relative to White participants. This pattern of detrimental effects among African Americans extends well beyond test performance to include destabilized academic self-efficacy (Aronson & Inzlicht, 2004), lower outcome expectancies (Kellow & Jones, 2008), increased health-related concerns (e.g., hypertension; Blascovich, Spencer, Quinn, & Steele, 2001), and greater attrition from STEM fields (Beasley & Fischer, 2012).

Stereotype Inoculation and Historically Black Colleges and Universities

Determining whether group identification buffers or exacerbates the effects of negative stereotypes may depend in part on the demographic makeup of the environment in which they are engendered. According to Dasgupta's (2011) stereotype inoculation model (SIM), achievement environments in which one's ingroup represents a numeric majority confer benefits to identity development by inoculating one' self-concept against the harmful effects of stereotypes. As Figure 1 indicates, the demographic composition of the achievement context is theorized to activate threat appraisals and social cognitive attitudes that in turn influence career-related motivation and behavior. These influences are conditional upon an individual's status and identification with other ingroup members. To date, the majority of research on this model has assumed a gender perspective in examining the protective benefits of majority-women environments. Dasgupta and colleagues have shown that female students' exposure to same-sex role models in STEM is associated with greater implicit math identification (Stout et al., 2011) and engineering career aspirations (Dasgupta, McManus Scircle, & Hunsinger, 2015), and retention in engineering (Dennehy & Dasgupta, 2017). Similar research among African Americans supports the positive influence on one's self-esteem when a same-race peer's performance is observed to contradict a negative racial stereotype (Blanton, Crocker, & Miler, 2000), however, the influence of the racial compositions of achievement environments has yet to be examined within the SIM framework.

While African American representation in STEM education and employment is low, it is important to note the role of HBCUs in granting STEM baccalaureate degrees. HBCUs granted 14.9% of the baccalaureate degrees to African Americans in 2018, and 23.2% who earned a STEM doctorate degree between 2015 and 2019 graduated with a bachelor's degree from an HBCU (National Center for Science and Engineering Statistics, 2021). Thus, it is clear that HBCUs provide an effective course of education for African American students who are pursuing STEM careers. Research has consistently demonstrated that, compared to their predominantly White institution (PWI) counterparts, HBCUs provide more supportive and effective learning environments that in turn yield more positive outcomes for African American students (Fleming, 1984; Palmer et al., 2010). Given that HBCUs are primarily comprised of African American students, faculty, and staff, they are ideally suited to protecting their students against the harmful effects of racial stereotypes. Perhaps one reason for this is that HBCUs are more effective than PWIs in promoting Afrocentric racial identity development (Cokley, 1999), and it is this affirming racial identity subtype that ultimately reduces the detrimental effects of racial stereotypes for African American students (Smith & Hopkins, 2004). HBCUs also foster higher quality interactions between students and faculty (Cokley, 2002) that provide rich social contexts for expert role modeling to occur.

Present Research

The purpose of the present study was twofold. Our chief objective was to conduct a macrolevel test of the SIM by examining the influence that two university environments with distinct racial compositions exerts on African American students' perceptions of negative race-STEM stereotypes. Specifically, we sought to test a particular portion of the SIM (see Figure 1) wherein the relationship between university type (HBCU vs. PWI) and stereotype threat is posited to be conditional upon participants' level of social identification. There are to our knowledge few self-report measures that capture the complex identity (i.e., social and domain identification) and threat dimensions posited by stereotype threat theory, therefore a secondary objective of the current study was to assess the construct validity of a stereotype threat scale designed to address this issue. As part of this validation process, and in accordance with Dasgupta's (2011) assertion that situational factors should exert subtle effects on unconscious self-related attitudes, we constructed and administered an implicit association test (IAT) designed to measure implicit race-STEM stereotypes and assessed its empirical association with the stereotype threat scale. We advanced five hypotheses. First, the stereotype threat scale was predicted to evidence a 2-factor structure consisting of identity threat and social identity. Second, the identity threat subscale was hypothesized to be positively and significantly correlated with IAT scores in the PWI group only. Third, our chief hypothesis involved a substantive test of the SIM in which we predicted that social identity would moderate the relationship between university type and identity threat such that identity threat would be significantly lower for HBCU students with high social identity. Finally, fear of confirming stereotypes is known to be an important source of decreased academic self-efficacy among college students (e.g., Aronson & Inzlicht, 2004; Deemer et al. 2014) while identity constructs typically foster self-efficacy by orienting students to the importance of personal values, goals, and skill development (Eccles, 2009). Academic self-efficacy is an important outcome to investigate in the current study because of its ability to predict future persistence intentions, particularly among African American STEM students (Lent et al., 2010). Thus, in a test of the convergent validity of the stereotype threat scale, we predicted that identity threat (hypothesis 4) and social identity (hypothesis 5) would be significant negative and positive predictors of STEM self-efficacy, respectively.

Method

Participants

Data were collected from 357 African American undergraduate STEM majors enrolled at an HBCU (n = 189) and PWI (n = 168) in the southeastern U.S. Twenty-four cases were removed due to completely missing data on the measures, resulting in a final N of 333 (HBCU n = 175, PWI n = 158). Most participants (197) identified as women, 134 identified as men, and one participant identified as transgender male. The mean age of the sample was 19.04 (SD =1.44) and mean grade point average was 3.11 (*SD* = .52). Most participants (213) were first-year students, followed by sophomores (125), juniors (6), and seniors (3); two students did not report their academic status. Biology (153) and engineering (75) programs comprised the majority of reported majors, followed by computer science (39), technology (22), chemistry (13), other majors (e.g., environmental science; 8), animal science (8), math (4), and physics (2). Six participants reported pursuing a double major (e.g., biology & chemistry) and three participants did not report their major. In terms of contextual differences between the two institutions, the HBCU represented in the current study is primarily a teaching institution comprised of approximately 4,000 undergraduate students and 93% of all students identify as Black or African American. The PWI is a research-intensive institution comprised of approximately 8,000 undergraduate students and 12% of all students identify as Black or African American. With regard to socioeconomic diversity, 85% of the HBCU students received an income-based Pell grant as compared to 31% for the PWI students. The majority of the faculty (86%) at the HBCU identify as Black or African American versus 14.4% at the PWI. Both institutions are located in rural areas.

