Published in final edited form as:

Soc Psychol Personal Sci. 2016 March ; 7(2): 184–192. doi:10.1177/1948550615608401.

Diversifying Science: Intervention Programs Moderate the Effect of Stereotype Threat on Motivation and Career Choice

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Abstract

Stereotypes influence academic interests, performance, and ultimately career goals. The long-standing National Institutes of Health Research Initiative for Scientific Enhancement (RISE) training program has been shown to be effective at retaining underrepresented minorities in science. We argue that programs such as RISE may alter the experience and impact of stereotype threat on academic achievement goals and future engagement in a scientific career. We report analyses of a national sample comparing RISE students with a propensity score-matched control group over a 6-year period. Mediation analyses revealed that while RISE program membership did not buffer students from stereotype threat, it changed students' downstream responses and ultimately their academic outcomes. Nonprogram students were less likely than RISE students to persist in the sciences, partially because feelings of stereotype threat diminished their adoption of mastery goals. We discuss how these findings inform stereotype threat and goal orientation theories and provide insight into the success of intervention programs.

Keywords

achievement goals; diversity; longitudinal research; interventions; stereotype threat

The importance of diversifying the U.S. scientific research workforce is widely acknowledged, yet African Americans and Hispanic/Latinos or Latinas continue to be chronically underrepresented in research careers (National Institutes of Health, 2012; National Science Foundation, 2010). One oft-cited reason for this underrepresentation is prevalent negative racial stereotypes about aptitude for science-related endeavors. Negative stereotypes about one's group are a source of identity threat and have well-documented detrimental effects on performance across many stereotyped domains (e.g., Steele & Aronson, 1995; Steele, Spencer, & Aronson, 2002). Researchers typically measure the

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Portions of this article were presented at the 2014 meeting of the Society for Personality and Social Psychology in Austin, TX and the 2015 Understanding Interventions conference in San Diego, CA.

Declaration of Conflicting Interests: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Supplemental Material: The online supplemental materials are available at <http://spps.sagepub.com/supplemental>.

effects of a discrete stereotype-threatening episode, such as performance on a test after a reminder of negative performance stereotypes about the participant's group. One immediate consequence of a stereotype-threatening episode in academic contexts is the adoption of performance-avoidance goals (Brodish & Devine, 2009; Smith, 2006). Longitudinal research has shown that African American and Hispanic/Latino or Latina science majors experience stereotype threat that occurs much of the time and is pervasive across academic contexts. This experience of persistent and pervasive stereotype threat persists year after year and predicts underrepresented minorities' (URMs) disidentification with and attrition from the sciences (Woodcock, Hernandez, Estrada, & Schultz, 2012). We argue that disparities such as ethnic/racial underrepresentation in the scientific workforce are a consequence of contending with persistent and pervasive stereotype threat and the long-term impact of such threat on academic achievement goals.

Achievement goals affect how students frame and cope with academic challenges, and the effect of more persistent episodes of stereotype threat may differ from the immediate impact of a discrete stereotype-threatening episode. Understanding how achievement goals mediate the effects of stereotype threat across time may help in addressing issues of disparity. Here, we examine the impact of persistent and pervasive stereotype threat on URMs academic achievement goals and engagement in science across time in the context of a well-established intervention and training program—the National Institutes of Health's (NIH) Research Initiative for Scientific Enhancement (RISE) program.

