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Feeling the Threat: Stereotype Threat as a Contextual Barrier to Women's Science Career Choice Intentions

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Abstract

Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994, 2000) holds that contextual barriers inhibit self-efficacy and goal choice intentions from points both near and far from the active career development situation. The current study examined the influence of one such proximal barrier, stereotype threat, on attainment of these outcomes among women considering careers in science. Participants were female undergraduate students ($N = 439$) enrolled in chemistry and physics laboratory classes. As predicted, results indicated that stereotype threat exerted a significant negative indirect effect on women's science career choice intentions in physics but not chemistry. Single-pathway models positing a chain of effects of stereotype threat via science self-efficacy and intentions to pursue undergraduate research were also shown to fit the data better than multiple-pathway models in

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both physics and chemistry. Implications for the career development of women in science, technology, engineering, and mathematics (STEM) are discussed.

Keywords
social cognitive career theory, stereotype threat, women in STEM, science self-efficacy

Although women have been awarded 58% of the bachelor's degrees in the United States since 2002, they remain underrepresented at more advanced levels in science, technology, engineering, and mathematics (STEM; National Science Foundation, 2010). This problem is particularly glaring in physics. A recent report by the National Science Foundation (2011) indicated that women received only 20.3% of the bachelor's degrees and 18.6% of the PhD degrees in physics in 2008. In chemistry, the issue is less problematic but concerning nonetheless, as the same report indicated that women earned roughly one half (49.95%) of the bachelor's degrees but only 36.1% of the doctoral degrees. By comparison, women received 59.8% of the bachelor's degrees and 50.6% of the doctoral degrees in biology in 2008. The problem extends into the workplace as well: Employment studies indicate higher attrition rates among women in STEM fields when compared to both male counterparts and women counterparts in other fields (Simard, Henderson, Gilmartin, Schiebinger, & Whitney, 2008).

Both individual factors and contextual factors have been proposed as to why women either do not initiate pursuit of STEM careers or opt out of such careers prematurely. Our focus in the present study was on the latter, but at the proximal level of analysis, aiming to investigate the role that contextual factors play in impeding women's movement toward adopting adaptive science-related self-efficacy beliefs and career choice behaviors. Social cognitive career theory (SCCT; Lent, Brown, & Hackett, 1994) was used as the framework from which to empirically examine this process.

Contextual Barriers and SCCT

SCCT posits that efficacy beliefs play an important role in determining individuals' career-related interests and choices. Specifically, Lent et al. (1994) maintain that vocational self-efficacy exerts direct and mediated effects on career decision making through interest and career outcome expectations. Self-efficacy can thus be thought of as the centerpiece of SCCT because it transmits the effects of person inputs, contextual variables, and learning experiences to individual career-related cognition (e.g., goals) and behavior. Past research has yielded a consistent pattern of results to suggest that self-efficacy is a positive predictor of outcomes such as goal commitment (e.g., Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010), vocational personality type (e.g., Turner & Lapan, 2002), academic achievement (e.g., Hackett & Betz, 1989), and goal progress (e.g., Lent, Singley, Sheu, Schmidt, & Schmidt, 2007).

However, Lent, Brown, & Hackett (2000) pointed out that while person inputs are important variables in the SCCT framework, contextual factors play a similarly important role in shaping career development behavior but receive far less empirical attention. To address this issue, Lent et al. called for more comprehensive study of the construct. They identified two types of contextual influences: (a) *affordances*, which are factors that promote optimal career decision making and behavior and (b) *barriers*, which are factors that serve to inhibit career development processes. Moreover, these factors can exert their influence at either the distal or proximal level of effect. Lent et al. described distal influences as those that are instrumental in determining the learning experiences that ultimately affect self-efficacy and outcome expectations, whereas proximal influences exert their effects during active phases of career development and are also believed to moderate interest–goal and goal–behavior relationships.