Measures

Stereotype Threat. Six items from the Stereotype Threat in Science Scale-Gender (Deemer et al., 2016) were adapted and used to measure perceptions of threatening race-STEM stereotypes. Four items from the original scale were not included in the current study because they tap women's fears of being negatively evaluated by outgroup members (i.e., men) rather than fears of confirming negative stereotypes. An additional item ("I feel pressure to represent my gender group in science because there are so few of us in my field of interest") was omitted from the current study because racial representation may vary widely across STEM disciplines, therefore this item was viewed as an unreliable indicator of the social identity construct.

The scale items were adapted by replacing references to women with references to African Americans, and by replacing the term "science" with the term "STEM." As an example, the original item "I feel pressure to do what I can to improve the image of my gender group in science" was adapted to read "I feel pressure to do what I can to improve the image of African Americans in STEM." The identity threat (items 1-3) and social identity (items 4-6) items are as follows: (1) "I am afraid that I will not perform the way I want in STEM because of my race/ethnicity", (2) "I am afraid that if I do poorly in STEM, it will confirm the stereotype that African Americans cannot perform well in these disciplines", (3) "I am afraid of confirming the stereotype that African Americans do not have the skills to be STEM professionals", (4) "I feel pressure to do what I can to improve the image of African Americans in STEM", (5) "I feel pressure to do what I can to change the negative stereotype that African Americans are weak in STEM", and (6) "It is important to me that I represent the interests of other African Americans who aspire to be STEM professionals." Participants were asked to rate the items on a 4-point scale ranging from 0 (*never*) to 3 (*frequently*). Identity threat and social identity have been shown to be positively associated with existing measures of stereotype threat and science identity, thus supporting their convergent validity (Deemer et al., 2016). The adapted scale is hereafter referred to as the Stereotype Threat in STEM Scale-Race (STSS-R).

Implicit Association Test. Implicit race-STEM stereotypes were measured using the IAT (Greenwald et al., 1998). The IAT is a computer-based reaction time task in which participants sort items (words or pictures) into categories as quickly as possible. The fundamental assumption underlying the test is that performance should be faster when pairs of concepts (e.g., "competent" and "self") are more strongly associated through experience than discrepant concepts (e.g., "incompetent" and "self"). Unlike self-report measures, the IAT is thought to be immune to response bias due to the unconscious nature of the associative process (Greenwald et al., 1998). Participants are first given the task of learning to differentiate targets (e.g., "me") and attributes (e.g., "competent") in separate blocks of trials. After being trained on the simple differentiation tasks, attributes are paired with targets and participants are asked to repeat the procedure in a block of trials with a particular pairing pattern (e.g., "me" + "competent") and then one in which the pairing is reversed (e.g., "me" + "incompetent"). The difference in mean response latencies between the initial combined task and reversed combined task provides an index, *d* (Cohen, 1988), of the IAT effect.

In the current study, race ("African American" vs. "White") represented the target concept and career type ("STEM career" vs. "service/production career") represented the attribute dimension. We chose service/production careers as the contrast category to STEM careers because African Americans are overrepresented in these fields relative to other racial/ethnic groups (U.S. Bureau of Labor Statistics, 2020). Picture items were used to represent the target concept and word items were used for the attribute dimension. Six pictures of African American individuals (4 males, 2 females) and six pictures of White individuals (4 males, 2 females) were used to represent the race target. The following words were used to represent the STEM career attribute: (a) astronomer, (b) biologist, (c) chemist, (d) engineer, (e) geologist, (f) mathematician, and (g) physicist. Words used for the service/production career attribute were (a) assembly line worker, (b) cashier, (c) childcare worker, (d) construction worker, (e) customer service representative, (f) food service worker, (g) nurse's aide, (h) office administrative assistant, and (i) telemarketer. Consistent with previous research showing science is a negatively stereotyped domain for women, the IAT has been shown to reveal gender differences with respect to scientific identity and gender-math/science stereotypes (Nosek, Banaji, & Greenwald, 2002), thus supporting the validity of the IAT.

Scientific Identity. We used a 6-item scale developed by Chemers and colleagues (Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011) to measure participants' identification as scientists. Participants rate the items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An example item includes "In general, being a scientist is an important part of my self-image." Previous research supports the scale's internal consistency reliability (α = .89; Chemers et al., 2011) and construct validity, as Robnett, Chemers, and Zurbriggen (2015) obtained evidence of a unidimensional factor structure with standardized factor loadings ranging from .69 to .80. Cronbach's alpha for the scale was .92 in the current study.

STEM Self-Efficacy. Participants' self-efficacy perceptions in STEM were measured using an adapted version of Fantz et al.'s (2011) engineering self-efficacy scale. Items were adapted by replacing the term "engineering" with "STEM." Items were rated on a 7-point Likert scales ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). An example of an original item includes "I'm certain I can master the skills being taught in my engineering classes." The adapted version of this item is as follows: "I'm confident I can understand the basic concepts in my STEM classes." Recent research on the adapted scale suggests the measure has good internal consistency reliability (α = .93) and exhibits concurrent validity through a significant positive association with STEM inspiration (Deemer et al., 2021). Fantz et al. have similarly shown that the original scale is quite reliable (α = .83) and correlates positively with academic achievement. The scale exhibited excellent reliability (α = .96) in the current study.

Procedure

Participants were recruited using two methods: targeted emailing and in-class solicitation. The email addresses of African American STEM majors were obtained from each university's registrar's office and these students were contacted regarding their interest in participating. Research assistants also attended biology, chemistry, computer science, engineering technology, mathematics, and physics classes and requested students' involvement. Those students who agreed to participate were instructed to meet a research assistant at a computer lab on campus where they gave written consent to participate. Participants were then seated at a computer and administered the IAT followed by the online survey. Upon completion they were thanked for their participation and compensated with gift cards ranging in value from $20 to $40, depending on whether they were new or returning participants. Materials and analysis code for this study are available by emailing the corresponding author. This study was not preregistered.

Results

Data Screening and Confirmatory Factor Analysis

As noted above, 24 cases were removed from the data set due to completely missing values on the study variables. To evaluate the pattern of missingness in the remaining data we dummy-coded the substantive variables (0 = not missing, 1 = missing) and performed a series of logistic regression analyses whereby the binary outcomes were regressed on all other variables in the data set. Results indicated that missingness was not a function of the other variables (*p*-values ranged from .241 to .996), therefore missing values were assumed to be missing at random and were dealt with using full information maximum likelihood estimation.