Academic Achievement Goals

Academic achievement goals give purpose and direction to academic behaviors and are predictive of academic performance, field choice, and success (Harackiewicz, Barron, Tauer, & Elliot, 2002). We focus on three academic achievement goals: mastery goals, performance-approach goals, and performance-avoidance goals. *Mastery goals* reflect an individual's focus on developing personal competence and attaining mastery of material (as opposed to demonstrating competence relative to others; Ames, 1992; Dweck, 1986). Mastery goals positively predict task engagement, deep study strategies, persistence in the face of difficulty, and both short- and long-term interest in an academic domain (Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000; Harackiewicz et al., 2002; Hulleman, Schragar, Bodmann, & Harackiewicz, 2010). *Performance-approach goals* describe an individual's focus on demonstrating competence, especially in the presence of others (Covington, 2000). The academic outcomes of adopting performance-approach goals vary depending upon the focus of the goals. A competitive focus is predictive of positive academic performance, whereas a focus on demonstrating competence is a negative predictor (Hulleman et al., 2010). *Performance-avoidance goals* describe an individual's focus on avoiding the appearance of incompetence, especially in the presence of others (Covington, 2000), and predict negative academic outcomes, such as test anxiety and low academic self-efficacy, and maladaptive academic behaviors such as self-handicapping and shallow study strategies (Middleton & Midgley, 1997; Payne, Youngcourt, & Beaubien, 2007). Individuals can develop adaptive or maladaptive patterns of achievement goals (Dweck, 1986). Research with minority science students indicates that adopting mastery goals while eschewing performance-avoidance goals is optimal for cultivating long-term

academic success and persistence in science (Hernandez, Schultz, Estrada, Woodcock, & Chance, 2013).

Stereotype Threat and Achievement Goals

Achievement goal theory provides a framework for understanding the cognitive and motivational consequences of stereotype threat (Ryan & Ryan, 2005). Evidence from experiments with women and math links discrete episodes of experimentally induced stereotype threat to the immediate adoption of performance-avoidance goals. Smith (2006) showed that under stereotype-threatening conditions, women's mathematics performance expectations were significantly lower than men's, and this effect was partially mediated by women's adoption of performance-avoidance goals. Brodick and Devine (2009) found that inducing stereotype threat significantly increased women's performance-avoidance goals, which partially mediated the impact of stereotype threat on mathematics task performance.

Threats to the self trigger protective defenses (Cohen & Sherman, 2014), and cross-sectional data suggest that discrete stereotype-threatening events in academic contexts induce a prevention focus—the adoption of performance-avoidance goals. However, minority science students experience pervasive and persistent stereotype threat that endures across time (Woodcock et al., 2012). Activating performance-avoidance goals to avoid looking bad to others may be a situationally adaptive defensive response to a discrete episode of stereotype threat, but more chronic experiences of stereotype threat may promote a different defensive strategy. In addition to activating the need to avoid looking bad to others, persistent and pervasive stereotype threat may create a defensive state that impedes students' adoption of mastery goals. Learning for the sake of learning requires tolerance for the vulnerability that making and overcoming mistakes entails. Students contending with the pressure of pervasive and persistent self-threats may face diminished psychological capacity for such vulnerability. This process may not be fully captured in cross-sectional research, so it is important to measure more generalized feelings of stereotype threat and their downstream outcomes as they unfold across time.

We test the impact of pervasive and persistent stereotype threat on achievement goals, intention to persist, and active engagement in a stereotyped domain across 6 years. We hypothesize that feelings of pervasive and persistent stereotype threat in college will lead to a pattern of maladaptive achievement goals (specifically increasing performance-avoidance goals and thwarting mastery goals), which, in turn, will have a negative impact on intentions to pursue a scientific research career and future engagement in a scientific career.

Intervention and Training Programs

There are many programs with the explicit goal of increasing the number of URM students completing doctoral degrees and taking positions as scientific researchers in the United States. The focus of this research is the NIH's RISE program that has been implemented on many campuses across the United States and Puerto Rico since 1972. RISE programs are designed to “strengthen students' academic preparation, research training and professional skills” (<http://www.nigms.nih.gov/training/RISE/Pages/default.aspx>). RISE programs