Data suggest that contextual barriers map onto career-related outcomes in theoretically expected ways. A number of studies have shown that contextual barriers are more salient among individuals who have historically struggled against marginalization in the achievement environment, including women (Fouad et al., 2010; Luzzo & McWhirter, 2001) and persons of color (e.g., Kenny, Blustein, Chaves, Grossman, & Gallagher, 2003). Several of these studies have been conducted specifically in the area of STEM career development. Lent and his research group, in particular, have contributed considerably to the body of knowledge on this topic. For instance, they have reported significant mediation effects whereby self-efficacy transmitted negative indirect effects of contextual barriers to engineering goals (Lent et al., 2003) and math interest (Lent et al., 2001) in samples of college students. Their group (Lent et al., 2005) has also shown that contextual barriers exert direct negative effects on undergraduate students' major choice goals. A key issue that has yet to be addressed, however, is the influence of contextual barriers at the proximal level of effect. Previous SCCT research has examined the effects of distal contextual barriers, such as pressure from parents (see, e.g., Lent et al., 2003) and institutional sexism (e.g., McWhirter, 1997). While important constructs to be sure, very little research has focused on barriers within the achievement environment where important career-related attitudes can be formed or reactivated (see Fouad et al., 2010, for an exception). We propose an analysis of a particular type of contextual barrier, stereotype threat (Steele, 1997; Steele & Aronson, 1995), as potentially facilitating the type of proximal aversive effects theorized by Lent et al. (2000).

Stereotype Threat

Stereotype threat has been a construct of interest to researchers in helping to understand this gender imbalance. When a gender stereotype is "in the air" it is said to result in stereotype threat, the concern that is experienced when stigmatized individuals perceive themselves to be at risk of confirming a negative stereotype about their group (Steele, 1997; Steele & Aronson, 1995). Even if women do not endorse the stereotype, they may still feel at risk of confirming it. Indeed, gender stereotypes seem to work against those who care most about achievement and success (Pronin, Steele, & Ross, 2004; Smith, Sansone, & White, 2007), as well as women who identify most strongly with their gender (Kaiser & Hagiwara, 2011). Stereotype threat has been shown to produce numerous negative consequences, ranging from poor performance on standardized tests (see Schmader, Johns, & Forbes, 2008 for a review) to identity conflict (Pronin et al., 2004) and disengagement of one's identity from the stereotyped domain (Stout, Dasgupta, Hunsinger, & McManus, 2011).

Stereotype threat is sometimes difficult to measure because its manifestation depends on a complex interplay between cues in the immediate environment and the relevance of the stereotype to the domain in question. According to this contingency, threats can remain dormant even in relevant achievement situations (e.g., women completing a math test) if situational cues are not present to activate them (Wout, Shih, Jackson, & Sellers, 2009). However, research suggests that specific stereotypes pertaining to women in STEM need not be made explicit by men (Logel et al., 2009), nor must they be made explicit in a stereotype-related situation (Smith & White, 2002) to negatively influence women's performance and experiences. Instead, simply being in a setting that is male-dominated and/or known to relate to gender stereotypes is enough to undermine women's performance and motivation. Researchers have addressed this issue by manipulating gender ratios in experimental studies. For instance, Inzlicht and Ben-Zeev (2000) have shown that simply being outnumbered by men in an intellectual performance setting can heighten women's awareness of their minority status within the overall group, thereby contributing to the activation of negative stereotypes about their abilities. However, much of the research in this area involves the analysis of experimental rather than observed data obtained in natural academic settings. The current research aims to complement experimental work in this area by examining women's perceptions of these social psychological factors.

Study Overview

The goal of the current project was to examine the influence of a proximal contextual barrier, stereotype threat, as a predictor of STEM career outcomes for women within the SCCT framework. The subtlety with which such stereotypes can be activated suggests that stereotype threat exerts indirect effects on decisions to ultimately pursue careers in science. College students often do not make decisions to pursue a particular career until they have been sufficiently exposed in the classroom to many of the tasks that are typical of that career. In science, the ideal setting in which this career decision-making process takes place is the laboratory course because it is emblematic of an actual work environment. Therefore, women who develop