To test the hypothesis that the STSS-R items would evidence a 2-factor structure we performed a confirmatory factor analysis (CFA) of the 2-factor model and compared it to an alternative 1-factor model. A 1-factor model was chosen as an alternative because previous research on the gender version of the STSS revealed that a unidimensional structure fit the data fairly well (Deemer et al., 2016). We used the following indices to evaluate model fit: (a) model chi-square test; (b) comparative fit index (CFI); (c) root mean square error of approximation (RMSEA); and (d) standardized root mean square residual (SRMR). All factor analytic models in the current study were tested using Mplus 7.4 (Muthén & Muthén, 1998-2015) statistical software. Estimation of the 2-factor model produced an excellent fit to the data, χ^2 (8) = 9.15, *p* =.33; CFI = .998; SRMR = .019; RMSEA = .021 (90% CI: .000, .070). Standardized factor loadings ranged from .65 to .83 for identity threat and from .58 to .89 for social identity. To construct the alternative 1-factor model we fixed the identity threat-social identity covariance 1, thus nesting the model within the 2-factor model. The 1-factor model fit the data poorly, χ^2 (9) = 122.11, p <.001; CFI = .807; SRMR = .070; RMSEA = .194 (90% CI: .164, .226), and results of chi-square difference testing indicated the model yielded a significantly worse fit to the data than the 2-factor model, $\Delta \chi^2$ (1) = 118.28, $p < .001$. Our first hypothesis was therefore supported and the 2-factor model was retained for invariance testing.

Descriptive statistics and reliability estimates are presented in Table 1. Inspection of histograms and the skewness and kurtosis values suggested that the variables were normally distributed. Cronbach's alpha coefficients were somewhat weaker in the HBCU sample (identity threat α = .70; social identity α = .77) as compared to the PWI sample (identity threat α = .84; social identity α = .79). Zero-order correlations among the variables are presented according to university type in Table 2. Notably, the correlation between the race-STEM IAT effect and identity threat failed to reach significance in the PWI group (r = .08, p = .32), thus our second hypothesis was not supported.

Measurement Invariance Testing

We conducted measurement invariance testing to determine whether the stereotype threat scale items measure the same construct across universities. Invariance testing involves assessing a series of nested confirmatory factor analytic models within a multiple group framework. If a given model is found to fit the data well, the analyst proceeds to testing a more restrictive model in which cross-group equality constraints on certain parameters. We evaluated three types of invariance in the current study: (a) configural invariance; (b) factor loading invariance; and (c) item intercept invariance. We chose not to examine residual invariance across groups because scholars suggest this test of invariance is overly restrictive (Byrne, Shavelson, & Muthén, 1989). Before assessing for configural invariance we estimated the 2-factor model in each group separately. Results indicated that both models fit the data reasonably well but model fit was somewhat weaker for the PWI group, χ^2 (8) = 21.19, $p = .007$; CFI = .959; SRMR = .038; RMSEA = .102 (90% CI: .050, .156), than the HBCU group, χ^2 (8) = 3.64, $p = .888$; CFI = 1.00; SRMR = .020; RMSEA = .000 (90% CI: .000, .041). The correlation between identity threat and social identity was slightly stronger in the HBCU group ($r = .68$, $p < .001$) than in the PWI group ($r = .66$, $p < .001$). The models were identified by freely estimating the factor variances, fixing the factor means to 0, and fixing the loading of the first indicator of each factor to 1. Results of the invariance testing sequence are presented in Table 3. Configural invariance was tested by estimating a multigroup model with all parameters freely estimated across groups. Results indicated that the model offered a good fit to the data, χ^2 (16) = 25.02, $p = .070$; CFI = .985; SRMR = .030; RMSEA = .058 (90% CI: .000, .100), therefore we proceeded to the test of loading invariance wherein the item intercepts were freely estimated across groups while the factor loadings were fixed to equivalence. Results of this test indicated the model fit the data well, χ^2 (20) = 29.84, $p = .073$; CFI = .983; SRMR = .040; RMSEA = .054 (90% CI: .000, .093).

Results of a chi-square difference test further indicated the model fit the data no worse than the configural model, $\Delta\ \chi^2$ (4) = 4.88, p = .30, Δ CFI = -.002. Finally, we constrained both the factor loadings and item intercepts in a test of intercept invariance. The model provided a mediocre fit to the data, χ^2 (26) = 58.64, $p < .001$; CFI = .945; SRMR = .101; RMSEA = .087 (90% CI: .057, .117), and results of chi-square difference testing indicated the model offered a significantly poorer fit to the data than the loading invariance model, $\Delta\ \chi^2$ (6) = 27.98, $p < .001$, Δ CFI = -.038. Results thus indicated that the stereotype threat items evidenced invariant factor loadings but noninvariant item intercepts across university samples.

Hierarchical Linear Regression Analyses

We performed a hierarchical regression analysis to test the hypothesis that social identity moderates the relationship between academic setting and stereotype threat. Social identity and university type (coded HBCU = 0, PWI = 1) were entered into the regression equation at step 1 as main effect predictors along with gender and STEM self-efficacy as control variables. Because participants who identified as gender nonbinary (n = 1) did not comprise a large enough group to be included in the regression analyses, gender was modeled as a dichotomous variable (coded men = 0, women = 1). The social identity x university type product term was entered into the equation at step 2. Results are presented in Table 4. The step 1 regression model was significant, F (4, 316) = 38.70, $p < .001$, as the predictors collectively explained 32.9% of the variance in identity threat. University type (β = .14, p = .004) and social identity (β = .51, $p < .001$) were significant positive predictors of identity threat after controlling for the effects of gender (β = .10, p = .050) and STEM self-efficacy (β = -.17, p = .001). The addition of the social identity x university type product term at step 2 yielded a significant increment of 0.9% of the variance explained in identity threat, Δ F (1, 315) = 4.48, p = .035 (β = .27). A plot of the two-way interaction is presented in Figure 2. Post hoc probing of the simple slopes indicated that university type was a significant positive predictor of identity threat at mean, t (314) = 2.54, p = .012 (b = .72), and high levels of social identity, t (314) = 3.23, p = .001 (b = 1.27), but not at low levels of social identity, t (314) = .47, p = .637 (b = .18). Our primary hypothesis was thus supported.