typically receive funds to support about 25 undergraduates and five master's-level URM students at minority serving institutions and typically offer faculty mentorship, on-campus research, graduate school preparation, summer research internships, funding to attend professional conferences, and stipends. There is mounting evidence that these programs help sustain the scientific career interests of URM students (Schultz et al., 2011; Maton, Pollard, McDougall Weise, & Hrabowski, 2012) and are effective, in part, by having a positive impact on scientific self-efficacy, science identity, and belonging in the scientific community (e.g., Estrada, Woodcock, Hernandez, & Schultz, 2011; Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011; Maton et al., 2012). However, little is known about the long-term impact of these programs on retaining URM science students on the scientific career pathway or their impact on stereotype threat and its downstream consequences. Programs such as RISE are not designed specifically to reduce the experience of stereotype threat for their students. However, evidence of these programs' positive impact on URM's science identity and feelings of belonging in the sciences suggests that programs might create a context that could alter students' experience of stereotype threat. Programs such as RISE may create a positive "microclimate" that either shields URM students from the experience of stereotype threat or acts as a buffer between the experience of threat and maladaptive responses.

We compare a sample of RISE students and a matched comparison group of students who were never supported by a minority intervention program. We hypothesize that RISE students will be significantly more likely to persist in the sciences than those students who were never in an undergraduate intervention program. We further hypothesize that the difference in persistence between RISE and the control group students will be due, in part, to differential experiences of, and defensive reactions to, stereotype threat. Specifically, that URM students never supported by an intervention program will adopt higher performance-avoidance goals and lower mastery goals than RISE students as a consequence of stereotype threat, and this will predict abandoning the pursuit of a scientific career.

Method

Participants

A sample of 424 participants was drawn from a larger research project—*The Science Study* an ongoing, longitudinal study of high-achieving URM science students with a declared interest in pursuing a scientific research career, recruited from 50 U.S. colleges. *The Science Study* project was designed to test the long-term impact of science minority training programs with a focus on the NIH RISE program. *The Science Study* began in 2005 (baseline) and has followed 1,420 minority science students who were enrolled in science training programs such as RISE and a propensity score-matched control group of no-program students across time (see Schultz et al., 2011, for details). Here, we report data from students' junior (Time 1) and senior (Time 2) years in college, and fifth-year senior/1 year post-college (Time 3), and 4.5 years post-baccalaureate¹ (Time 4). We restricted the sample to: (a) undergraduate students ($n = 1,236$), (b) Black/African American and Hispanic/Latino or Latina students ($n = 1,046$), and (c) students who were ever enrolled in a

¹This is consistent with the national-level percentage of female students in RISE programs.

RISE program as undergraduates or who never participated in any minority training program as undergraduates ($n = 697$). Students who were enrolled in other undergraduate programs were omitted. Finally, the sample was restricted to propensity score-matched RISE and unfunded students ($n = 424$, see Online Supplemental Materials for details of matching).

At baseline, the sample consisted of 15.1% first-year students 21.7% sophomores, 32.1% juniors, and 31.1% seniors, with an average age of 21 years (standard deviation = 2.63). Their majors were 66.3% biological sciences, 21% natural sciences, 8.3% social/behavioral sciences, and 4.4% engineering, computer sciences, or mathematics. Seventy-three percent of the sample were female.² Fifty-nine percent were African American. At Time 4, the mean age of the sample was 26 years, and 86% reported completing their baccalaureate degree.

Design and Procedure

This research is a propensity score-matched, quasi-experimental, prospective, longitudinal study. Participants completed baseline measures in 2005 and have completed online surveys twice per year concerning their educational/career status and aspirations, academic performance, and a number of psychological measures, including their perceived level of stereotype threat and achievement goal orientations. Survey response rates range from 68% to 84% (Estrada, Woodcock, & Schultz, 2014). We collected data for all variables at each point in time (see Online Supplemental Materials for treatment of missing data).

Propensity score matching—Random assignment to condition is the gold standard for making causal claims, but quasi-experimental designs are often used in cases where random assignment is unfeasible. Selection bias can occur however, as assignment to the treatment group is often correlated with attributes related to the outcomes of interest (Rosenbaum & Rubin, 1983; Rubin & Thomas, 1996). To estimate causal effects in this study, we used a propensity score-matching procedure to correct for selection bias when creating the matched control group (West et al., 2008; see Online Supplemental Materials for details). Independent samples t -tests and χ^2 tests revealed no statistically significant differences across the RISE and no-program control groups in students' age, sex, race/ethnicity, baseline grade point average, year in school, major, intention to pursue a science-related research career, or propensity score.

