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# Cuing disparities: The consequences of race-based social stressors for academic achievement

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## Abstract

Underrepresented racially and ethnically minoritized (URM) students contend with individual-level race-based stressors in college, like racialized discrimination and microaggressions. In this study, we consider whether URM students' perceptions of racial inequity on campus—a *context-level* race-based stressor—trigger adverse psychological and physical stress responses that, in turn, undermine academic achievement. Using a sample of 781 science, technology, engineering and math (STEM) students, we found in a longitudinal study that URM students report perceiving more inequality on campus compared with White and Asian students. Greater perceived inequality was, in turn, associated with increased psychological and physical stress responses, which, in some cases, predicted lower grades. Promoting more equitable college environments, therefore, may help attenuate inequalities in stress responses, ultimately, enhancing academic achievement. Please refer to the Supplementary Material section to find this article's [Community and Social Impact Statement](#).

## KEYWORDS

achievement inequity, race-based stressors, stress responses

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## 1 | INTRODUCTION

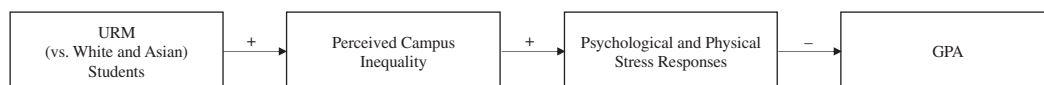
Inequities disadvantaging underrepresented racially and ethnically minoritized (URM) students in educational settings are sizeable, persistent and exist at every stage of the academic pipeline (Baker, Klasik, & Reardon, 2018; Burchinal et al., 2011; Perna, 2000; Posselt, Jaquette, Bielby, & Bastedo, 2012). These inequities are particularly striking in science, technology, engineering and mathematics (STEM) fields, where URM students—those identifying as Black, Latine, Pacific Islander and/or Native American—are significantly underrepresented, relative to their representation in the US population, and are more likely to leave STEM majors compared with their White and Asian counterparts (National Science Board, National Science Foundation, 2022).

The roots of these STEM retention disparities are complex and multifaceted (Crisp, Nora, & Taggart, 2009), encompassing individual, interpersonal and structural dimensions. In order to address and effectively combat these deeply entrenched disparities, it is critical that we understand these underpinning factors. Therefore, in the present research, we examine an important psychosocial factor that shapes and maintains educational inequities disadvantaging URM students in STEM: *students' perceptions of inequity at school*. We aim to understand how this perception influences both psychological and physical stress responses and, subsequently, how these responses shape the academic performance of URM students. Drawing from past research on race-based stressors (Clark, Anderson, Clark, & Williams, 1999; Levy, Heissel, Richeson, & Adam, 2016), we explore whether perceiving a higher level of school inequity heightens URM students' psychological and physical stress responses. Finally, we examine if these responses to the school context negatively impact URM students' academic performance (see Figure 1).

### 1.1 | Racial differences in race-based social stressors

Unequal exposure to race-based social stressors may serve as one pathway that shapes URM students' academic achievement. Key race-based social stressors include experiences with racial and ethnic discrimination (Clark et al., 1999) and racialized stereotype threat (i.e., a wariness of being seen or evaluated in light of negative stereotypes about one's racial or ethnic group; Steele & Aronson, 1995). STEM settings are rife with race-based social stressors for URM students. For instance, URM STEM students relative to their White and Asian peers report more experiences with racial and ethnic discrimination and microaggressions at school (Lee, Collins, Harwood, Mendenhall, & Hunt, 2020; Park, Kim, Salazar, & Hayes, 2020). URM students are also cognizant of negative cultural stereotypes impugning their group's intelligence and academic ability in these settings (Steele & Aronson, 1995; Steele, Spencer, & Aronson, 2002) and, consequently, report that many of their STEM peers and professors evaluate them through this stereotypical lens (Lee et al., 2020; McGee, 2018; McGee, 2020). Moreover, URM students also contend with similar race-based social stressors in their broader campus communities, extending beyond STEM settings specifically (Cokley, Hall-Clark, & Hicks, 2011; Cokley, McClain, Enciso, & Martinez, 2013; Forrest-Bank & Jenson, 2015; Keels, Durkee, & Hope, 2017; Steele & Aronson, 1995).

#### *Theoretical Model*



**FIGURE 1** Theoretical model.

## 1.2 | Understanding *context-level* race-based stressors

Extensive research clearly demonstrates the detrimental impact of *individual-level* race-based stressors, such as explicit instances of racialized discrimination and microaggressions, on URM students' academic achievement in high school (Baysu, Agirdag, & De Leersnyder, 2022; Thomas, Caldwell, Faison, & Jackson, 2009) and college settings (e.g., Del Toro & Hughes, 2020). Race-based stressors may have these adverse effects on academic achievement through mechanisms of psychological and physical stress responses (Levy et al., 2016). It is essential, however, to recognize that the *school context*—that is, a gestalt image of its biased structure, norms, values, policies and procedures (Murphy, Kroeper, & Ozier, 2018; Murphy & Taylor, 2012)—may itself serve as a potent source of race-based stress.

Like all students, URM students gauge the local meaning and value of their group identity based on cues from their campus environment (Murphy & Taylor, 2012). If certain aspects of this environment consistently produce inequitable experiences and outcomes related to race or ethnicity, then *the context itself* may be considered biased (Murphy et al., 2018). We describe this overall perception of the context as a *context-level* race-based stressor because it transcends isolated instances of bias to include a holistic assessment of the environment.

Various cues can converge to create a *context-level* race-based stressor. For instance, a campus predominantly comprised of nondiverse faculty who continually endorse (or fail to challenge) stereotypical depictions of URM people may create the perception of a biased campus. Similarly, structural inequities on campus, including underrepresentation and racialized opportunity gaps for URM students—like unequal access to informal mentoring opportunities and undergraduate research positions (Hurtado et al., 2011; Kim & Sax, 2009; McGee, 2020)—might also contribute to perceptions of a biased campus. Notably, personalized experiences with discrimination may not be necessary to perceive the context as biased—mere awareness of inequity, even if experienced vicariously, is likely enough to create the perception that “this is a place where inequity happens.”

Thus, we propose that the school context itself can be perceived as a race-based stressor, potentially with unique effects on students' psychological and physical stress responses. In the current research, we use students' perceptions of inequality to capture this context-level race-based stressor, and we investigate its impact on students' educational experiences.

## 1.3 | The impact of race-based stressors on psychological and physical stress responses

Race-based social stressors can trigger a variety of physical and psychological stress responses that have implications for academic achievement (Levy et al., 2016; McGee, Griffith, & Houston, 2019). Race-based stressors are associated with poorer physical well-being, such as headaches, chest pains and disturbed sleep (Cénat et al., 2022; Flores et al., 2008; Levy et al., 2016). Responses to race-based stressors also include heightened psychological distress, including feelings of anxiety and daily stress (Barnes & Lightsey, 2005; Ong, Fuller-Rowell, & Burrow, 2009; Sosoo, Bernard, & Neblett Jr., 2020), as well as reduced confidence in one's ability to successfully navigate and manage the stress and negative emotional reactions these stressors provoke (Berjot & Gillet, 2011; Espinosa, Anglin, & Pandit, 2022).

A specific type of psychological stress response elicited by race-based stressors is social identity threat. This refers to the psychological discomfort experienced when individuals feel at risk of being mistreated, devalued, or stereotyped due to their social group memberships (Steele et al., 2002). Identity threats take many forms (Murphy & Taylor, 2012), including concerns that one does not belong or fit in within their environment (Walton & Brady, 2017) or that they might be exposed as an imposter or a fraud (Cokley et al., 2017; McClain et al., 2016; McGee et al., 2019). Social identity threat is distinct from generalized psychological distress as it pertains directly to students' concerns about being devalued or mistreated due to their social identities. Consequently, our investigation will examine whether students' perceptions of inequality differentially predict psychological distress, manifested as

general anxiety *and* more specific social identity threats, and how these distinct psychological stress responses affect students' academic outcomes.