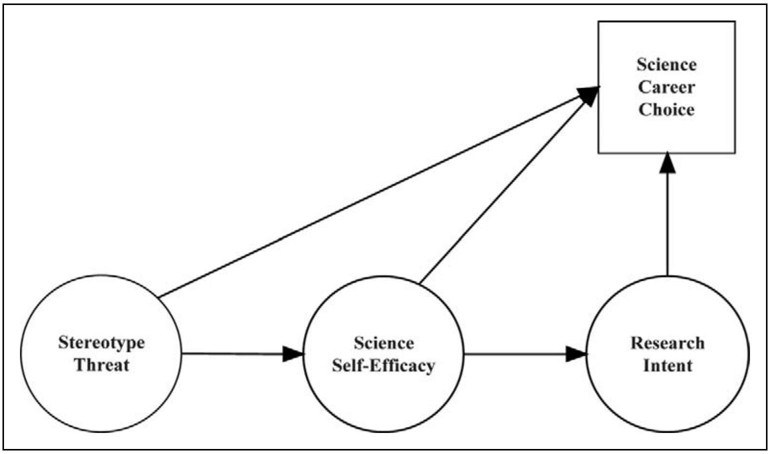

Figure 1. Alternative multiple effects model.

unfavorable impressions of science as a result of ego-threatening interactions with men should be less likely to participate in undergraduate research. We use the term *science career choice* (SCC) to broadly refer to two types of career choice intentions, one occurring nearer (proximal) women's academic experience and the other having long-term science career implications (distal). Referred to as *research intent* (RI) in the present study, the proximal SCC outcome is an important index because women who participate in undergraduate research are more inclined to demonstrate long-term persistence in STEM (Espinosa, 2011). In turn, and in line with SCCT predictions, women who do not intend to engage in undergraduate research should also be less likely to pursue a career in science. Thus, stereotype threat effects should be transmitted to science career intent (SCI) by first inhibiting efficacy percepts and undermining RI.

Three hypotheses were proposed, two of which posited within-science differences in model fit and one which posited a between-science difference in the indirect effect of stereotype threat. The first of the within-science hypotheses stated that, for women in chemistry, a model in which stereotype threat predicts SCI through one path mediated by science self-efficacy (SSE) and RI (hereafter referred to as the indirect effect model) would offer significant improvement in fit over one in which stereotype threat predicts SCI both directly and indirectly through RI (hereafter referred to as the multiple effects model; see Figure 1). Our second within-science hypothesis stated that for women in physics the indirect effect model would offer significantly better fit than the multiple effects model. The between-science hypothesis posited that because (a) physics is a more gender-stereotyped domain than chemistry and (b) gender stereotypes are rather covertly expressed in actual achievement settings and therefore not very robust in effect, the indirect effect model would be significant in the physics group but not in the chemistry group.

Method

Participants

The sample consisted of 457 female undergraduate students at universities in the northwest, southeast, and southwest United States. A total of 18 cases were removed from the sample because 6 participants identified as graduate students and 12 participants provided incomplete data, resulting in a final *N* of 439 (256 in chemistry and 183 in physics). Age ranged from 18 to 39 ($M = 20.32$, $SD = 2.27$). Reported ethnicities were as follows: 63.7% White/Anglo American, 16.4% Asian/Asian American, 7.3% African/African American, 7.3% Latino/Hispanic, 3.0% multiracial, 1.1% identified as other, 0.7% identified as Arabic/Arab American, and 0.5% identified as Native American. In terms of academic rank, most participants reported being sophomores (35.3%), followed by juniors (24.9%), seniors (22.6%), and freshmen (15.7%). A small proportion of students (1.6%) indicated they were not enrolled in an academic degree program.

Measures

Stereotype Threat. Stereotype threat was measured using adapted versions of 3 of the 4 items used by Marx and Goff (2005). The items were originally developed to measure experimentally manipulated racial stereotype threat (e.g., "I worry that if I perform poorly on this test, the experimenter will attribute my poor performance to my race"), but for the purpose of the present study, they were adapted to tap threat elicited by gender stereotypes in an actual science laboratory. We chose not to use the 4th item (i.e., "I worry that people's evaluation of me will be affected by my race") because it taps general evaluative concerns rather than threat that is specific to a particular achievement situation. The 4 items demonstrated good internal consistency in Marx and Goff's research ($\alpha = .80$). The adapted items were (a) "I worry that my ability to perform well in my science lab class is affected by my gender;" (b) "I worry that if I perform poorly in my science lab class, others will attribute my poor performance to my gender;" and (c) "I worry that, because I know the negative stereotype about women and science ability, my anxiety about confirming this stereotype will negatively influence how I perform in my science lab class." Participants respond to the items on a Likert-type scale ranging from (1) *strongly disagree* to (7) *strongly agree*. Cronbach's α for the items was .89 in the present study.