We then performed a second hierarchical regression analysis to test the hypotheses that identity threat and social identity are significant negative and positive predictors of STEM self-efficacy, respectively. Results are presented in Table 5. Gender, university type, scientific identity, and the implicit IAT effect scores were entered as covariates at step 1 of the analysis, followed by identity threat and social identity at step 2. The step 1 regression model was significant, F (4, 268) = 13.35, $p < .001$, as the predictors accounted for 16.6% of the variance in STEM self-efficacy. Inclusion of the STSS-R constructs at step 2 yielded a significant improvement in model fit, ΔF (2, 266) = 5.52, p = .004, as the model accounted for an additional 3.3% of the variance in STEM self-efficacy. Identity threat (β = -.21, p = .001) and social identity (β = .15, p = .026) were found to be significant predictors of STEM self-efficacy, thus supporting hypotheses 4 and 5. Support for hypothesis 4 suggest that as participants experience increasingly threatening stereotypes in their environments, they perceive themselves to possess lower confidence in their STEM abilities. Similarly, support for hypothesis 5 suggests that as participants identify more strongly with their racial and STEM identities, they experience greater confidence in their STEM abilities.

Discussion

The current research aimed to extend the empirical scope of the stereotype inoculation model by examining the psychological and career development benefits of being exposed to a majority ingroup learning context for African American STEM students. Our results extend previous research documenting the protective effects of contact with ingroup peers and experts by demonstrating that these benefits can be generalized from individual role model and small group exposures (e.g., Dasgupta et al., 2015) to the broader environment. Supporting our primary hypothesis, we found a significant university x social identity interaction whereby HBCU students reported experiencing significantly lower identity threat than their PWI counterparts when they endorsed a strong social identity. This effect was even observed at average levels of social identity, which suggests that African American STEM students do not necessarily need to over-identify with ingroup faculty and peers to experience the threat-reducing benefits of studying in a majority-Black environment. It is important to note that this significant interaction was observed after controlling for gender and self-efficacy, which have been implicated as important factors in accounting for participation in STEM careers (e.g., Cheryan, Ziegler, Montoya, & Jiang, 2017).

Our findings indicate that the HBCU examined in the present study contains structural features in its academic environment that buffer against threatening stereotypic cues. While these results cannot be generalized to all HBCUs, they are consistent with the notion that HBCUs and other minority-serving institutions may be considered exemplar of identity-safe environment (Spencer, Logel, & Davies, 2016) in that they are largely free of contextual signals that African American students do not belong in STEM. This is in light of the fact that over 90% of the students and over 85% of the faculty at the current HCBU identify as Black or African American. Thus, the abundance of African American role models for students to emulate likely serves as a protective agent but to draw more generalizable conclusions it would be important to test this assumption across several HBCUs. The current research offers support for the inoculating efficacy of majority-Black contexts at the institutional level, microlevel tests of the SIM in HBCU environments await further application. Prior research supports the influential effect that individual role models can exert on female students in terms of reducing self-stigmatizing beliefs (e.g., Asgari et al., 2012) and increasing career ambition (e.g., Asgari et al., 2010), therefore one should expect similar findings among African American students who see themselves as being similar to their role models. Extending this line of inquiry to mentor-mentee dyads and/or small group contexts in HBCU environments would be a profitable direction for future SIM research. The STEM participation literature would also benefit from further research on stereotype inoculation among individuals with intersecting racial and gender identities. Some research indicates that African American women tend to view biology and chemistry as less stereotypically masculine fields than White women (e.g., O'Brien et al., 2015), which may be attributed to ingroup role model exposure but this too remains to be examined empirically.

Although our main objective in this study was to test the SIM, the results also provide further support for the tenets of stereotype threat theory. Specifically, we obtained support for the theoretical proposition that stigmatizing contextual cues should activate concerns about confirming a negative stereotype when targets of the stereotype are highly domain-identified. Social identity, as measured by the STSS-R, thus appears to contribute to the reduction of threat perceptions in majority-Black contexts while sensitizing individuals to threat in minority-Black contexts. This finding illustrates the complexity of determining when domain identification may shift from being a protective factor to a risk factor and vice versa given that some research suggests a moderate level of domain identification may present more vulnerabilities for stigmatized groups than high domain identification (Nguyen & Ryan, 2008). It should be noted, however, that our social identity construct reflects an amalgam of domain and group identification, therefore either one of these identities may have emerged as more or less salient depending on the university context (Roccas & Brewer, 2002). It is possible that the safety of the HBCU environment led these students to emphasize their cultural identity in a way that granted them protection from the fear of confirming the race-STEM stereotype whereas an incongruence between features of the PWI environment and students' cultural identities may have triggered domain identity salience for the PWI group. Interestingly, the zero-order correlation between social identity and STEM self-efficacy was significant and positive in the PWI group but nonsignificant in the HBCU group. This significant association in the PWI group may reflect a self-regulatory response aimed at boosting one's confidence in an effort to maintain a desired level of STEM performance while protecting one's self-esteem from the inimical effects of negative stereotypes. Unfortunately, however, strengthening one's social identity in a minority-Black context appears to have the ironic effect of rendering African American students more vulnerable to stereotypic cues.

In the process of testing this model we further validated a scale designed to measure stereotype threat and social identity as key constructs within both the stereotype inoculation and stereotype threat theories. Our first hypothesis was designed to explore the validity of the identity threat construct, but it also aimed to test Dasgupta's (2011) assertion that implicit stereotypic attitudes can be shaped by situations that either do or do not afford exposure to ingroup experts and peers. The IAT effect was not significantly correlated with explicit identity threat in the PWI sample as we had predicted, however, a weak positive correlation between the two variables did emerge. It may be that PWI students were sufficiently exposed to ingroup role models to weaken the internalization of the race-STEM stereotype. In contrast, the correlation between the IAT effect and explicit identity threat among HBCU students was near zero. This could be due to the abundance of ingroup role models that HBCU students have access to, but additional studies are needed to explore this more directly. Research exploring the quantity and quality of African American students' ingroup interactions and mentor-mentee relationships could yield important information regarding changes in their implicit self-conceptions. It is also important to note that the identity threat and social identity scores were found to be sufficiently reliable, although the internal consistency estimates were somewhat lower in the HBCU group. The between-group disparity in reliability estimates for identity threat signifies the high degree of consistency with which PWI students experience the affective consequences of negative stereotypes.