## 1.4 | How psychological and physical stress responses shape academic performance

Psychological and physical stress responses to race-based stressors often precede adverse academic outcomes. Social identity threat in STEM, like feelings of belonging uncertainty, has been linked to reduced topic interest (Belanger et al., 2020) and lower grade point averages (GPAs) among college students (LaCosse, Murphy, Garcia, & Zirkel, 2021). Similarly, anxiety is related to poorer academic achievement in higher education settings (Daker, Gattas, Sokolowski, Green, & Lyons, 2021; Schneider & Preckel, 2017), as is self-rated poor physical health (DeBerard, Spielmans, & Julka, 2004; Del Toro & Hughes, 2020; El Ansari & Stock, 2010). Thus, in the present research, we examine how psychological (i.e., social identity threat and general distress) and physical stress responses (e.g., somatic complaints) shape academic performance among STEM students.

## 2 | THE PRESENT RESEARCH

URM students, relative to their White and Asian peers, are more likely to contend with race-based stressors. These stressors have been shown to induce psychological and physical stress responses that can negatively impact academic achievement. Historically, the influences of race-based stressors on academics and stress responses have been studied separately, but recent models, bringing these two bodies of work together, have argued that these adverse responses to race-based stressors may form pathways linking race and ethnicity to achievement outcomes (Levy et al., 2016).

Little research, however, has traced the full pathway from race-based stressors, through stress responses, to academic achievement (see Figure 1). Previous work has linked discriminatory climates and school belonging to performance in math and reading among high school students (Baysu et al., 2022), and other studies have explored whether psychological distress from discrimination impacts Latine college students' academic performance (Castro, Sasser, Sills, & Doane, 2022; see also, Keels et al., 2017). Yet, there is no comprehensive research to date that has simultaneously considered social identity threat, psychological distress and physical stress in response to race-based stressors and how they shape disparities in achievement among URM college students in STEM fields.

The present study seeks to remedy this gap by examining the longitudinal consequences of students' perceptions of inequality on their stress responses and, in turn, their academic achievement. First, we investigate whether URM students perceive greater inequality compared with White and Asian students. Then, we examine whether students' perceptions of inequality are associated with adverse psychological (i.e., distress and social identity threat) and physical stress responses. So, we also explore this possibility. Finally, we test whether students' psychological and physical stress responses negatively impact their end-of-term GPA.

## 3 | METHOD

### 3.1 | Participants

We recruited 957 freshman and sophomore students at a large, public Midwestern university. Participants were part of a larger study examining students' experiences in introductory-level STEM courses and were enrolled in the largest introductory STEM courses on campus. Through listwise deletion, 176 students were excluded from the analyses for not providing their perceptions of inequality at the beginning of the semester ( $n = 13$ ), missing information on key covariates ( $n = 6$ ), or failing to complete the end-of-semester stress outcomes ( $n = 157$ ). This resulted in a final

sample of 781 students (66.2% female; 70.2% White, 10.0% Asian/Asian American, 4.1% Black, 3.3% Latine, 12.5% others/biracial).

## 3.2 | Procedure

Students completed an initial survey between the second and the fourth weeks of the semester. In this beginning-of-semester survey, students reported their perceptions of inequality on campus and their demographic characteristics. Students also reported on several indicators of psychological stress responses, including their imposter feelings, belonging uncertainty, day-to-day distress levels, and ability to cope with their day-to-day distress. Between the fourteenth and fifteenth week of the semester, students completed an end-of-semester survey in which they again reported the same psychological stress responses assessed at the beginning of the semester along with a measure of their anxiety symptoms. In addition to these items, participants reported their physical stress responses—specifically, measures assessing their physical health complaints. Finally, after the semester ended, we obtained students' college GPA (and their high school GPA, used as a covariate) from university academic records.<sup>1</sup>

## 3.3 | Measures

The full text of all measures for all studies can be found in the Supplemental Materials.

### 3.3.1 | Perceptions of inequality

To assess students' perceptions of campus inequality, students responded to the single item, “Inequalities due to race and class are deeply entrenched at [SCHOOL NAME],” on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).<sup>2</sup>

### 3.3.2 | Psychological stress responses

To measure students' psychological stress responses, we measured their feelings of social identity threat and distress. To index, social identity threat, we measured students' *imposter feelings* and *belonging uncertainty* (for a similar method, see Muenks et al., 2020). We used four items to measure *imposter feelings* (adapted from Leary, Patton, Orlando, & Funk, 2000); for example, “At times, I feel afraid others will discover how much knowledge or ability I really lack.”;  $\alpha_{\text{Time1}} = .87$ ;  $\alpha_{\text{Time2}} = .91$  rated on a scale ranging from 1 (*not at all true*) to 6 (*very true*). To assess *belonging uncertainty*, students responded to the single item adapted from Walton and Cohen (2007; “When you think about [SCHOOL NAME], how often, if ever, do you wonder: ‘Maybe I don't belong here?’”) on a scale from 1 (*never*) to 5 (*always*). We standardized the imposter feelings and belonging uncertainty items, and these items were aggregated to index social identity threat ( $\alpha_{\text{Time1}} = .84$ ;  $\alpha_{\text{Time2}} = .85$ ).

To index psychological distress, we measured students' perceptions of their day-to-day levels of distress and their confidence in their ability to handle day-to-day distress. We also assessed their anxiety symptoms. To assess *day-to-day levels of stress*, students responded to one item—“How much stress do you experience on a day-to-day basis at [SCHOOL NAME]?”—from 1 (*none*) to 7 (*an extreme amount*). Students then rated their *confidence in their ability to handle day-to-day distress* by responding to another item—“How confident do you feel that you can handle the stress you experience on a day-to-day basis at [SCHOOL NAME]?”—on a scale ranging from 1 (*not at all confident*) to 7 (*extremely confident*). We also measured students' anxiety symptoms using five items adapted from Brief

Symptom Inventory (Derogatis & Melisaratos, 1983; e.g., “How often do you experience feeling tense or keyed up?”;  $\alpha = .90$ ) on a scale ranging from 1 (*never*) to 4 (*all of the time*). We standardized the end of semester measurements of day-to-day levels of distress, ability to handle day-to-day distress, and anxiety symptoms, and these items were aggregated to index psychological distress ( $\alpha = .88$ ).<sup>3,4</sup>

### 3.3.3 | Physical stress responses

To assess students' physical stress responses, we measured their somatic symptoms. Fourteen items (e.g., “In the past month have you had headaches?” “...experienced sleep that is disturbed?”;  $\alpha = .83$ ) adapted from The Symptom Checklist 90-Revised (Derogatis & Unger, 2010) and the Patient Health Questionnaire-15 Somatic Symptom Scale (Kroenke, Spitzer, & Williams, 2002) assessed students' physical health complaints. These items were aggregated to index physical health complaints ( $\alpha = .83$ ).

### 3.3.4 | URM students

Students self-reported their race/ethnicity. White and Asian students were categorized as the socially advantaged group ( $n = 626$ ) because both racial groups tend to be *overrepresented* (and *positively* stereotyped) in U.S. STEM courses (Beede et al., 2011; National Science Board, 2014). Students who self-identified as Black, Latine, American Indian, Native American, Pacific Islander and multiracial were categorized as URM ( $n = 99$ ), because these racial groups tend to be *underrepresented* (and *negatively* stereotyped) in U.S. STEM courses (National Science Board, 2014). See Table 1 for demographic characteristics for the full sample.

### 3.3.5 | Gender

Students self-reported their gender, which was included as a covariate in all analyses. The participants were included in the analyses if they self-identified as male ( $n = 264$ ) or female ( $n = 517$ ). Students who marked “others” ( $n = 6$ ) were excluded from analyses.