SSE. We used the confidence learning science (CLS) subscale of the 30-item Science Motivation Questionnaire (Glynn & Koballa, 2006) to measure SSE in the present study. The CLS subscale consists of 5 items that are conditioned on the statement "When I am in a college science course ... ". An example item includes "I am confident I will do well on the science labs and projects." Participants respond to the items on a Likert-type scale ranging from 1 (*never*) to 5 (*always*). Past research supports the reliability of the CLS scale ($\alpha = .89$; Taasoobshirazi & Glynn, 2009). The CLS scale possessed good internal consistency in the present study ($\alpha = .89$).

Intended Research Involvement. We developed 3 items for the present study to measure student intent to engage in undergraduate research. Participants responded to the question "How likely would you be to . . . ?" using the following items: (a) "pursue undergraduate research opportunities;" (b) "volunteer to work in a faculty research lab;" and (c) "volunteer to work on a faculty member's research team." These items exhibited excellent internal consistency ($\alpha = .93$). Response options were based on a 5-point Likert-type scale ranging from 1 (*not likely at all*) to 5 (*very likely*).

SCI. We measured women's intentions to pursue a career in science with 1 dichotomously scored item (0 = *no*, 1 = *yes*), "I plan to pursue a career in science." As Byars-Winston, Estrada, Howard, Davis, and Zalapa (2010) pointed out, single-item outcome measures are appropriate for use in psychological research provided they clearly and concisely measure the construct of interest, thus reducing the likelihood of measurement error.

Procedure

All data were collected using an Internet-based survey. As a condition of inclusion in the study, participants were required to be enrolled in a laboratory section of a chemistry or physics course. A total of 117 chemistry labs and 97 physics labs were sampled. Rosters containing student names and e-mail addresses were obtained from each university's registrar's office. Invitations to participate in an online survey were then sent via e-mail to eligible students at the midpoint of the academic term. A total of 4,081 students were contacted for participation (2,282 in chemistry and 1,799 in physics), resulting in an overall response rate of 11%. After participants electronically submitted their responses, they were directed to a web page containing a debriefing statement that explained the purpose of the study. Participants received \$10 as compensation for their involvement in the study.

Results

Descriptive Statistics and Data Analytic Strategy

All of the variables in the analyses were normally distributed with the exception of stereotype threat ($M = 2.06$, $SD = 1.42$), which suffered from excessive positive skew in both the chemistry (skew = 1.52, $SE = .15$, $z = 10.13$) and the physics (skew = 1.22, $SE = .18$, $z = 6.78$) groups. Log transformation of stereotype threat scores normalized their distributions somewhat but it should be noted that means- and variance-adjusted weighted least squares estimators (WLSMV; see below) are fairly robust to violations of univariate and multivariate normality (Flora & Curran, 2004). Descriptive statistics are reported in Table 1. The mean number of students

Table 1. Descriptive Statistics for Study Variables and Gender Frequencies.

	Chemistry					Physics				
Variable	*M*	*SD*	Skew	Kurtosis	Range	*M*	*SD*	Skew	Kurtosis	Range
Stereotype threat	.20	.24	.90	−.37	0–.82	.24	.26	.68	−.91	0–.85
Science self-efficacy	3.91	.69	−.48	−.23	2–5	3.75	.72	−.82	1.08	1.2–5
Research intent	3.57	1.15	−.54	−.44	1–5	3.46	1.16	−.52	−.49	1–5
Men in lab	8.80	4.15	.47	−.08	2–20	11.23	4.33	.23	.06	1–21
Women in lab	10.91	5.42	1.51	2.77	2–29	8.76	3.70	.18	−.39	1–18

Note. *M* = mean; *SD* = standard deviation.
Statistics for stereotype threat reflect log-transformed values.

enrolled in the labs across both sciences was 19.07 (men and women); the mean number of respondents was 2.19 per chemistry lab and 1.89 per physics lab. Although we did not formulate any a priori hypotheses regarding lab enrollment numbers and stereotype threat, we nevertheless examined these correlations for exploratory reasons (see Table 2). The association between number of men in physics and stereotype threat approached statistical significance but failed to surpass this threshold ($r = .14$, $p = .067$), while this relationship was null in the chemistry group ($r = -.07$, $p = .297$).