Our last two hypotheses asserted that identity threat and social identity would be significant negative and positive predictors of STEM self-efficacy, respectively. Our findings supported these hypotheses as both constructs were found to predict STEM self-efficacy over and above the influence of demographic, environmental, and both implicit (i.e., IAT effect) and explicit (i.e., scientific identity) STEM-related attitudes. These results offer preliminary evidence of the concurrent validity of STSS-R scores. Results of measurement invariance testing also revealed that the STSS-R factor loadings were equivalent across groups, however, the item intercepts were not. Despite the fact that STSS-R item means cannot be directly compared across samples, we believe this finding illustrates the scale's sensitivity in detecting environmental differences in perceived identity threat and social identity, and as such, reflects the ecological validity of the scale.

Practice Implications

The current results offer some useful possibilities with regard to assisting African American students in their pursuit of STEM careers. Our findings are consistent with previous research demonstrating that HBCUs offer vital contextual benefits in terms of presenting African American students with ample exposure to ingroup role models (e.g., Allen, 1992; Cokley, 2000, 2002; Strayhorn & Saddler, 2009) and protecting them from experiences of race-related stress (e.g., Greer & Chwalisz, 2007). Clearly, then, university administrators at PWIs would do well to work toward increasing the racial diversity of their faculty and student bodies such that African American students have greater access to role models who share their racial and cultural identities. University faculty members could also contribute to creating supportive campus climates by encouraging administrators and academic advising staff to pair African American students with mentors they more closely identify with. For instance, Black male initiative programs are important to the academic retention of Black students because they afford social experiences that promote a sense of bonding, mutual validation, and cultural familiarity among peers. Student experiences in such programs have in turn been shown to foster greater perceptions of resilience and leadership capability (e.g., Druery & Brooms, 2019), thus programs that target STEM majors specifically would be particularly useful given the dearth of Black males in STEM fields (National Center for Science and Engineering Statistics, 2021). Regardless of the cultural match between the mentor and mentee, it is critical that mentoring programs at PWIs move beyond simple academic mentoring and extend to a person-centered approach that responds to students' nonacademic concerns as well (e.g., social isolation, family issues; Sato, Eckert, & Turner, 2018).

Limitations and Conclusion

There are limitations to the study that merit discussion. First, by comparing differences across universities, our study only focused on aggregate demographic composition effects on students' perceptions of stereotype threat. It is difficult to infer global environmental effects on individual attitudes given the multitudes of campus sub-contexts in which students function and socially interact. A much more targeted focus on dyadic mentor-mentee relationships and smaller demographic units (e.g., classrooms) is needed to assess the explanatory reach of the SIM. Second, aside from the IAT, all measures used in the current study were self-report in nature, therefore the data may have been subject to response bias. For example, some participants may have underreported their perceptions of stereotype threat to avoid the appearance of psychological vulnerability. Finally, selection bias may have been a mitigating factor in that students may have been more or less likely to participate if they were highly interested in the topic or perhaps had painful experiences of discrimination. Any such selection biases may have been a function of academic setting given that HBCU students were perhaps not as likely as PWI students to have been subjected to a race-STEM stereotype on their campus.

Numerous researchers have explored the benefits of exposure to mentors and role models for members of underrepresented groups over the years, but few have expanded such analyses to broader contextual effects of achievement environments. We addressed this issue in the present research by evaluating the utility of the SIM in explaining African American students' stereotype threat perceptions across two demographically distinct universities. We have shown that a majority-Black academic environment presents significant benefits to students in reducing this threat when they identify strongly with African American peers and faculty in STEM. This study represents but a partial test of the SIM, however. Future investigations focusing on the effects of demographic factors on downstream variables such as STEM career persistence and decision-making would do much to increase our understanding of how African American students may be protected against harmful stereotypes.

References

Allen, W. R. (1992). The color of success: African American college student outcomes at predominantly White and historically Black public colleges and universities. *Harvard Educational Review, 62*(1), 26-44. http://doi.org/10.17763/haer.62.1.wv5627665007v701

Armenta, B. E. (2010). Stereotype boost and stereotype threat effects: The moderating role of ethnic identification. *Cultural Diversity and Ethnic Minority Psychology, 16*(1), 94-98. http://dx.doi.org/10.1037/a0017564

Aronson, J., & Inzlicht, M. (2004). The ups and downs of attributional ambiguity: Stereotype vulnerability and the academic self-knowledge of African American college students. *Psychological Science, 15*(12), 829-836. http://dx.doi.org/10.1111/j.0956-7976.2004.00763.x

Asgari, S., Dasgupta, N., & Cote, N. G. (2010). When does contact with successful ingroup members change self-stereotypes? A longitudinal study comparing the effect of quantity vs. quality of contact with successful individuals. *Social Psychology, 41*(3), 203-211. http://doi.org/10.1027/1864-9335/a000028

Asgari, S., Dasgupta, N., & Stout, J. G. (2012). When do counterstereotypic ingroup members inspire versus deflate? The effect of successful professional women on young women's leadership self-concept. *Personality and Social Psychology Bulletin, 38*(3), 370-383. http://doi.org/10.1177/0146167211431968

Beasley, M. A., & Fischer, M. J. (2012). Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math, and engineering majors. *Social Psychology of Education, 15*(4), 427-448. http://dx.doi.org/10.1007/s11218-012-9185-3

Blanton, H., Crocker, J., & Miller, D. T. (2000). The effects of in-group versus out-group social comparison on self-esteem in the context of a negative stereotype. *Journal of Experimental Social Psychology, 36*(5), 519-530. http://doi.org/10.1006/jesp.2000.1425

Blascovich, J., Spencer, S. J., Quinn, D., & Steele, C. (2001). African Americans and high blood pressure: The role of stereotype threat. *Psychological Science, 12*(3), 225-229. http://doi.org/10.1111/1467-9280.00340

Byrne, B. M., Shavelson, R. J., & Muthén, B. O. (1989). Testing for equivalence of factor covariance and mean structures: The issue of partial measurement invariance. *Psychological Bulletin, 105*(3), 456-466. http://doi.org/10.1037/0033-2909.105.3.456

Chang, M. J., Eagan, M. K., Lin, M. H., & Hurtado, S. (2011). Considering the impact of racial stigmas and science identity: Persistence among biomedical and behavioral science aspirants. *Journal of Higher Education, 82*(5), 564-596. http://doi.org/10.1353/jhe.2011.0030

Chemers, M. M., Zurbriggen, E. L., Syed, M., Goza, B. K., & Bearman, S. (2011). The role of efficacy and identity in science career commitment among underrepresented minority students. *Journal of Social Issues, 67*(3), 469-491. http://doi.org/10.1111/j.1540-4560.2011.01710.x

Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological Bulletin, 143*(1), 1-35. http://doi.org/10.1037/bul0000052

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Psychology Press.