**TABLE 1** Demographic characteristics presented for the full sample and by URM and socially advantaged student status.

Demographic characteristics	Full sample	URM students	White and Asian students
Gender			
% female	66.20	73.74	65.10
% male	33.80	26.26	34.90
Age			
Mean score	18.59	18.52	18.60
Family SES			
% working class	6.40	15.15	5.13
% lower middle class	11.70	22.22	10.12
% middle class	35.70	42.42	34.75
% upper middle class	40.10	20.20	42.96
% upper class	6.10	0.00	7.04

### 3.3.6 | Socioeconomic status

Students self-reported their perceived family Socioeconomic status (SES) using a single item: "How would you describe your family's social class?" rated on the following scale: 1 = *working class*, 2 = *lower middle class*, 3 = *middle class*, 4 = *upper middle class* and 5 = *upper class*. As in previous research (Canning, LaCrosse, Kroeper, & Murphy, 2020), family SES was recoded into a dichotomous variable (1 = *working class, lower middle class and middle class*; 0 = *upper middle class and upper class*). We used this dichotomous variable as a covariate in all analyses, however, the results are similar when using the continuous measure as a covariate.

### 3.3.7 | High school GPA

High school GPA was obtained from university academic records scale and were provided using the university's GPA scale ranging from A indicating the highest grade to F indicating a failing grade (A/A+ = 4.0, A- = 3.7, B+ = 3.3, B = 3.0, B- = 2.7, C+ = 2.3, C = 2.0, C- = 1.7, D+ = 1.3, D = 1.0, D- = 0.7, F = 0.0).<sup>5</sup>

### 3.3.8 | GPA

Students' end-of-semester GPA scores were obtained from university academic records. Grades were provided using the university's GPA scale.

## 4 | RESULTS

### 4.1 | Descriptive statistics and correlations

Table 2 includes descriptive statistics and zero-order correlations for all dependent variables.

### 4.2 | Analysis plan

We first compared socially advantaged and URM students in STEM students across all variables. We used analyses of covariance (ANCOVAs) for variables with baseline measures (i.e., measures included in the beginning-of-semester survey: imposter feelings, belonging uncertainty, day-to-day levels of distress and ability to cope with their day-to-day distress). For other descriptive analyses, we used t-tests.

Next, we conducted our primary analysis, which focused on examining the sequential relationships between URM students' perception of campus inequality, stress responses and end-of-semester GPA (see Figure 1). We tested this hypothesized model using the PROCESS macro in SPSS (Model 81; Hayes, 2017), with bias-corrected 95% confidence intervals computed with 10,000 bootstrap resamples. In this model, URM status (0 = White/Asian, 1 = URM) was entered as the predictor; perceptions of inequality as the first mediator; then students' social identity threat, psychological distress and physical stress responses as separate parallel mediators; and end-of-semester GPA as our outcome. All the models controlled for student gender and family SES. Beginning-of-semester stress responses, where available, were entered as covariates for their respective end of semester stress responses. Finally, high school GPA was entered as a covariate for GPA. See Table S1 for full model details. The pattern of results remains consistent when we do not include covariates in the mediation model (see Table S2). The pattern of results also remains largely unchanged when we examine imposter feelings,



TABLE 2 Descriptive statistics and zero-order correlations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. URM																
2. Perc. Of inequality (T1)	.22***															
3. Gender	.06	.12***														
4. SES	.20***	.12***	.06													
5. Imposter feelings (T1)	.01	.16***	.10*	.10**												
6. Imposter feelings (T2)	.07	.19***	.10**	.10**	.63***											
7. Bel. uncertain. (T1)	.04	.20**	.17***	.07	.40**	.30**										
8. Bel. uncertain. (T2)	.08*	.19***	.11***	.07	.27***	.32***	.60**									
9. Day-to-day stress (T1)	.07	.15***	.20***	.09**	.25***	.22***	.31***	.25**								
10. Day-to-day stress (T2)	.04	.16***	.17***	.08*	.26***	.31***	.23***	.25**	.58**							
11. Day-to-day stress cope (T1)	-.06	-.17***	-.18***	-.13**	-.36**	-.30***	-.34***	-.27***	-.43**	-.29***						
12. Day-to-day stress cope (T2)	-.11**	-.20***	-.17***	-.14**	-.30**	-.39***	-.32***	-.37***	-.32***	-.44***	.48***					
13. Anxiety	.08*	.17***	.24***	.10*	.36***	.46***	.30***	.34***	.38***	.45***	-.37***	-.48***				
14. Health complaints	.05	.15***	.26***	.05	.27***	.34***	.31***	.28***	.33***	.45***	-.26***	-.39***	.61***			
15. High school GPA	-.10*	-.08*	.13***	-.09*	.06	.04	-.02	-.05	.06	.01	-.01	.002	-.05	-.03		
16. End-of-semester GPA	-.15***	-.02	.02	-.13***	-.01	-.13***	-.02	-.10**	-.02	-.13***	.04	.16***	-.10**	-.09*	.40***	
N	781	781	781	781	781	781	781	781	781	781	781	781	781	781	740	761
Mean	N/A	2.66	N/A	N/A	3.29	2.69	2.33	2.25	4.06	4.00	4.87	4.66	1.91	2.06	3.78	3.38
Standard deviation	N/A	1.62	N/A	N/A	1.46	1.49	1.06	1.06	1.24	1.28	1.32	1.46	0.77	0.61	0.29	0.57
Range	0-1	1-7	0-1	0-1	1-6	1-6	1-5	1-5	1-7	1-7	1-7	1-4	1-4	1-4.71	2.40-4.00	0.69-4.00

Note: Perc = perception; T1 = beginning of the semester measures; T2 = End of the semester measures. Underrepresented racial minority (URM) status was coded 0 = White, Asian, 1 = Black, Latine, American Indian, Native American, Pacific Islander and multiracial. Gender was coded 0 = female, 1 = male. SES was coded 0 = upper middle class and upper class, 1 = working class, lower middle class and middle class.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

belonging uncertainty, day-to-day levels of distress, ability to handle day-to-day distress, anxiety symptoms and physical health complaints as separate mediators predicting end-of-semester grades. See Tables S3 and S4 for details associated with these models.

### 4.3 | Descriptive analyses

Table 3 presents differences between socially advantaged and URM students on key outcomes. Relative to socially advantaged students in STEM, URM students reported higher levels of perceived inequality, imposter feelings, belonging uncertainty and anxiety. While both groups reported similar levels of day-to-day distress, URM students reported a reduced ability to cope with that distress. Additionally, URM students also exhibited a lower end-of-semester GPA. No detectable differences were found between socially advantaged and URM students concerning their physical health complaints.

### 4.4 | Mediation analyses

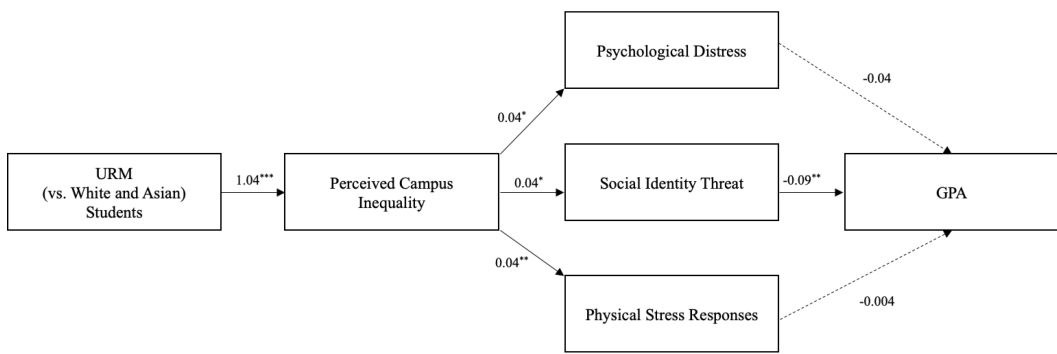
We conducted mediation analyses to test our full hypothesized model, examining how URM students' perception of greater inequality on campus may positively predict their stress responses and, in turn, negatively impact their end-of-semester GPA. Results partly confirmed our hypotheses (see Figure 2). URM students perceived greater campus inequality compared with their White and Asian peers. This perception of inequality was then associated with increased social identity threat, psychological distress and physical stress responses, although these associations were small.