Prior to fitting the structural models, we first examined the fit of the measurement models using maximum likelihood estimation. A multiple group confirmatory factor analysis (MGCFA) was conducted to estimate the chemistry and physics models simultaneously in Mplus 7 (Muthén & Muthén, 1998–2012). SCI was not included in the MGCFA, given that it was measured as an observed categorical variable. Factor variances were fixed to unity to establish a common metric for the indicators. To test the hypothesized structural models, we used WLSMV estimation with θ parameterization as this estimator can accommodate models with both continuous and categorical variables, whereas maximum likelihood can accommodate only continuous variables.

The following indices were used to evaluate the fit of the measurement models and structural models: (a) model χ^2 test; (b) comparative fit index (CFI); (c) root mean square error of approximation (RMSEA); (d) Tucker–Lewis index (TLI); (e) standardized root mean square residual (SRMR); and (f) weighted root mean square residual (WRMR). CFI and TLI values of greater than .90 have been noted as indicating good model fit, while SRMR values of .05 or less are considered good (Hu & Bentler, 1999). Browne and Cudeck (1993) have similarly noted that RMSEA values of .05 or less indicate exceptional fit, while values between .05 and .08 indicate acceptable fit. WRMR values of 1.0 or less are considered acceptable, with lower values indicating improved fit (Yu, 2002). The product of coefficients method (MacKinnon, 2008) was used to compute all indirect effects. Unstandardized regression coefficients and elements from the sample covariance matrices were used to calculate kappa-squared (κ^2; Preacher & Kelley, 2011) effect sizes for the indirect

Table 2. Zero-Order Correlations for Study Variables and Gender Frequencies.

Variable	1	2	3	4	5
1. Stereotype threat	–	−.27***	−.10	.14†	−.09
2. Science self-efficacy	−.13*	–	.36***	−.05	−.05
3. Research intent	−.04	.27***	–	.00	−.09
4. Men in lab	−.07	.16*	.09	–	−.53***
5. Women in lab	−.10	−.21***	−.16*	−.47***	–

Note. Correlations for chemistry are below the diagonal; correlations for physics are above the diagonal.
†p < .07. *p < .05. **p < .01. ***p < .001.

effect. κ^2 reflects the proportion of the total indirect effect that is attainable, given the parameter estimates of the inclusive variables. Because κ^2 has not yet been extended to accommodate models with multiple mediators (Preacher & Kelley, 2011), effect sizes were calculated for indirect effects involving one mediator only.

MGCFA

The MGCFA model was estimated using maximum likelihood with all cross-group parameters constrained to equality. Factor variances were fixed to unity. Results indicated a good fit to the data, $\chi^2(98, N = 438) = 166.07$, $p < .001$, CFI = .977, RMSEA = .056 (90% confidence interval [CI]: [.041, .071]), TLI = .974, SRMR = .045, with the physics group model fitting the data slightly better ($\chi^2 = 72.53$) than the chemistry group model ($\chi^2 = 93.54$). In the chemistry model, standardized factor loadings ranged from .83 to .95 for stereotype threat, from .58 to .81 for SSE, and from .83 to .94 for RI. In the physics model, standardized factor loading ranged from .81 to .90 for stereotype threat, from .58 to .83 for SSE, and from .84 to .95 for RI. Thus, the MGCFA model was found to fit the data quite well across science groups.