Measures

RISE program membership—Students enrolled in a RISE program as undergraduates were assigned to the RISE group, while students who reported no participation in any undergraduate intervention or training program were assigned to the no-program control group ($control = 0$, $RISE = 1$).

Stereotype threat—We used the 8-item Stereotype Vulnerability Scale (Spencer, 1994), modified to reflect the perceived judgments of others on the basis of ethnicity. Relating the questions to their “experiences at college,” participants used the stem phrase “How often do you feel that because of your ethnicity ...,” and responded to each item (e.g., “Some people

²Median year post-baccalaureate = 4.5 (range: 1.5–5.5 years)

believe that you have less ability,” “You are not fully accepted or included by your program,” and “Professors expect you to do poorly”) on a 5-point scale, ranging from 1 (*never*) to 5 (*almost always*). The scale items capture the pervasiveness of the stereotype threat across academic contexts, and the anchors capture the persistence of the threat. We averaged the items to create a scale score. See Table 1 for measures of internal consistency and descriptives for all scales and Table 2 for bivariate correlations by group.

Academic achievement goal orientations—We used the mastery goal orientation and ability approach and avoid subscales of the Patterns of Adaptive Learning Survey (Midgley et al., 1998). Short forms of the scales were used due to evidence of their measurement invariance across race/ethnicity (Hernandez et al., 2013; Midgley et al., 1998). All goal orientation items were answered on a 5-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The mastery goal orientation scale included five statements regarding students' motivation to develop abilities and skills (e.g., “I like school work that I'll learn from, even if I make a lot of mistakes”). The performance-approach goal orientation scale included four statements regarding students' motivation to compete against and to demonstrate abilities relative to their peers (e.g., “I would feel really great if I were the only one who could answer the teacher's questions in class”). The performance-avoidance goal orientation scale included four statements regarding students' motivation to avoid demonstrating a lack of abilities and skills (e.g., “The reason I do my school work is so that others won't think I'm dumb”). Subscale items were averaged.

Intention to pursue a scientific research career—Our proximal outcome measure was students' intention to pursue a science-related research career. We averaged scores on two questions: “To what extent do you intend to pursue a science-related research career?” and “How likely is it that you will attend graduate school?” answered on a scale of 0 (*definitely will not*) to 10 (*definitely will*).

Scientific career engagement—The more distal behavioral outcome measure, engagement in a scientific career, was measured using participants' self-reported data regarding current employment or enrollment in a graduate program (coded 0 = *nonscience*, 1 = *science*). RISE program outcomes specifically focus on research careers in the biomedical sciences; therefore, nonresearch medical careers and enrollment in medical school were coded as nonscience for these analyses.

Results

RISE Effect

Having established baseline equivalence across groups, we tested the RISE effect on scientific career engagement by comparing the proportion of RISE (50.4% of 139 responses) and no-program control group participants (36.8% of 125 responses) who reported being engaged in a scientific career (or graduate program) at Time 4 (4.5 years post-baccalaureate graduation). The test revealed that RISE status was significantly related to career choice, $\chi^2(1, n = 264) = 4.91, p = .03$, *Cramer's V* = .14, odds ratio (OR) = 1.74. Thus, former RISE

program students were 1.74 times more likely to be engaged in, or training for, a scientific career than students from the matched no-program control group.³