As theorized, there was also a small but significant negative indirect effect of URM status on grades (*indirect effect* =  $-.003$ ,  $SE = .002$ , 95% CI [ $-.008$ ,  $-.001$ ]) in a chain of serial mediation via perceived inequality and identity threat. That is, URM students reported perceiving more inequality on campus and these perceptions of inequality were related to greater feelings of identity threat which, in turn, were associated with lower grades at the end of the semester.

**TABLE 3** Comparisons between students from socially advantaged groups in STEM and URM students.

Outcome	Socially advantaged M (SE)	URM M (SE)	<i>p</i>	<i>d</i>
Perc. of inequality	2.52 (.06)	3.61 (.20)	<.001	.69
Imposter feelings	2.65 (.04)	2.93 (.12)	.023	.25
Belonging uncertainty	2.23 (.03)	2.41 (.09)	.045	.21
Day-to-day distress	4.00 (.04)	4.02 (.11)	.892	.02
Ability to cope with day-to-day distress	4.71 (.05)	4.36 (.13)	.012	.27
Anxiety	1.89 (.03)	2.06 (.09)	.033	.23
Physical health complaints	2.05 (.02)	2.15 (.06)	.132	.16
High school GPA	3.79 (.01)	3.71 (.03)	.026	.29
End-of-semester GPA	3.41 (.02)	3.15 (.06)	<.001	.46

Note: Perc = perception. We used ANCOVAs for variables with baseline measures included in the beginning-of-semester survey: imposter feelings, belonging uncertainty, day-to-day levels of stress and ability to cope with their day-to-day stress). For other descriptive analyses, we used t-tests.



**FIGURE 2** Mediation model depicting the effects of URM status on end-of-semester GPA via perceptions of inequality and psychological and physical stress responses.

However, contrary to our expectations, there were no detectable indirect effects linking URM status to students' end-of-semester GPA via psychological distress (*indirect effect* =  $-.001$ ,  $SE = .002$ , 95% CI [ $-.006$ ,  $.001$ ]) or physical stress responses (*indirect effect* =  $.0002$ ,  $SE = .002$ , 95% CI [ $-.004$ ,  $.004$ ]).

In sum, URM students reported perceiving greater inequality on campus, and these perceptions of inequality were related to increased psychological and physical stress responses. Among these stress responses, social identity threat emerged as related to poorer academic performance; however, there was no evidence supporting a link between other indicators of psychological or physical stress and academic performance in this sample. Again, see Table S1 for full model details.

## 5 | DISCUSSION

In the current research, we longitudinally examined how perceived inequality shaped the psychological and physical stress responses of URM STEM (compared with White and Asian students) and whether these stress responses influenced academic performance. As expected, URM students perceived greater inequality on campus relative to their White and Asian counterparts. This perceived inequality, in turn, was related to increased social identity threat, psychological distress and physical stress responses.

Surprisingly, social identity threat emerged as the only stress response predicting academic achievement in our mediation model, highlighting the importance of examining multiple indicators of psychological and physical health when investigating the downstream impacts of race-based stressors on academic outcomes. These findings are of theoretical and practical import as they shed light on the mechanisms underlying inequities in STEM fields.

### 5.1 | Theoretical implications

The present research replicates and extends the literature demonstrating that URM students are more likely to perceive the school context as biased and inequitable (Byrd, 2019; Del Toro & Hughes, 2020). In line with theorizing and recent research (Baysu et al., 2022; Hurtado, Clayton-Pedersen, Allen, & Miley, 1998), however, we find that perceptions of inequality negatively impacted *all* students' psychological and physical stress responses, although URM students perceived more inequality. This finding highlights the powerful role that environments play in shaping students' experiences and outcomes.

Similar to previous work (e.g., Barnes & Lightsey Jr., 2005; McClain et al., 2016; Pascoe & Smart Richman, 2009; Walton & Brady, 2017), our descriptive analyses revealed a number of disparities in psychological and physical stress

responses between URM students and White and Asian students. Specifically, URM students relative to White and Asian students endorsed more imposter feelings, more belonging uncertainty, reduced ability to cope with their day-to-day distress, and greater anxiety. Extending and replicating previous research (Baysu et al., 2022; Hurtado & Ruiz Alvarado, 2015), perceptions of inequality predicted students' stress responses. Thus, our findings establish perceived inequality as a *contextual race-based social stressor* that negatively impacts students' psychological and physical stress responses. While prior studies have primarily focused on individual-level race-based stressors, such as racialized discrimination, this study underscores the importance of examining context-level race-based stressors, such as perceived campus inequality, as predictors of students' psychological and physical stress.

Importantly, our study also demonstrated that students' stress responses can influence their academic achievement. Specifically, social identity threat was related to poorer academic performance at the end of the semester, complementing previous research demonstrating the pernicious effects of belonging uncertainty (Walton & Cohen, 2007) and imposter feelings (Canning et al., 2020) on academic achievement. In our mediation model, psychological distress and physical stress responses were also associated with poorer academic performance, albeit, non-significantly. These findings suggest that social identity threat concerns may be a more proximal predictor of students' academic outcomes. Social identity threat relative to psychological distress and physical stress responses may have been more predictive due to its relevance to the academic context (Steele, 1997). That is, negative intelligence-based stereotypes related to one's social group membership may trigger doubts about one's competence (i.e., imposter feelings; Cokley et al., 2017; McGee et al., 2019) or the extent to which one fits within their academic environment (i.e., belonging uncertainty; Walton & Cohen, 2007). These social identity threat concerns can lead to decreased motivation and engagement, ultimately, undermining academic achievement (e.g., Canning et al., 2020). Psychological distress and physical stress responses may be influenced by various factors not directly tied to the academic context and thus might be less influential in shaping academic outcomes relative to social identity threat. Although these are intriguing possibilities, future research is needed to examine what role different contexts, individuals, and sociodemographic factors might play in shaping the relative influence of social identity threat, psychological distress and physical stress responses on academic outcomes.

While on the topic of stress responses and academic performance, we think it is important to acknowledge that psychological and physical stress responses are problematic in their own right, independent of their direct link to academic outcomes. Our findings, which demonstrate that perceived inequality significantly predicts all examined psychological and physical stress responses, raise concerns that should not be overlooked. Efforts should be directed towards fostering more inclusive and equitable educational environments where all students, regardless of their racial and ethnic backgrounds, feel valued, supported, and empowered. By addressing and mitigating perceived inequality, we can work towards reducing the psychological and physical stress experienced by students, ultimately contributing to healthier and more positive learning environments for all.

A novel contribution of the current study is the simultaneous examination of health (i.e., psychological and physical stress responses) and educational outcomes associated with race-based stressors. The health and educational outcomes associated with race-based stressors are often examined separately. That is, extensive research has separately examined the negative impacts of race-based stressors on mental and physical health (Williams & Mohammed, 2013) and on educational outcomes (Del Toro & Hughes, 2020; Steele et al., 2002). However, health and educational outcomes influence each other and are interconnected. For instance, stress-related changes in psychological and physical well-being have implications for attention, working memory and executive functioning (cognitive control processes) which are important for academic performance (Alapin et al., 2000; Miller & Bichsel, 2004). Conversely, educational outcomes such as degree attainment have long-term implications for people's health outcomes (Zajacova & Lawrence, 2018). To remedy inequities in educational outcomes, a more nuanced understanding of the complex relationship between race-based stressors, stress responses and academic achievement is needed. By incorporating a comprehensive approach, the present research provides important insights into the mechanisms linking race-based stressors to inequities in education and orients researchers towards novel points of intervention.