Cokley, K. (1999). Reconceptualizing the impact of college racial composition on African American students' racial identity. *Journal of College Student Development, 40*(3), 235-246.

Cokley, K. (2000). An investigation of academic self-concept and its relationship to academic achievement in African American college students. *Journal of Black Psychology, 26*(2), 148-164. http://doi.org/10.1177/0095798400026002002

Cokley, K. (2002). The impact of college racial composition on African American students' academic self-concept: A replication and extension. *The Journal of Negro Education, 71*(4), 288-296. http://doi.org/10.2307/3211181

Craemer, T., & Orey, D. (2017). Implicit Black identification and stereotype threat among African American students. *Social Science Research, 65*, 163-180. http://dx.doi.org/10.1016/j.ssresearch.2017.02.003

Crocker, J., Karpinski, A., Quinn, D. M., & Chase, S. K. (2003). When grades determine self-worth: Consequences of contingent self-worth for male and female engineering and psychology majors. *Journal of Personality and Social Psychology, 85*(3), 507-516. http://doi.org/10.1037/0022-3514.85.3.507

Dasgupta, N. (2011). Ingroup experts and peers as social vaccines who inoculate the self-concept: The stereotype inoculation model. *Psychological Inquiry, 22*(4), 231-246. http://dx.doi.org/10.1080/1047840X.2011.607313

Dasgupta, N., McManus Scircle, M., & Hunsinger, M. (2015). Female peers in small work groups enhance women's motivation, verbal participation, and career aspirations in engineering. *Proceedings of the National Academy of Sciences (PNAS), 112*(16), 4988-4993. https://www.pnas.org/content/112/16/4988

Davis, C., Aronson, J., & Salinas, M. (2006). Shades of threat: Racial identity as a moderator of stereotype threat. *Journal of Black Psychology, 32*(4), 399-417. http://doi.org/10.1177/0095798406292464

Deemer, E. D., Derosa, P. A., Duhon, S. A., & Dotterer, A. M. (2021). Psychological momentum and inertia: Toward a model of academic motivation. *Journal of Career Development, 48*(3), 275-289. http://doi.org/10.1177/0894845319848847

Deemer, E. D., Lin, C., Graham, R., & Soto, C. (2016). Development and validation of a measure of threatening gender stereotypes in science: A factor mixture analysis. *Journal of Career Assessment, 24*(1)*,* 145-161. http://doi.org/10.1177/1069072714565772

Delisle, M-N., Guay, F., Senécal, C., & Larose, S. (2009). Predicting stereotype endorsement and academic motivation in women in science programs: A longitudinal model. *Learning and Individual Differences, 19*(4)*,* 468-475. http://doi.org/10.1016/j.lindif.2009.04.002

Dennehy, T. C., & Dasgupta, N. (2017). Female peer mentors early in college increase women's positive academic experiences and retention in engineering. *Proceedings of the National Academy of Sciences (PNAS), 114*(23)*,* 5964-5969. http://doi.org/10.1073/pnas.1613117114

Druery, J. E., Brooms, D. R. (2019). "It lit up the campus": Engaging Black males in culturally enriching environments. *Journal of Diversity in Higher Education, 12*(4), 330-340. http://dx.doi.org/10.1037/dhe0000087

Eccles, J. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist, 44*(2), 78-89. https://doi.org/10.1080/00461520902832368

Fantz, T. D., Siller, T. J., & DeMiranda, M. A. (2011). Pre-collegiate factors influencing the self-efficacy of engineering students. *Journal of Engineering Education, 100*(3)*,* 604-623. http://doi.org/10.1002/j.2168-9830.2011.tb00028.x

Fleming, J. (1984). *Blacks in college: A comparative study of students' success in Black and in White institutions*. Jossey-Bass.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 74*(6)*,* 1464-1480. http://doi.org/10.1037/0022-3514.74.6.1464

Greer, T. M., & Chwalisz, K. (2007). Minority-related stressors and coping processes among African American college students. *Journal of College Student Development, 48*(4), 388-404. http://doi.org/10.1353/csd.2007.0037

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. http://doi.org/10.1111/1467-9280.00272

Johnson, A. C. (2007). Unintended consequences: How science professors discourage women of color. *Science Education, 91*(5), 805–821. http://doi.org/10.1002/sce.20208

Kellow, J. T., & Jones, B. D. (2008). The effects of stereotypes on the achievement gap: Reexamining the academic performance of African American high school students. *Journal of Black Psychology, 34*(1), 94-120. http://doi.org/10.1177/0095798407310537

Lawrence, J. S., Marks, B. T., & Jackson, J. S. (2010). Domain identification predicts Black students' underperformance on moderately difficult tests. *Motivation and Emotion, 34*(2)*,* 105-109. http://doi.org/10.1007/s11031-010-9159-8

Lent, R. W., Sheu, H.-B., Gloster, C. S., & Wilkins, G. (2010). Longitudinal test of the social cognitive model of choice in engineering students at historically Black universities. *Journal of Vocational Behavior, 76*(3)*,* 387-394. http://doi.org/10.1016/j.jvb.2009.09.002

Muthén, L. K., & Muthén, B. O. (1998-2015). *Mplus user's guide* (7th ed.). Muthén & Muthén.

National Center for Science and Engineering Statistics. (2021). *Women, minorities, and persons with disabilities in science and engineering: 2021* (Special Report NSF 21-321). National Science Foundation. Available at https:// ncses.nsf.gov/wmpd

National Science Board. (2018). *Science and engineering indicators 2018* (NSB-2018-1). National Science Foundation. Available at https://www.nsf.gov/statistics/indicators/

National Science Board. (2020). *Science and engineering indicators 2020: The state of U.S. science and engineering* (NSB-2020-1). National Science Foundation. Available at https://www.nsf.gov/statistics/indicators/

Nguyen, H-H. D., & Ryan, A. M. (2008). Does stereotype threat affect test performance of minorities and women? A meta-analysis of experimental evidence. *Journal of Applied Psychology, 93*(6)*,* 1314-1334. http://doi.org/10.1037/a0012702

Nosek, B. A., Banaji, M. R., & Greenwald, A. G. (2002). Math = male, me = female, therefore math ≠ me. *Journal of Personality and Social Psychology, 83*(1)*,* 44-59. http://doi.org/10.1037/0022-3514.83.1.44

O'Brien, L. T., Blodorn, A., Adams, G., Garcia, D. M., & Hammer, E. (2015). Ethnic variation in gender-STEM stereotypes and STEM participation: An intersectional approach. *Cultural Diversity and Ethnic Minority Psychology, 21*(2), 169-180. http://doi.org/10.1037/a0037944

Osborne, J. W., & Walker, C. (2006). Stereotype threat, identification with academics, and withdrawal from school: Why the most successful students of colour might be most likely to withdraw. *Educational Psychology, 26*(4), 563-577. http://doi.org/10.1080/01443410500342518

Palmer, R. T., Davis, R. J., & Maramba, D. C. (2010). Role of an HBCU in supporting academic success for underprepared Black males. *The Negro Educational Review, 61*(1-4), 85-106.