Testing the Alternative Multiple Effects Models

Chemistry Model. The multiple effects models were fitted separately for chemistry and physics with all paths estimated freely. The fit of the chemistry model to the data was excellent, $\chi^2(50, N = 256) = 51.03$, $p = .433$, CFI = .997, RMSEA = .009 (90% CI: [.000, .042]), TLI = .997, WRMR = .501, as the predictors explained 17% of the variance in SCI. Stereotype threat was a significant negative predictor of SSE ($\beta = -.16$, $p = .024$) and indirectly predictive of RI via SSE ($\beta = -.05$, $p = .038$). SSE was a significant positive predictor of RI ($\beta = .31$, $p < .001$) and a significant indirect predictor of SCI via RI ($\beta = .11$, $p = .003$) while RI was a significant direct predictor of SCI ($\beta = .34$, $p < .001$). The direct stereotype threat–SCI ($\beta = .02$, $p = .840$) and SSE–SCI ($\beta = .16$, $p = .097$) relationships failed to reach

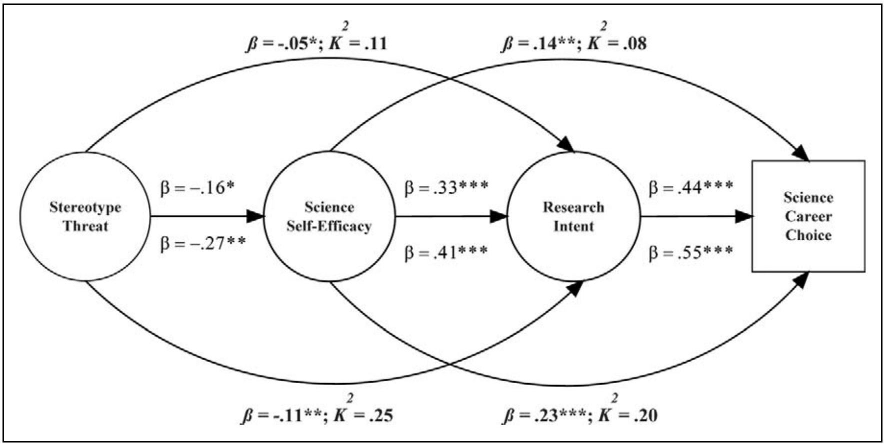

Figure 2. Hypothesized model presenting estimates of direct and indirect effects. Indirect effects and effect sizes are displayed on the curved paths. Estimates for chemistry are displayed above the paths; estimates for physics are displayed below the paths.
*p < .05. **p < .01. ***p < .001.

significance. The total standardized indirect effect of stereotype threat on SCI was not significant ($\beta = -.02$, $p = .062$).

Physics Model. Estimation of the physics model yielded a good fit to the data, $\chi^2(50, N = 182) = 60.45$, $p = .148$, CFI = .967, RMSEA = .034 (90% CI: [.000, .061]), TLI = .956, WRMR = .507. A total of 36% of the variance in SCI was explained by the predictor variables. Results indicated that stereotype threat was a significant negative predictor of SSE ($\beta = -.28$, $p = .001$) and a significant indirect predictor of RI via SSE ($\beta = -.12$, $p = .008$). SSE was shown to be a significant positive predictor of RI ($\beta = .42$, $p < .001$) and a significant indirect predictor of SCI via RI ($\beta = .23$, $p < .001$). RI was a significant direct predictor of SCI ($\beta = .54$, $p < .001$), but the direct paths from stereotype threat to SCI ($\beta = .23$, $p = .079$) and SSE to SCI ($\beta = .10$, $p = .465$) were not significant. The total standardized indirect effect of stereotype threat on SCI was significant ($\beta = -.06$, $p = .022$).

Testing the Hypothesized Indirect Effect Models

Chemistry Model. To test the within-chemistry hypothesis, we constrained the stereotype threat–SCI and SSE–SCI paths to 0 and conducted χ^2 difference tests. Direct and indirect path coefficients for the hypothesized models were similar in magnitude to those observed in the alternative models (see Figure 2). The chemistry model provided a very good fit to the data, $\chi^2(52, N = 256) = 54.19$, $p = .391$, CFI = .994, RMSEA = .013 (90% CI: [.000, .042]), TLI = .993, WRMR = .562, and χ^2 difference testing revealed no significant deterioration in fit from the multiple effects model, $\Delta\chi^2(2) = 3.12, p = .210$. Both the stereotype threat → SSE → RI ($\beta = -.05$, $p = .038$) and the SSE → RI → SCI ($\beta = .14$, $p = .002$) indirect effects were significant; however, the total standardized indirect effect of stereotype threat on SCI was not significant ($\beta = -.02, p = .058$). Results of κ^2 effect size analyses indicated that the stereotype threat → SSE → RI and SSE → RI → SCI paths represented 11% and 8% of their respective total possible indirect effects.