## 5.2 | Practical implications

Identifying influential race-based social stressors in the school context is critical to promote URM students' psychological, physical and academic well-being. Moving from individual to contextual determinants of students' experiences and outcomes allows researchers, policymakers, and practitioners alike to consider interventions and strategies that foster an equitable campus environment. Efforts to create inclusive and supportive environments will likely promote health and academic outcomes for all students, but especially URM students who perceive more inequity in the first place. Policies and practices that are geared towards increasing diversity and representation in higher education settings may be an important first step in reducing overall exposure to race-based stressors, thus improving students' health. URM students, for instance, report more incidences of discrimination at low-diversity institutions (Hurtado & Ruiz, 2012). Further, research has demonstrated that being exposed to classmates and faculty from underrepresented groups is associated with reduced likelihood of dropping out of college (Herzog, 2022) and increased degree attainment among racially and ethnically minoritized students (Curtis, 2021). Therefore, diversifying the faculty and student body will likely reduce experiences with discrimination and racialized opportunity gaps that inform students' perceptions of inequity on their college campuses. Further, such intentional policies are needed to counteract the historical legacy of exclusionary admission practices, particularly in STEM fields, that contribute to the underrepresentation of people from racially and ethnically minoritized groups (McGee, 2020). However, it is important to be cautious of superficial diversity efforts that merely use diversity as a recruitment tactic. These practices can inadvertently increase identity threat, rather than reduce it (Kroeper, Williams, & Murphy, 2022).

Educators also play a vital role in fostering inclusive and supportive environments for URM students. Diverse curriculums that include courses where the perspectives of racially and ethnically minoritized individuals are incorporated and that require students to enroll in courses with a diversity focus are associated with students' perceptions that the institution successfully cultivated an inclusive and diverse environment (Mayhew, Grunwald, & Dey, 2005). Educators can also adopt a diversity-centred approach in their courses by constructing syllabi that centre authors of historically underrepresented and marginalized backgrounds and that incorporate themes related to equity, diversity and inclusion throughout the course schedule and topics (Fuentes, Zelaya, & Madsen, 2021). Developing diverse curricula and syllabi are vital in promoting fair and equitable environments where all students can thrive and perform well academically.

Finally, given the role that students' stress responses play in shaping their academic outcomes, interventions that reduce stress responses can also enhance academic outcomes. For instance, interventions that address students' belonging concerns have been shown to improve retention and persistence among historically underrepresented students (LaCosse, Canning, Bowman, Murphy, & Logel, 2020; Murphy et al., 2020; Walton & Cohen, 2011). Importantly, these interventions are effective in supportive environments that afford students the opportunity to belong (Walton et al., 2023). Thus, although interventions that promote students' psychological and physical health are useful, they do not replace the need for structural interventions that foster equitable educational environments. Therefore, collective effort and engagement from various stakeholders, including students, faculty, administrators and policymakers, is needed to address inequities in education.

## 5.3 | Limitations and future directions

While the present research provides important insights into the effects of contextual race-based stressors on social identity threat, stress responses and subsequent achievement, it is limited in ways that suggest promising avenues for future research. Given that our data were collected as part of a larger study examining students' experiences in introductory-level STEM courses, we were constrained in our measures and our sample. Specifically, some of our key variables were measured using a single item and we only tested our hypothesized model among students enrolled in STEM courses. Despite recruiting an STEM-specific sample, we believe that our findings can still be

applied to the experiences of students from the broader student population. It is worth noting that we recruited students from a wide variety of STEM subdisciplines recognized by the National Science Foundation, such as physical sciences, biological sciences, social sciences, computer science, engineering, and math. Thus, we obtained results from a wide cross section of the university population. Moreover, students in our sample reported being interested in a wide variety of majors, including education, gender studies, law, public policy and social work, in addition to the STEM majors listed above. Further, the measures we employed assessed students' experiences on campus as a whole, rather than focusing solely on their STEM-specific experiences. Thus, we believe our findings provide insights into the broader student experience. Nevertheless, additional studies will be required to replicate these results using multi-item measures and with students recruited from non-STEM and STEM courses. Another limitation of using a larger dataset is that we were unable to identify factors that shape students' perceptions of inequality on campus. Future research could include measures of individual-level race-based stressors such as perceived discrimination and/or use multidimensional measures of school context and examine their role in shaping overall inequality perceptions. Further work could also consider whether education-related federal or state laws influence students' perceptions of campus inequality. For instance, the Supreme Court's recent decision to strike down race-conscious college admissions (*Students for Fair Admissions, Inc. v. President and Fellows of Harvard College*, 2023) will likely exacerbate underrepresentation in college settings (Reardon, Baker, Kasman, Klasik, & Townsend, 2018), consequently increasing students' perceptions of campus inequality. Thus, such legislation may indirectly shape URM students' educational experiences and outcomes.

An additional limitation of our study is that we grouped all URM students into a single category. Although our overall sample was reasonably large, it is worth noting that the proportion of URM students was small, constituting less than 20% of the total sample. As a result, we were unable to conduct a detailed analysis by disaggregating URM groups in this particular study. Given that students from different underrepresented racial and ethnic groups experience different types of negative group-based stereotypes and sources of discrimination (e.g., immigrant status, language; Greene, Way, & Pahl, 2006; Rosenbloom & Way, 2004), they are likely to experience the school environment differently. Future work examining larger samples of URM students, therefore, could disaggregate and consider the varying experiences between groups in college settings.

A final limitation relates to our small effects. Although, some of our effects were small, they can still be meaningful especially in the context of a longitudinal, field study (Preacher & Kelley, 2011). Specifically, our results revealed that perceptions of inequality at the beginning of the semester impacted students' psychological and physical stress responses at the end of the semester over and above their stress responses at the beginning of the semester. In addition, our findings demonstrate that social identity threat influences academic performance. Although small, these effects may accumulate over time to shape group-based differences in overall GPAs, graduation rates and career trajectories thus contributing to further inequities in educational outcomes (Massey & Probasco, 2010).

## 6 | CONCLUSION

The current study demonstrates that students' perceptions of inequality on their college campus can be considered a contextual race-based stressor that has an adverse impact on students' psychological and physical stress responses and subsequent academic performance. These results suggest that cultivating campus environments that are more equitable may be one lever to enhance stress responses and performance among URM students. Thus, it is essential to identify and implement structural reforms that address inequalities on college campuses to strengthen the health and performance for all students.

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### CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

### DATA AVAILABILITY STATEMENT

All de-identified data, code, and materials are available upon request and by IRB approval. In compliance with IRB policies, group characteristics will only be shared when there are 10 or more individuals within the group to preserve participants' anonymity. Additional data related to this paper may be requested from the authors.

### ENDNOTES

- <sup>1</sup> The procedure in the current manuscript resembles the procedures outlined by Canning et al. (2020), since data was drawn from the same dataset. However, the present manuscript considers different variables and focuses on different topics.
- <sup>2</sup> We surveyed students on their perceptions of inequality related to both race and class, given research demonstrating a great deal of overlap between these types of inequalities. Students from racially and ethnically marginalized groups often experience additional marginalization due to their social class backgrounds (e.g., Alon, 2007; Feasel, Dover, Small, & Major, 2023; Massey, Charles, Lundy, & Fischer, 2003). This is because, in the U.S., socially disadvantaged racial and ethnic minority groups tend to be overrepresented among the lower social classes relative to their representation in the overall population (Creamer, 2020).
- <sup>3</sup> At the request of a reviewer, we performed a factor analysis to empirically examine the distinctness of these measures. The analysis confirmed that, while these measures are correlated, they load onto separate factors, accounting for unique variance. See Supplemental Materials for the factor analysis results.
- <sup>4</sup> Since we did not measure anxiety at the beginning of the semester, we did not create an index of Time 1 psychological distress.
- <sup>5</sup> Given the documented gender and SES differences in the reporting of psychological and physical stress responses (Jury et al., 2017; Murphy, Steele, & Gross, 2007; Rainey, Dancy, Mickelson, Stearns, & Moller, 2018), as well as in academic performance (Bowman et al., 2022; Sirin, 2005) we accounted for these disparities by including gender and SES as a covariate. We also controlled for high school GPA as it predicts students' college grades (Allensworth & Clark, 2020). Therefore, accounting for these variables reduces potential noise in our analyses.