Purdie-Vaughns, V., Steele, C. M., Davies, P. G., Ditlmann, R., & Crosby, J. R. (2008). Social identity contingencies: How diversity cues signal threat or safety for African Americans in mainstream institutions. *Journal of Personality and Social Psychology, 94*(4), 615-630. http://doi.org/10.1037/0022-3514.94.4.615

Robnett, R. D., Chemers, M. M., & Zurbriggen, E. L. (2015). Longitudinal associations among undergraduates' research experience, self-efficacy, and identity. *Journal of Research in Science Teaching, 52*(6), 847-867. http://doi.org/10.1002/tea.21221

Roccas, S, & Brewer, M. B. (2002). Social identity complexity. *Personality and Social Psychology Review, 6*(2), 88-106. http://doi.org/10.1207/S15327957PSPR0602_01

Sato, T., Eckert, K., Turner, S. L. (2018). Perceptions of Black student athletes about academic mentorship at a predominantly White institution in higher education. *Urban Review, 50*(4), 559-583. https://doi.org/10.1007/s11256-018-0456-y

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science, 10*(1), 80-83. http://doi.org/10.1111/1467-9280.00111

Smith, C. E., & Hopkins, R. (2004). Mitigating the impact of stereotypes on academic performance: The effects of cultural identity and attributions for success among African American college students. *The Western Journal of Black Studies, 28*(1), 312-321.

Spencer, S. J., Logel, C., & Davies, P. G. (2016). Stereotype threat. *Annual Review of Psychology, 67*(1)*,* 415-437. http://doi.org/10.1146/annurev-psych-073115-103235

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*(6)*,* 613-629. http://doi.org/10.1037/0003-066X.52.6.613

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5)*,* 797-811. http://doi.org/10.1037/0022-3514.69.5.797

Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. P. Zanna (Ed.), *Advances in experimental social psychology, Vol. 34* (p. 379–440). Academic Press. https://doi.org/10.1016/S0065-2601(02)80009-0

Stout, J. G., Dasgupta, N., Hunsinger, M., & McManus, M. A. (2011). STEMing the tide: Using ingroup experts to inoculate women's self-concept in science, technology, engineering, and mathematics (STEM). *Journal of Personality and Social Psychology, 100*(2)*,* 255-270. https://doi.org/10.1037/a0021385

Strayhorn, T. L., & Saddler, T. N. (2009). Gender differences in the influence of faculty-student mentoring relationships on satisfaction with college among African Americans. *Journal of African American Studies, 13*(4)*,* 476-493. http://doi.org/10.1007/s12111-008-9082-1

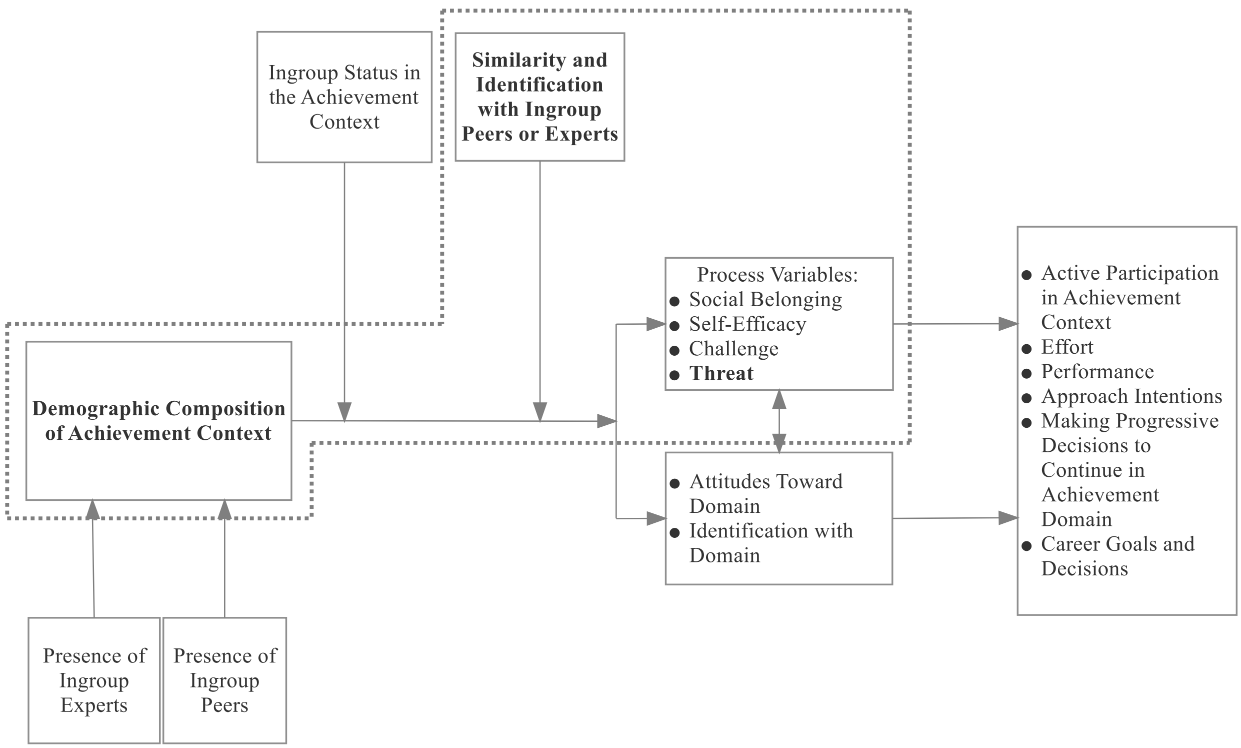
U.S. Bureau of Labor Statistics. (2020). *Labor force characteristics by race and ethnicity, 2019* (Report 1088). https://www.bls.gov/opub/reports/race-and-ethnicity/2019/pdf/home.pdf