Longitudinal Mediation

Prior to testing for longitudinal mediation, we compared the RISE and no-program control groups at Time 1. Independent samples *t*-tests revealed no statistically significant differences in stereotype threat, intention to pursue a scientific research career, or the tendency to adopt mastery, performance-avoidance, or performance-approach goals between groups. Stereotype threat was strongly correlated across Times 1–3 ($r_s = .50-.69$), and the correlations were not moderated by group ($z_s > 0.07-1.11$; $p_s \geq .20$; see Online Supplemental Materials). The only between-group differences of note were: the remaining RISE students enrolled for a fifth year reported higher mean levels of stereotype threat than the no-program control group students ($M_{\text{difference}} = 0.33$, $p < .05$), and the RISE students reported lower mean levels of performance-approach goal orientations than the no-program control group students in their senior year ($M_{\text{difference}} = 0.31$, $p < .01$).

We assessed the impact of the RISE program on the relationship between pervasive and persistent stereotype threat, achievement goals, and engagement in science across time using a series of nested multiple-groups (RISE, no-program control group) structural equation models (SEMs; see Figure 1). First, we were interested in the impact of stereotype threat on achievement goals for the no-program control group students as their experience can be generalized to URMs in negatively stereotyped domains broadly. Second, we were interested in the impact of participation in a program such as RISE on this process. We hypothesized that the RISE program would alter patterns of achievement goal orientations in response to pervasive and persistent threat. Specifically, we expected that stereotype threat (Time 1) would exhibit a statistically significant effect on mastery goals and performance-avoidance goals (Time 2) for those in the no-program control group, controlling for prior goals. However, we expected that the path from stereotype threat to mastery goals and performance-avoidance goals would be nonsignificant for those in the RISE program. Further, we expected that achievement goal orientations would influence intentions to pursue a scientific research career and ultimately scientific career engagement.

Single-groups model—To assess the overall fit, we first estimated the SEMs depicted in Figure 1 separately in the no-program control and RISE groups using maximum likelihood (ML) estimation in *Mplus* version 7.11 (Muthén & Muthén, 1998/2012). In addition to the model χ^2 test, we used the comparative fit index (CFI = 0.95) and the root mean square error of approximation (RMSEA = .05 or RMSEA 90% confidence interval [CI] that included .05 but did not exceed .10) to evaluate model fit as per Hu and Bentler (1999). The model provided excellent fit to the data for both groups, no-program: $\chi^2(df=17) = 9.98$, $p = .90$; CFI = 1.00; RMSEA = .00, 90% CI [0.00, 0.03]; RISE: $\chi^2(df=17) = 19.86$, $p = .28$; CFI = 0.99; RMSEA = .03, 90% CI [0.00, 0.07]. The path coefficients from the no-program control and RISE groups revealed that the effects of performance-approach goals on intentions and

³Additional analyses combining engagement in science and medical training indicate no differences across groups (see Online Supplemental Materials).

the effects of all achievement goals on scientific career engagement might also differ across groups (i.e., paths β_{10j} , OR_{14j} , OR_{15j} , and OR_{16j} in Figure 1).

Multiple-groups models—Having established good model fit, we tested the hypothesized pattern of effects using a multiple-groups SEM framework with ML estimation (i.e., a two-class mixture model using the known classes: no-program control = 0 and RISE = 1). We conducted a series of three nested SEMs and used a likelihood ratio difference test (χ^2) to evaluate relative model fit. Model 1 allowed all paths to be freely estimated. Model 2 constrained all paths to be equal across groups, with the exception of hypothesized paths and paths identified as potentially different across groups. Model 3 sequentially constrained each hypothesized or potentially different path to be equal across groups to test for significantly worsened model fit. The final model revealed that constraining paths from stereotype threat to mastery goals (β_{1j}), from performance-approach goals to intentions (β_{10j}), and from performance-avoidance goals to science career engagement (OR_{16j}) to be equal across the no-program control and RISE groups significantly worsened model fit, $\chi^2(df=1) = 8.84, p = .003$; $\chi^2(df=1) = 5.01, p = .03$; $\chi^2(df=1) = 4.00, p = .045$, respectively. All other paths were constrained to be equal across groups.