### REFERENCES

- Alapin, I., Fichten, C. S., Libman, E., Creti, L., Bailes, S., & Wright, J. (2000). How is good and poor sleep in older adults and college students related to daytime sleepiness, fatigue, and ability to concentrate? *Journal of Psychosomatic Research*, 49(5), 381–390. [https://doi.org/10.1016/S0022-3999\(00\)00194-X](https://doi.org/10.1016/S0022-3999(00)00194-X)
- Allensworth, E. M., & Clark, K. (2020). High school GPAs and ACT scores as predictors of college completion: Examining assumptions about consistency across high schools. *Educational Researcher*, 49(3), 198–211. <https://doi.org/10.3102/0013189X20902110>
- Alon, S. (2007). Overlapping disadvantages and the racial/ethnic graduation gap among students attending selective institutions. *Social Science Research*, 36(4), 1475–1499. <https://doi.org/10.1016/j.ssresearch.2007.01.006>
- Baker, R., Klasik, D., & Reardon, S. F. (2018). Race and stratification in college enrollment over time. *AERA Open*, 4(1), 2332858417751896. <https://doi.org/10.1177/2332858417751896>
- Barnes, P. W., & Lightsey, O. R., Jr. (2005). Perceived racist discrimination, coping, stress, and life satisfaction. *Journal of Multicultural Counseling and Development*, 33(1), 48–61. <https://doi.org/10.1002/j.2161-1912.2005.tb00004.x>
- Baysu, G., Agirdag, O., & De Leersnyder, J. (2022). The association between perceived discriminatory climate in school and student performance in math and Reading: A cross-National Analysis Using PISA 2018. *Journal of Youth and Adolescence*, 52, 619–636. <https://doi.org/10.1007/s10964-022-01712-3>
- Beede, D. N., Julian, T. A., Khan, B., Lehrman, R., McKittrick, G., Langdon, D., & Doms, M. E. (2011). Education supports racial and ethnic equality in STEM. *Economics and Statistics Administration Issue*, Brief No. 05-11, 1–11.

- Belanger, A. L., Joshi, M. P., Fuesting, M. A., Weisgram, E. S., Claypool, H. M., & Diekman, A. B. (2020). Putting belonging in context: Communal affordances signal belonging in STEM. *Personality and Social Psychology Bulletin*, 46(8), 1186–1204. <https://doi.org/10.1177/0146167219897181>
- Berjot, S., & Gillet, N. (2011). Stress and coping with discrimination and stigmatization. *Frontiers in Psychology*, 2, 1–13. <https://doi.org/10.3389/fpsyg.2011.00033>
- Bowman, N. A., Logel, C., LaCosse, J., Jarratt, L., Canning, E. A., Emerson, K. T. U., & Murphy, M. C. (2022). Gender representation and academic achievement among STEM-interested students in college STEM courses. *Journal of Research in Science Teaching*, 59(10), 1876–1900. <https://doi.org/10.1002/tea.21778>
- Burchinal, M., McCartney, K., Steinberg, L., Crosnoe, R., Friedman, S. L., McLoyd, V., & Pianta, R. (2011). Examining the black–white achievement gap among low-income children using the NICHD study of early child care and youth development. *Child Development*, 82(5), 1404–1420. <https://doi.org/10.1111/j.1467-8624.2011.01620.x>
- Byrd, C. M. (2019). A measure of school racial socialization and quality of intergroup interactions. *Cultural Diversity and Ethnic Minority Psychology*, 25(2), 137. <https://doi.org/10.1037/cdp0000202>
- Canning, E. A., LaCosse, J., Kroeper, K. M., & Murphy, M. C. (2020). Feeling like an imposter: The effect of perceived classroom competition on the daily psychological experiences of first-generation college students. *Social Psychological and Personality Science*, 11(5), 647–657. <https://doi.org/10.1177/1948550619882032>
- Castro, S. A., Sasser, J., Sills, J., & Doane, L. D. (2022). Reciprocal associations of perceived discrimination, internalizing symptoms, and academic achievement in Latino students across the college transition. *Cultural Diversity and Ethnic Minority Psychology*. <https://doi.org/10.1037/cdp0000528>
- Cénat, J. M., Kouamou, L. N., Moshirian Farahi, S. M. M., Darius, W. P., Dalexis, R. D., Charles, M., & Kogan, C. S. (2022). Perceived racial discrimination, psychosomatic symptoms, and resilience among black individuals in Canada: A moderated mediation model. *Journal of Psychosomatic Research*, 163, 111053. <https://doi.org/10.1016/j.jpsychores.2022.111053>
- Clark, R., Anderson, N. B., Clark, V. R., & Williams, D. R. (1999). Racism as a stressor for African Americans: A biopsychosocial model. *American Psychologist*, 54(10), 805–816. <https://doi.org/10.1037/0003-066X.54.10.805>
- Cokley, K., Hall-Clark, B., & Hicks, D. (2011). Ethnic minority-majority status and mental health: The mediating role of perceived discrimination. *Journal of Mental Health Counseling*, 33(3), 243–263. <https://doi.org/10.17744/mehc.33.3.u1n011t020783086>
- Cokley, K., McClain, S., Enciso, A., & Martinez, M. (2013). An examination of the impact of minority status stress and impostor feelings on the mental health of diverse ethnic minority college students. *Journal of Multicultural Counseling and Development*, 41(2), 82–95. <https://doi.org/10.1002/j.2161-1912.2013.00029.x>
- Cokley, K., Smith, L., Bernard, D., Hurst, A., Jackson, S., Stone, S., ... Roberts, D. (2017). Impostor feelings as a moderator and mediator of the relationship between perceived discrimination and mental health among racial/ethnic minority college students. *Journal of Counseling Psychology*, 64(2), 141–154. <https://doi.org/10.1037/cou0000198>
- Creamer, J. (2020). Poverty rates for blacks and Hispanics reached historic lows in 2019. Retrieved from <https://www.census.gov/library/stories/2020/09/poverty-rates-for-blacks-and-hispanics-reached-historic-lows-in-2019.html>
- Crisp, G., Nora, A., & Taggart, A. (2009). Student characteristics, pre-college, college, and environmental factors as predictors of majoring in and earning a STEM degree: An analysis of students attending a Hispanic serving institution. *American Educational Research Journal*, 46(4), 924–942. <https://doi.org/10.3102/0002831209349460>
- Curtis, J. W. (2021). Faculty diversity and minoritized student outcomes: An analysis of institutional factors. In S. Shulman (Ed.), *Trends in academic employment*, Working paper. Fort Collins, CO: Colorado State University.
- Daker, R. J., Gattas, S. U., Sokolowski, H. M., Green, A. E., & Lyons, I. M. (2021). First-year students' math anxiety predicts STEM avoidance and underperformance throughout university, independently of math ability. *NPJ Science of Learning*, 6(1), 1. <https://doi.org/10.1038/s41539-021-00095-7>
- DeBerard, M. S., Spielmans, G. I., & Julka, D. L. (2004). Predictors of academic achievement and retention among college freshmen: A longitudinal study. *College Student Journal*, 38, 66–80.
- Del Toro, J., & Hughes, D. (2020). Trajectories of discrimination across the college years: Associations with academic, psychological, and physical adjustment outcomes. *Journal of Youth and Adolescence*, 49(4), 772–789. <https://doi.org/10.1007/s10964-019-01147-3>
- Derogatis, L. R., & Melisaratos, N. (1983). The brief symptom inventory: An introductory report. *Psychological Medicine*, 13(3), 595–605. <https://doi.org/10.1017/S0033291700048017>
- Derogatis, L. R., & Unger, R. (2010). Symptom Checklist-90-revised. In C. Nemeroff & W. E. Craighead (Eds.), *Corsini encyclopedia of psychology* (pp. 1–2). Hoboken, NJ: John Wiley & Sons, Inc. [https://doi.org/10.1007/978-3-319-56782-2\\_2012-2](https://doi.org/10.1007/978-3-319-56782-2_2012-2)
- El Ansari, W., & Stock, C. (2010). Is the health and wellbeing of university students associated with their academic performance? Cross sectional findings from the United Kingdom. *International Journal of Environmental Research and Public Health*, 7(2), 2. <https://doi.org/10.3390/ijerph7020509>