Wasserberg, M. J. (2014). Stereotype threat effects on African American children in an urban elementary school. *The Journal of Experimental Education, 82*(4), 502-517. http://doi.org/10.1080/00220973.2013.876224

Wright, B. L., Counsell, S. L., Goings, R. B., Freeman, H., & Peat, F. (2016). Creating access and opportunity: Preparing African American male students for STEM trajectories preK-12. *Journal for Multicultural Education, 10*(3), 384-404. http://doi.org/10.1108/JME-01-2016-0003

Figure 1

Dasgupta's (2011) stereotype inoculation model. Bolded variables within the dashed lines represent the portion of the model being tested in the current study.



Note. From "Ingroup experts and peers as social vaccines who inoculate the self-concept: The stereotype inoculation model," by N. Dasgupta, 2011, *Psychological Inquiry, 22*(4)*,* p. 234. Copyright 2011 by Taylor & Francis (www.tandfonline.com).

Table 1

Descriptive Statistics and Reliability Estimates for the STSS-R Variables by University Type

	HBCU					PWI				
Factor/item	*M*	*SD*	Skew	Kurtosis	α	*M*	*SD*	Skew	Kurtosis	α
Identity threat	.92	.79	.50	-.64	.70	1.31	.95	-.06	-1.26	.84
Item 1	.83	.94	.72	-.67	--	1.10	1.00	.30	-1.15	--
Item 2	1.05	1.07	.47	-1.15	--	1.48	1.15	-.06	-1.44	--
Item 3	.86	.99	.78	-.63	--	1.36	1.12	.07	-1.39	--
Social identity	1.78	.91	-.29	-.87	.77	2.08	.80	-.95	.47	.79
Item 4	1.67	1.09	-.27	-1.22	--	1.92	.93	-.70	-.26	--
Item 5	1.46	1.15	.01	-1.43	--	1.97	1.03	-.73	-.59	--
Item 6	2.22	1.04	-1.07	-.19	--	2.34	.87	-1.30	.99	--

Table 2

Zero-Order Correlations for the Study Variables by University Type

Variable	1	2	3	4	5
1. IAT effect	--	-.02	-.06	-.04	-.05
2. Identity threat	.08	--	.15†	.50***	-.06
3. Scientific identity	.05	.10	--	.44***	.36***
4. Social identity	-.06	.53***	.34***	--	.11
5. STEM self-efficacy	.003	-.11	.33***	.21**	--

Note. Correlations for the PWI group are below the diagonal; correlations for the HBCU group are above the diagonal. † $p < .06$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Summary of Model Fit Statistics for Measurement Invariance Tests

Model	χ^2	*df*	RMSEA (90% CI)	SRMR	CFI	$\Delta \chi^2$ (*df*)	*p*	Δ CFI
Configural Invariance	25.02	16	.058 (.000, .010)	.030	.985	--	--	--
Loading Invariance	29.84	20	.054 (.000, .093)	.043	.983	4.88 (4)	.30	-.002
Intercept Invariance	58.64	26	.087 (.057, .117)	.101	.945	27.98 (6)	< .001	-.038

Note. Corrected chi-square difference test values are reported rather than absolute difference values.

Table 4

Results of Hierarchical Regression Analysis Predicting Identity Threat

Predictor	*B*	*SE*	β	*p*	ΔR^2	R^2
Step 1					--	.332
Gender	.57	.25	.11	.026		
University	.75	.26	.14	.004		
STEM self-efficacy	-.05	.01	-.17	< .001		
Social identity	.53	.05	.51	< .001		
Step 2					.009	.341
Social identity x university	.21	.10	.27	.035		

Figure 2

Identity threat as a function of the interaction between university type and social identity

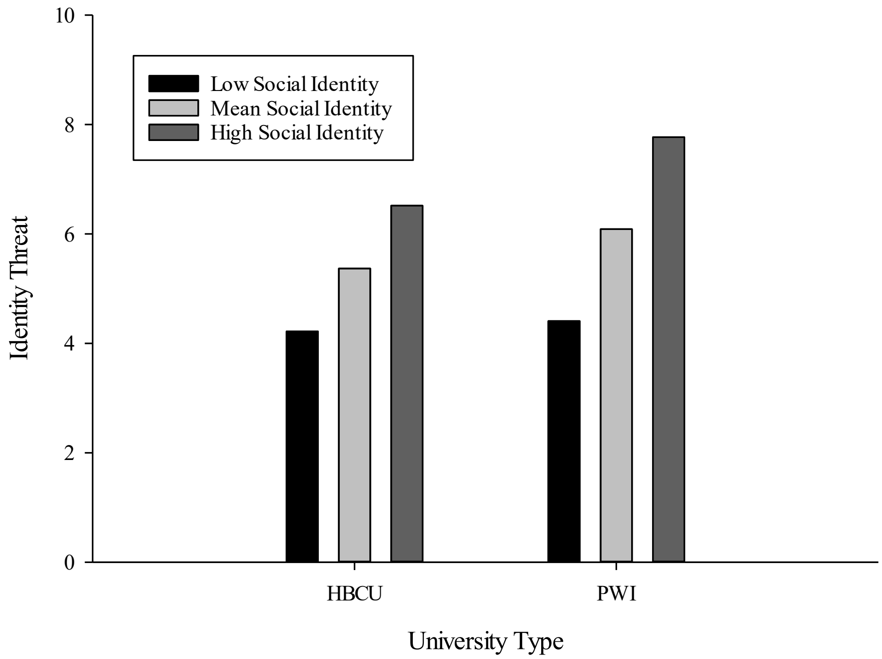


Table 5

Results of Hierarchical Regression Analysis Predicting STEM Self-Efficacy

Predictor	*B*	*SE*	β	*p*	Δ R^2	R^2
Step 1					--	.166
Gender	1.53	1.09	.09	.160		
University	-.97	1.08	-.05	.370		
IAT effect	-.26	1.22	-.01	.833		
Scientific identity	.59	.09	.38	< .001		
Step 2					.033	.199
Identity threat	-.71	.22	-.21	.001		
Social identity	.56	.25	.15	.026		