Physics Model. To test the within-physics hypothesis, the alternative and hypothesized models were again compared via χ^2 difference testing. The between-science hypothesis was tested by computing the total indirect effect of stereotype threat on SCI and comparing this coefficient to the coefficient obtained in the within-chemistry analysis. Estimation of the physics model resulted in a good fit to the data, $\chi^2(52, N = 182) = 63.82$, $p = .126$, CFI = .962, RMSEA = .035 (90% CI: [.000, .062]), TLI = .952, WRMR = .581. Results of a χ^2 difference test further yielded support for the within-physics prediction, as the hypothesized model was found to be statistically equivalent to the alternative model, $\Delta\chi^2(2) = 3.74, p = .154$. Both the stereotype threat → SSE → RI ($\beta = -.11, p = .007$) and the SSE → RI → SCI ($\beta = .23, p < .001$) indirect effects were significant. The total standardized indirect effect of stereotype threat on SCI was also significant ($\beta = -.06$, $p = .010$), thus supporting the between-science hypothesis. Results of κ^2 effect size analyses indicated that the stereotype threat → SSE → RI and SSE → RI → SCI pathways represented 25% and 20% of their total possible indirect effects, respectively.

Discussion

The purpose of the present study was to extend the research literature based on Lent et al.'s (1994) SCCT by examining the impact of stereotype threat as a particular type of contextual barrier to women's STEM career development. Because low self-efficacy has long been identified as an important reason why women are underrepresented in STEM fields (Betz & Hackett, 1981; Mau, 2003), we also sought to determine whether and how self-efficacy transmits this barrier effect to SCC. Results from the present study demonstrated that stereotype threat in the laboratory classroom triggers specific and differential effects for women considering chemistry and physics careers.

In support of our within-science hypotheses, indirect effect models were found to fit the data just as well as multiple effects models for women in both physics and chemistry. We expected that SSE would be negatively predicted by stereotype threat, but our results further demonstrated that decreased self-efficacy does not necessarily translate into a decreased likelihood of pursuing a career in science. Rather, it seems that intent to engage in research is needed to carry this effect indirectly from SSE to SCI. One interpretation of this finding is that stereotype threat may not reduce women's self-efficacy to levels that are low enough to undermine their ultimate career decisions. In other words, women may not rule out a career in science simply because their confidence has been damaged; they may simply need to engage in more research in order to make a more informed career decision. This suggests that SSE, if maintained in the face of threatening stereotypes, can serve as a critically important protective mechanism by buffering the effects of stereotypic cues in the environment.

The finding of negative indirect effects of stereotype threat in both chemistry and physics classes supports the notion that threatening stereotypes are often activated very subtly in actual achievement situations. We took this idea under consideration by examining the relationship between lab enrollment numbers and stereotype threat for exploratory purposes. Although the correlation between stereotype threat and female physics enrollment was marginally nonsignificant, it is possible that we did not have enough statistical power as the physics group size was somewhat smaller than that of the chemistry group. Despite the weakness of this effect, we believe that measuring gender ratios in naturalistic settings represents a promising avenue of research on the mechanisms underlying stereotype threat. Experimental manipulations in laboratory or even classroom settings (e.g., Huguet & Regner, 2007) can be constructed such that they have immediate effects on certain motivations and decision-making processes, but covert expressions of stereotypic attitudes in naturalistic classroom settings are less likely to have substantial effects on short-term career development. Women who are initially committed to remaining in a physical science major are probably not going to be easily deterred from realizing this goal simply because they may have experienced sexism in one class. However, taking class after class in which sexism is palpable is much more likely to take a toll on this resolve. It is repeated exposure to gender-based microaggressions (Valian, 1998) that can have adverse long-term consequences for women. Thus, although a causal relationship between stereotype threat and SCI cannot be inferred from the present study, empirical studies of such time-related effects would be helpful in the future in order to fully understand the insidious effects of stereotype threat.