- Espinosa, A., Anglin, D. M., & Pandit, S. (2022). Emotional self-efficacy informs the interrelation between discrimination, ethnic identity and psychotic-like experiences. *Emotion*, 22(6), 1347–1358. <https://doi.org/10.1037/emo0000922>
- Feasel, S. H., Dover, T. L., Small, P., & Major, B. (2023). Discrimination and perceived cultural mismatch increase status-based identity uncertainty. *Personality and Social Psychology Bulletin*, 01461672231163736. <https://doi.org/10.1177/01461672231163736>
- Flores, E., Tschann, J. M., Dimas, J. M., Bachen, E. A., Pasch, L. A., & de Groat, C. L. (2008). Perceived discrimination, perceived stress, and mental and physical health among Mexican-origin adults. *Hispanic Journal of Behavioral Sciences*, 30(4), 401–424. <https://doi.org/10.1177/0739986308323056>
- Forrest-Bank, S., & Jenson, J. M. (2015). Differences in experiences of racial and ethnic microaggression among Asian, Latino/Hispanic, black, and white young adults. *Journal of Sociology and Social Welfare*, 42, 141–161.
- Fuentes, M. A., Zelaya, D. G., & Madsen, J. W. (2021). Rethinking the course syllabus: Considerations for promoting equity, diversity, and inclusion. *Teaching of Psychology*, 48(1), 69–79. <https://doi.org/10.1177/0098628320959979>
- Greene, M. L., Way, N., & Pahl, K. (2006). Trajectories of perceived adult and peer discrimination among black, Latino, and Asian American adolescents: Patterns and psychological correlates. *Developmental Psychology*, 42(2), 218–236. <https://doi.org/10.1037/0012-1649.42.2.218>
- Hayes, A. F. (2017). Introduction to mediation, moderation, and conditional process analysis. In *A regression-based approach* (2nd ed.). New York, NY: Guilford Publications.
- Herzog, S. (2022). Classroom diversity and college student dropout: New evidence from panel data and objective measures. *Innovative Higher Education*, 47, 609–637. <https://doi.org/10.1007/s10755-021-09591-5>
- Hurtado, S., Clayton-Pedersen, A. R., Allen, W. R., & Milem, J. F. (1998). Enhancing campus climates for racial/ethnic diversity: Educational policy and practice. *The Review of Higher Education*, 21(3), 279–302. <https://doi.org/10.1353/rhe.1998.0003>
- Hurtado, S., Eagan, M. K., Tran, M. C., Newman, C. B., Chang, M. J., & Velasco, P. (2011). “We do science here”: Underrepresented Students’ interactions with Faculty in Different College Contexts. *The Journal of Social Issues*, 67(3), 553–579. <https://doi.org/10.1111/j.1540-4560.2011.01714.x>
- Hurtado, S., & Ruiz, A. (2012). *The climate for underrepresented groups and diversity on campus*. Los Angeles, CA: Higher Education Research Institute, University of California.
- Hurtado, S., & Ruiz Alvarado, A. (2015). *Discrimination and Bias, Underrepresentation, and Sense of Belonging on Campus* [Report]. HERI. Retrieved from <https://vtechworks.lib.vt.edu/handle/10919/83064>
- Jury, M., Smeding, A., Stephens, N. M., Nelson, J. E., Aelenei, C., & Darnon, C. (2017). The experience of low-SES students in higher education: Psychological barriers to success and interventions to reduce social-class inequality. *Journal of Social Issues*, 73(1), 23–41. <https://doi.org/10.1111/josi.12202>
- Keels, M., Durkee, M., & Hope, E. (2017). The psychological and academic costs of school-based racial and ethnic microaggressions. *American Educational Research Journal*, 54(6), 1316–1344. <https://doi.org/10.3102/0002831217722120>
- Kim, Y. K., & Sax, L. J. (2009). Student–faculty interaction in research universities: Differences by student gender, race, social class, and first-generation status. *Research in Higher Education*, 50(5), 437–459. <https://doi.org/10.1007/s11162-009-9127-x>
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine*, 64(2), 258–266.
- Kroeper, K. M., Williams, H. E., & Murphy, M. C. (2022). Counterfeit diversity: How strategically misrepresenting gender diversity dampens organizations’ perceived sincerity and elevates women’s identity threat concerns. *Journal of Personality and Social Psychology*, 122(3), 399–426. <https://doi.org/10.1037/pspi0000348>
- LaCosse, J., Canning, E. A., Bowman, N. A., Murphy, M. C., & Logel, C. (2020). A social-belonging intervention improves STEM outcomes for students who speak English as a second language. *Science Advances*, 6(40), eabb6543. <https://doi.org/10.1126/sciadv.abb6543>
- LaCosse, J., Murphy, M. C., Garcia, J. A., & Zirkel, S. (2021). The role of STEM professors’ mindset beliefs on students’ anticipated psychological experiences and course interest. *Journal of Educational Psychology*, 113(5), 949–971. <https://doi.org/10.1037/edu0000620>
- Leary, M. R., Patton, K. M., Orlando, A. E., & Funk, W. W. (2000). The impostor phenomenon: Self-perceptions, reflected appraisals, and interpersonal strategies. *Journal of Personality*, 68(4), 725–756. <https://doi.org/10.1111/1467-6494.00114>
- Lee, M. J., Collins, J. D., Harwood, S. A., Mendenhall, R., & Huntt, M. B. (2020). “If you aren’t white, Asian or Indian, you aren’t an engineer”: Racial microaggressions in STEM education. *International Journal of STEM Education*, 7(1), 48. <https://doi.org/10.1186/s40594-020-00241-4>
- Levy, D. J., Heissel, J. A., Richeson, J. A., & Adam, E. K. (2016). Psychological and biological responses to race-based social stress as pathways to disparities in educational outcomes. *American Psychologist*, 71(6), 455–473. <https://doi.org/10.1037/a0040322>