The final model standardized (i.e., β s) and OR coefficients revealed two key differences in the effect of stereotype threat across groups. First, stereotype threat exhibited a moderate negative effect on mastery goals (Time 2) in the no-program control group ($\beta_{1C} = -.30$), controlling for prior mastery goals, but there was no effect of stereotype threat on mastery goals in the RISE group ($\beta_{1R} = .02$). To investigate the potential indirect effects of stereotype threat on intentions and scientific career engagement, we examined the downstream links between goals and these outcomes. For both groups, mastery goals (Time 2) exhibited a small positive effect on intentions (Time 3, $\beta_9 = .20$), controlling for Time 1 intentions. Furthermore, intentions (Time 3) exhibited a small positive effect on scientific career engagement (Time 4, $OR_{13} = 1.27$; i.e. a one-unit change in intentions predicted a 1.27 increase in the odds of being engaged in a scientific career). We used a bootstrapping procedure (with 5,000 repetitions) to test the statistical significance of the longitudinal indirect effect of stereotype threat on intentions and on scientific career engagement (MacKinnon, Fairchild, & Fritz, 2007; Shrout & Bolger, 2002). The results indicated that stereotype threat exhibited a significant negative indirect effect on intention to pursue a scientific research career through mastery goals for the no-program control group ($a\beta_{1C} \times b_{\beta_9}$: $\beta = -.06, b = -0.20$, bias-corrected 95% CI $[-0.41, -0.08]$). Furthermore, stereotype threat exhibited a significant negative indirect effect on scientific career engagement through both mastery goals and intentions for the no-program control group ($a\beta_{1C} \times b_{\beta_9} \times b_{OR_{13}}$: $b = -0.05$, bias-corrected 95% CI $[-0.13, -0.02]$). Stereotype threat exhibited neither direct nor indirect effects on intentions or career engagement for the RISE group.

A second key difference across groups concerned performance-avoidance goals. As shown in Figure 1, stereotype threat exhibited a consistent small positive effect on performance-avoidance goals across groups. Counter to our expectations, performance-avoidance goals exhibited a small positive effect on scientific career engagement in the no-program control group. As described above, we tested the longitudinal mediation hypothesis via a bootstrapping procedure. The results indicated that stereotype threat exhibited a significant

positive indirect effect on intention to pursue a scientific career engagement through performance-avoidance goals for the no-program control group ($a\beta_3 \times b_{OR16C}$: $b = 0.09$, bias-corrected 95% CI [0.01, 0.26]). Mediation analysis was not warranted for the RISE group, as performance-avoidance goals were not predictive of scientific engagement in that group.

Discussion

African American and Hispanic/Latino or Latina science majors in the United States can experience persistent and pervasive stereotype threat in academic environments. This study measured the longitudinal impact of experiencing such threat on students' academic achievement goal orientations in the context of a well-established intervention program (NIH's RISE program). Research has demonstrated a positive impact of programs such as RISE on proximal outcomes such as doctoral program enrollment and intentions to pursue a scientific career, but assessments of longer-term outcomes have been elusive (e.g., National Research Council Committee for the Assessment of NIH Minority Research Training Programs, 2005). Our findings quantify the impact of RISE on post-baccalaureate engagement in a scientific career and offer a partial explanation—a change in defensive responses to stereotype threat.

We found that RISE students were significantly more likely than students who had never participated in an undergraduate program to be engaged in the pursuit of a scientific career 4.5 years post-graduation. The RISE effect was partially explained by differences in achievement goals adopted by the RISE and no-program students in response to persistent and pervasive stereotype threat. Students in both groups reported moderate levels of stereotype threat and, consistent with research on discrete episodes of stereotype threat (e.g., Brodish & Devine, 2009; Smith, 2006), adopted performance-avoidance goals as a consequence. In contrast with existing research, however, the effect of stereotype threat for the students who had never participated in an undergraduate intervention program was driven by a substantial decrease in mastery goal adoption. Mastery goals mediated the impact of stereotype threat on these students' downstream scientific career intentions and engagement. Stereotype threat exhibited neither direct nor indirect effects on scientific career engagement or intentions for RISE students.