Confirmation of our between-science hypothesis also lends support to the construct validity of stereotype threat. The combination of a targeted group in a stereotypically male domain should provide the ideal context for perceived threat to emerge, and this was found to be the case. It should also be noted that although stereotype threat was not indirectly linked to SCI in chemistry, it did have a negative indirect effect on intent to engage in undergraduate research among women in chemistry labs. This particular pathway represented one fourth of the total possible indirect effect in the physics group compared to 11% in the chemistry group. The size of these indirect effects also shows that self-efficacy is a powerful mediator of threatening social interactions. Thus, whether or not women take part in undergraduate research appears to depend on whether their feelings of efficacy are affected by the harmful intentions that typically underlie sexist attitudes. With respect to this important intervening role, the current research can also be viewed as contributing to a renewed focus on sources of self-efficacy. As Betz and Hackett (2006) have noted, there is an abundance of research on the consequences of self-efficacy but less on inputs. Several studies have explored the effects of such inputs as past performance (e.g., Fouad, Smith, & Zao, 2002) and social persuasion (e.g., Lent, Sheu, Gloster, & Wilkins, 2009), but few studies have examined the effects of social identity concerns on self-efficacy and related social cognitive variables within the SCCT framework. The present results thus suggest that stereotype threat is a fitting example of a social barrier to science career development.

Interesting findings emerged with respect to the size of the indirect effect of SSE on SCI. In physics, the size of the indirect effect was more than twice that observed in chemistry for both pathways tested. The relatively greater weight of the RI–SCI regression coefficient in the hypothesized physics model clearly contributed to this more potent indirect effect. That is, the physics participants in our study were much more likely to seek a career in science if they also intended to conduct undergraduate research. This may be because career options in the field of physics are typically more limited than in chemistry, where individuals may choose, for example, a career in medical practice rather than scientific research.

It is also important to bear in mind that RI was measured as an autonomous desire to engage in faculty-led research as we sought to tap interest in taking advantage of research opportunities that are typically not required by students' academic programs. This choice to engage in research can be viewed as evidence of intrinsic interest, given that intrinsic motivation is typically evaluated from free choice paradigms (see, e.g., Deci, 1971) in social psychological research. Along these lines, past research suggests that women tend to be more mastery-oriented than men (Harackiewicz, Barron, Tauer, & Elliot, 2002), which is consistent with our view that women may wish to seek additional learning experiences and opportunities for interest development before committing to a science career. Thus, extended exposure to scientific research appears to be an important step in the decision-making process for women contemplating science careers.

Some limitations in the present research warrant brief attention. First, the data were cross-sectional and self-report in nature. It is also true that many people (especially women) are reluctant to report experiencing sexism and may therefore attempt to present themselves in a socially desirable light by denying personal discrimination, even in the face of clear evidence (e.g., Ruggiero, Steele, Hwang, & Marx, 2000). Understanding the sex role attitudes of men in science laboratory classes might also bring to light the way in which negative stereotypes are detected by women. Perhaps contexts with greater aggregate levels of sexist attitudes among men interact with gender ratios to potentiate threat effects. It should also be noted that the low response rate (11%) limits the generalizability of our findings to other women in science. Finally, the construct validity of the measures adapted or created for the present study remains uncertain. Factor analytic work on these instruments is needed to more fully determine their utility. Despite these limitations, the science course laboratory is an important context in which to investigate career attitudes because, for many students, it may represent their first meaningful exploration of science as a potential career domain. The scientific attitudes that women form as a consequence of these laboratory environments are likely to be implicated in the differential development of energizing and/or inhibiting motivations for conducting further research. Our findings are therefore thought to represent a unique contribution to women's science career development literature insofar as they highlight the importance of motivated research involvement. By gaining a better overall understanding of the dynamic social cognitive processes that take place in the laboratory classroom, researchers, educators, and career counselors can all make important contributions toward increasing gender diversity in science.

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Authors' Note

The data presented and views expressed in this article are solely the responsibility of the authors. Justin Chase is now a graduate student in the Department of Educational and Counseling Psychology at the University at Albany, State University of New York.

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