- Massey, D. S., Charles, C. Z., Lundy, G. F., & Fischer, M. J. (2003). *The source of the river: The social origins of freshmen at America's selective colleges and universities*. Princeton, NJ: Princeton University Press.
- Massey, D. S., & Probasco, L. (2010). Divergent streams: Race-gender achievement gaps at selective colleges and universities. *Du Bois Review: Social Science Research on Race*, 7(1), 219–246. <https://doi.org/10.1017/S1742058X10000160>
- Mayhew, M. J., Grunwald, H. E., & Dey, E. L. (2005). Curriculum matters: Creating a positive climate for diversity from the student perspective. *Research in Higher Education*, 46(4), 389–412. <https://doi.org/10.1007/s11162-005-2967-0>
- McClain, S., Beasley, S. T., Jones, B., Awosogba, O., Jackson, S., & Cokley, K. (2016). An examination of the impact of racial and ethnic identity, impostor feelings, and minority status stress on the mental health of black college students. *Journal of Multicultural Counseling and Development*, 44(2), 101–117. <https://doi.org/10.1002/jmcd.12040>
- McGee, E. (2018). “Black genius, Asian fail”: The detriment of stereotype lift and stereotype threat in high-achieving Asian and black STEM students. *AERA Open*, 4(4), 2332858418816658. <https://doi.org/10.1177/2332858418816658>
- McGee, E. O. (2020). Interrogating structural racism in STEM higher education. *Educational Researcher*, 49(9), 633–644. <https://doi.org/10.3102/0013189X20972718>
- McGee, E. O., Griffith, D. M., & Houston, S. L. (2019). “I know I have to work twice as hard and Hope that makes me good enough”: Exploring the stress and strain of black doctoral students in engineering and computing. *Teachers College Record*, 121(4), 1–38. <https://doi.org/10.1177/016146811912100407>
- Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. *Personality and Individual Differences*, 37(3), 591–606. <https://doi.org/10.1016/j.paid.2003.09.029>
- Muenks, K., Canning, E. A., LaCrosse, J., Green, D. J., Zirkel, S., Garcia, J. A., & Murphy, M. C. (2020). Does my professor think my ability can change? Students' perceptions of their STEM professors' mindset beliefs predict their psychological vulnerability, engagement, and performance in class. *Journal of Experimental Psychology: General*, 149, 2119–2144. <https://doi.org/10.1037/xge0000763>
- Murphy, M. C., Gopalan, M., Carter, E. R., Emerson, K. T. U., Bottoms, B. L., & Walton, G. M. (2020). A customized belonging intervention improves retention of socially disadvantaged students at a broad-access university. *Science Advances*, 6(29), eaba4677. <https://doi.org/10.1126/sciadv.aba4677>
- Murphy, M. C., Kroeper, K. M., & Ozier, E. M. (2018). Prejudiced places: How contexts shape inequality and how policy can change them. *Policy Insights from the Behavioral and Brain Sciences*, 5(1), 66–74. <https://doi.org/10.1177/2372732217748671>
- Murphy, M. C., Steele, C. M., & Gross, J. J. (2007). Signaling threat: How situational cues affect women in math, science, and engineering settings. *Psychological Science*, 18(10), 879–885. <https://doi.org/10.1111/j.1467-9280.2007.01995.x>
- Murphy, M. C., & Taylor, V. J. (2012). The role of situational cues in signaling and maintaining stereotype threat. In *Stereotype threat: Theory, process, and application* (pp. 17–33). New York, NY: Oxford University Press.
- National Science Board. (2014). *Science and engineering indicators 2014*. Arlington, VA: National Science Foundation.
- National Science Board, National Science Foundation. (2022). National Science Board, National Science Foundation. 2022. Higher Education in Science and Engineering. Science and Engineering Indicators 2022. NSB-2022-3. Alexandria, VA. Retrieved from <https://nces.nsf.gov/pubs/nsb20223/>
- Ong, A. D., Fuller-Rowell, T., & Burrow, A. L. (2009). Racial discrimination and the stress process. *Journal of Personality and Social Psychology*, 96(6), 1259–1271. <https://doi.org/10.1037/a0015335>
- Park, J. J., Kim, Y. K., Salazar, C., & Hayes, S. (2020). Student–faculty interaction and discrimination from faculty in STEM: The link with retention. *Research in Higher Education*, 61(3), 330–356. <https://doi.org/10.1007/s11162-019-09564-w>
- Pascoe, E. A., & Smart Richman, L. (2009). Perceived discrimination and health: A meta-analytic review. *Psychological Bulletin*, 135(4), 531–554. <https://doi.org/10.1037/a0016059>
- Perna, L. W. (2000). Differences in the decision to attend college among African Americans, Hispanics, and whites. *The Journal of Higher Education*, 71(2), 117. <https://doi.org/10.2307/2649245>
- Posselt, J. R., Jaquette, O., Bielby, R., & Bastedo, M. N. (2012). Access without equity: Longitudinal analyses of institutional stratification by race and ethnicity, 1972–2004. *American Educational Research Journal*, 49(6), 1074–1111. <https://doi.org/10.3102/0002831212439456>
- Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: Quantitative strategies for communicating indirect effects. *Psychological Methods*, 16(2), 93–115. <https://doi.org/10.1037/a0022658>
- Rainey, K., Dancy, M., Mickelson, R., Stearns, E., & Moller, S. (2018). Race and gender differences in how sense of belonging influences decisions to major in STEM. *International Journal of STEM Education*, 5(1), 10. <https://doi.org/10.1186/s40594-018-0115-6>
- Reardon, S. F., Baker, R., Kasman, M., Klasik, D., & Townsend, J. B. (2018). What levels of racial diversity can be achieved with socioeconomic-based affirmative action? Evidence from a simulation model. *Journal of Policy Analysis and Management*, 37(3), 630–657. <https://doi.org/10.1002/pam.22056>

- Rosenbloom, S. R., & Way, N. (2004). Experiences of discrimination among African American, Asian American, and Latino adolescents in an urban high school. *Youth & Society*, 35(4), 420–451. <https://doi.org/10.1177/0044118X03261479>
- Schneider, M., & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review of meta-analyses. *Psychological Bulletin*, 143(6), 565–600. <https://doi.org/10.1037/bul0000098>
- Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, 75(3), 417–453. <https://doi.org/10.3102/00346543075003417>
- Sosoo, E. E., Bernard, D. L., & Neblett, E. W., Jr. (2020). The influence of internalized racism on the relationship between discrimination and anxiety. *Cultural Diversity and Ethnic Minority Psychology*, 26(4), 570–580. <https://doi.org/10.1037/cdp0000320>
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52(6), 613–629. <https://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. <https://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, pp. 379–440). San Diego, CA: Academic Press, Inc. [https://doi.org/10.1016/S0065-2601\(02\)80009-0](https://doi.org/10.1016/S0065-2601(02)80009-0)
- Students for Fair Admissions, Inc. (2023). V. President and Fellows of Harvard College, No. 20-1199. (Supreme Court of the United States June 29, 2023).
- Thomas, O. N., Caldwell, C. H., Faison, N., & Jackson, J. S. (2009). Promoting academic achievement: The role of racial identity in buffering perceptions of teacher discrimination on academic achievement among African American and Caribbean black adolescents. *Journal of Educational Psychology*, 101(2), 420–431. <https://doi.org/10.1037/a0014578>
- Walton, G. M., & Brady, S. T. (2017). The many questions of belonging. In A. Elliot, C. Dweck, & D. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (2nd ed., pp. 272–293). New York, NY: Guilford Press.
- Walton, G. M., & Cohen, G. L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology*, 92(1), 82–96. <https://doi.org/10.1037/0022-3514.92.1.82>
- Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, 331(6023), 1447–1451. <https://doi.org/10.1126/science.1198364>
- Walton, G. M., Murphy, M. C., Logel, C., Yeager, D. S., Goyer, J. P., Brady, S. T., ... Krol, N. (2023). Where and with whom does a brief social-belonging intervention promote progress in college? *Science*, 380(6644), 499–505. <https://doi.org/10.1126/science.ade4420>
- Williams, D. R., & Mohammed, S. A. (2013). Racism and health I: Pathways and scientific evidence. *American Behavioral Scientist*, 57(8), 1152–1173. <https://doi.org/10.1177/0002764213487340>
- Zajacova, A., & Lawrence, E. M. (2018). The relationship between education and health: Reducing disparities through a contextual approach. *Annual Review of Public Health*, 39(1), 273–289. <https://doi.org/10.1146/annurev-publhealth-031816-044628>

## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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