These results suggest that the longitudinal impact of stereotype threat and achievement goal orientations are sensitive to context and that programs such as RISE may confer benefits beyond supplemental scientific training and mentorship. Programs dedicated to increasing the persistence of URM science students may be creating a context that while not shielding students from experiencing stereotype threat in the broader educational environment alters their defensive reactions to that threat. One possibility is that by focusing on research skills and learning in preparation for a scientific career, programs such as RISE foster a context that supports mastery goals (e.g., Smeding, Darnon, Souchal, Toczek-Capelle, & Butera, 2013). An unexpected finding of this study was the positive impact of senior year performance-avoidance goals on post-baccalaureate scientific career engagement for no-program students. This finding is inconsistent with the notion of performance-avoidance goals being universally maladaptive in academic contexts. This effect may be consistent,

however, with the interpretation of negative stereotype threat effects being the result of regulatory mismatch between the self-regulatory state of the individual (i.e., gain promotion vs loss prevention) and the reward structure (i.e., gain vs loss structure) afforded by the task (Grimm, Markman, Maddox, & Baldwin, 2009). From this perspective, individuals from a negatively stereotyped group (loss prevention focus) should perform poorly on a gains-focused task, but perform well when focused on mitigating loss, due to a regulatory “fit” or match between the negative stereotype and the individual's regulatory focus. This suggests that there may be some element of engagement in a scientific career that is aligned with an avoidance motivation for African American and Hispanic/Latino or Latina science majors.

Our findings illustrate the mediational role of achievement goals for the success of the RISE program, and raise further questions about how programs such as RISE foster mastery achievement goals in the face of persistent stereotype threat. Given the powerful impact of self-affirmation on ameliorating the negative effects of stereotype threat (e.g., Cohen, Garcia, Apfel, & Master, 2006; Cohen & Sherman, 2014), it is plausible that program membership is self-affirming to URM students. Many programs only support students from underrepresented groups, and students typically meet regularly, attend events together, and listen to research presentations from successful URM scientists—often former program students themselves. This may create opportunities for affirming common values (both educational and other) that URM students who are not part of a structured program may not get. Contact with successful URM peers and experts may also build resilience against the effects of stereotype threat by decreasing self-doubt and increasing feelings of belonging in science. This is consistent with Dasgupta's stereotype inoculation model that speaks to the importance of in-group role models for traditionally underrepresented students early in their academic careers and at critical points of transition (Dasgupta, 2011).

Another potential explanation for the observed effects is that RISE program membership bolsters both scientific and ethnic/racial identity, and promotes feelings of integration between them. Individuals who can successfully manage multiple, often competing, social identities and see them as compatible have been shown to have better outcomes and greater feelings of belonging in stereotyped domains (e.g., Darling, Molina, Sanders, Lee, & Zhao, 2008). From this perspective, RISE may foster greater integration between students' scientific and ethnic/racial identities, which allows for the adoption of mastery goals. Further research is needed to answer this question and potentially inform programs of even more effective practice.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors wish to thank Karen Rambo-Hernandez, Caleb Fitzpatrick, Dawn Formo, Sara Bufferd, Kimberly D'Anna-Hernandez, Rong-Ji Chen, and Eliza Bigham for their helpful comments.

Funding: The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This manuscript was supported by NIGMS grant R01-GM075316 awarded to the third author.

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Biographies

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Paul R. Hernandez, PhD, is an Assistant Professor of Educational Psychology in the Department of Learning Sciences and Human Development at West Virginia University, USA. His research focuses on psychological factors that promote academic/career success (particularly among underrepresented groups in science) and on the design, measurement, and evaluation of interventions aimed at broadening participation in science.

P. Wesley Schultz is Professor of Psychology at California State University San Marcos. His research involves the application of social psychological principles to understand and solve social problems, with a particular focus on programs aimed at encouraging students from underrepresented groups to pursue careers in science.

Figure 1.

Longitudinal mediation: Multiple-groups model 3. *Note.* Different coefficient values are only presented where a nested model comparison revealed that constraining the paths to be equal across groups significantly worsened model fit. β s represent standardized path coefficients, and ORs represent the odds ratio coefficients. The coefficients for the RISE group are denoted with subscript *R*, and the coefficients for the no-program control group are denoted with subscript *C*. The auxiliary variable (year in school) and all covariances are not depicted for the sake of simplicity. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 1

Descriptive Statistics of Variables by Group.

Variable	RISE (<i>n</i> = 218)			No-Program Control (<i>n</i> = 218)			<i>p</i>
	<i>M</i>	<i>SD</i>	<i>α</i>	<i>M</i>	<i>SD</i>	<i>α</i>	
1. Intention (jnr. year)	8.09	1.85	.74	7.81	1.91	.60	.28
2. Stereotype threat (jnr. year)	2.30	0.92	.88	2.24	0.83	.91	.66
3. Mastery goals (jnr. year)	4.26	0.66	.87	4.25	0.66	.89	.22
4. Performance-approach goals (jnr. year)	3.39	1.09	.90	3.42	1.03	.89	.39
5. Performance-avoidance goals (jnr. year)	2.51	1.02	.82	2.39	1.06	.89	.98
6. Mastery goals (snr. year)	4.23	0.63	.91	4.21	0.74	.90	.31
7. Performance-approach goals (snr. year)	3.15	1.06	.86	3.35	1.02	.85	.004
8. Performance-avoidance goals (snr. year)	2.51	1.12	.90	2.57	1.13	.89	.76
9. Intention to pursue a scientific career (fifth year/1 year post-graduation)	7.17	2.81	.81	7.03	2.44	.75	.67
10. Scientific career engagement (4.5 years post-baccalaureate)	0.51	0.51	—	0.34	0.49	—	—

Note. RISE = Research Initiative for Scientific Enhancement; jnr. year = junior year; snr. year = senior year; *SD* = standard deviation.

Table 2
Descriptive Statistics and Correlations Among the Variables for the No-Program Control and the RISE Groups.

Variables	1	2	3	4	5	6	7	8	9	10
1. Intention (jnr. year)	—	.04	.41***	-.03	-.03	.22*	-.02	-.10	.41***	.24*
2. Stereotype threat (jnr. year)	-.19	—	.05	.07	.24*	.04	.05	.33***	-.04	-.03
3. Mastery goals (jnr. year)	.07	-.25*	—	-.03	-.15	.59***	-.02	-.10	.31***	.16
4. Performance-approach goals (jnr. year)	.14	-.10	-.05	—	.37***	-.11	.72***	.32***	-.03	-.26*
5. Performance-avoidance goals (jnr. year)	-.03	.12	-.28**	.35***	—	-.14	.39***	.61***	-.07	-.15
6. Mastery goals (snr. year)	.09	-.40***	.67***	.03	-.18	—	.07	-.02	.31***	.30**
7. Performance-approach goals (snr. year)	.06	.00	-.09	.75***	.31**	.03	—	.50***	.06	-.09
8. Performance-avoidance goals (snr. year)	.03	.15	-.26*	.26**	.61***	-.18*	.30***	—	-.03	-.13
9. Intention to pursue a scientific career (fifth year/1 year post-graduation)	.40***	-.19	.22*	-.11	-.14	.24**	-.15	-.13	—	.28***
10. Scientific career engagement (4.5 years post-baccalaureate)	.31**	-.07	-.01	-.09	.14	.02	-.16	.15	.29***	—

Note. RISE = Research Initiative for Scientific Enhancement; jnr. year = junior year. snr. year = senior year. RISE group values are shown above the diagonal and values below the diagonal are for the no-program control group.

* p .05.

** p .01.

*** p .001.