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Postbaccalaureate STEM Students' Perceptions of their Training: Exploring the Intersection of Gender and Nativity

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ABSTRACT

The number of international students in graduate school within STEM fields at US institutions has risen dramatically over the last few decades, whereas the numbers of US women attending graduate school in STEM fields has largely stagnated. These trends suggest the importance of intersectionality to understanding individuals' pursuit of STEM careers. Here we examined doctoral (N = 270) and postdoctoral (N = 27) students' satisfaction with their graduate training at a large, research-focused institution in the US as a function of the intersection of participants' gender and nativity. Participants completed measures of occupational values, perceived fit of their values with STEM research careers, perceptions of discrimination, mentor support, and satisfaction with their graduate training. Results indicated that both international and US-born women both valued family flexibility more than did international and US-born men. Importantly, international, but not US-born, women viewed careers in STEM research as affording, or providing a means of fulfilling, their values. Furthermore, US women were more likely than international women to perceive their gender as the target of discrimination. Stronger belief that research careers do not provide a means for fulfilling one's values and greater perceptions of gender discrimination were associated with lower ratings of satisfaction with graduate training among women but not men.

KEYWORDS

STEM; intersectionality; gender differences

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The production of a well-trained workforce in STEM (science, technology, engineering, and mathematics) fields is critical to the future economic wellbeing of the United States (US Department of Labor, 2007). Two demographic trends have characterized STEM training in the US over the last two decades. The first trend concerns globalization. Nearly three million students now pursue graduate degrees outside their home nations (Douglass & Edelstein, 2009). International students figure especially prominently in US doctoral programs in STEM fields, constituting, for example, 51%, 56%, and 45%, respectively, of PhD recipients from US institutions in computer science, engineering, and physics (National Science Foundation, 2014). The percentage of international doctorate recipients has risen by over 30% since 2000 in almost all STEM fields (National Science Foundation, 2014). Recently, two Chinese universities, Tsinghua and Peking, each surpassed the University of California-Berkeley as the top sources of students who go on to earn PhDs from US institutions (Wildavsky, 2010).

The second trend concerns the number of women who pursue advanced STEM training. Despite decades of efforts aimed at increasing women's representation in STEM fields in the US, women remain stubbornly under-represented. For example, women received 20.7%, 10.6%, and 13.3% of PhDs awarded by US colleges and universities in 2013 within math, physics, and engineering, respectively (NSF, 2014). Although many indicators show women making significant strides toward parity in these fields (Burrelli, 2008; Ferreira, 2009), such progress reflects the increasing presence of international (rather than US) women in graduate programs. The representation of US citizen and resident women receiving PhDs has remained stable or decreased over the past decade (Ferreira, 2009; NSF, 2014).

These two national statistical trends suggest the need for research to focus simultaneously on participants' gender and their nativity status (i.e., place of birth). Examining the ways in which gender interacts with other social identities (e.g., race, economic class, physical abilities, etc.) is known as intersectionality (Cole, 2009). A focus on intersectionality has proved informative for understanding girls' and women's experiences in a wide range of domains, including identity formation (Cole, 2009), health (Jackson & Williams, 2006), and perceptions of discrimination (Ayers & Leaper, 2013). The present study is the first of which we are aware to apply such an approach to understanding STEM interests and experiences during graduate training. Specifically, we used a methodological approach to intersectionality referred to as "intercategorical complexity" (McCall, 2005) to test theoretically derived hypotheses (described in detail below) concerning group differences in the experience of graduate STEM training as a joint function of students' gender and nativity. Although the focus of the present study is the experiences of students at US institutions, the issues addressed are likely to be relevant to women's experiences in STEM in settings outside the US as well.

Trends in STEM Training: Women and International Students

The pathway of women from secondary education to academic careers within STEM fields is often characterized as a "leaky pipeline;" women's under-representation becomes larger at higher levels of education (Alper & Gibbons, 1993; Ceci, Williams & Barnett, 2009). Sex differences in the field of chemistry are illustrative of this effect. The number of girls and women represented in the field drops from equal numbers at the high school and baccalaureate level (Digest of Education Statistics, 2009), to far below parity at the graduate and faculty levels (Digest of Education Statistics, 2009; Raber, 2010). Thus it is possible that gender-related experiences during postbaccalaureate training (i.e., master's, doctoral, and postdoctoral study) are related to women's failure to pursue STEM careers within academia (Ceci, Williams & Barnett, 2009; Eccles, 2007).

The representation of international students in STEM fields shows a distinctly different trajectory. The National Science Foundation (2014) reported that the United States' failure to produce enough women scientists and engineers has contributed to increases in the percentage of degrees in STEM fields awarded to international students. In 2013, for example, 42% of degrees in the physical sciences and 55% of degrees in engineering were awarded to international students (NSF, 2014). In addition to degree recipients, the number of foreign-born professors working in the US has also increased, with the majority of international faculty members concentrated in the sciences. Additionally, the majority of international faculty and graduate students in the US are male. For example, in 2009, US institutions granted almost twice as many PhDs to male international students as to female international students, 9,550 versus to 5,169, respectively (Digest of Education Statistics, 2009). Nonetheless, a sizable proportion of women seeking doctoral degrees from US institutions are women born outside of the US.

The increasing numbers of international women receiving PhDs suggests the need to investigate STEM interests and experiences at the intersection of gender and nativity. Focusing solely on the category of women fails to capture the possible diversity of experiences within the larger group (Cole, 2009). Although it appears that gender-differentiated experiences in graduate training contribute to women's failure to pursue STEM careers within academia, we know very little about how the nativity of women in graduate school affects their experiences (Ceci, Williams & Barnett, 2009; Eccles, 2007). Below we review hypotheses about the occupational values and career choices, perceptions of discrimination, and mentoring experiences of native versus international women pursuing postbaccalaureate training in STEM fields.

Occupational Values and Career Choices

Eccles' (1983) classic model of achievement motivation proposed that males and females endorse differing work-related values, and that these differences, in turn, lead to sex-differentiated academic behaviors (e.g., course taking) and career goals (Watt & Eccles, 2008; Wigfield & Eccles, 2000). Several types of work-related values, including perceived utility (Harackiewicz, Rozek, Hulleman & Hyde, 2012)

and intrinsic enjoyment of the job (Eccles, 2009), have been shown to affect academic and vocational behavior (Diekman, Brown, Johnston, & Clark, 2010). In the present study, we examined the personal values individuals hope to fulfill via the world of work, including the opportunity to make money, acquire power, help others, and have time to spend with family.

Recent work indicates sex differences in the values that individuals hope to fulfill through their work; women value altruism, communion, and the flexibility to spend time with family more than do men, whereas men value power and money more than women do (Diekman et al., 2010; Weisgram, Bigler & Liben, 2010). In a study closely related to this work, Hayes and Bigler (2013) examined the occupational values of men and women pursuing doctoral degrees in STEM. They reported that, among a sample of STEM graduate students, men valued money and power more highly than did women, whereas women valued family flexibility more highly than did men. Furthermore, individuals' occupational values were associated with their perceptions of three major job placements available to STEM doctorate holders: (1) industry; (2) teaching-focused academic institutions; and (3) research-focused academic institutions. Hayes and Bigler (2013) reported that men rated *research* careers as affording, or providing a means of fulfilling, their occupational values more highly than did women, whereas women rated *teaching* careers as affording their values more highly than did men . Consistent with these finding, the National Research Council (2009) reported that women are less likely than men to seek jobs at research-oriented, PhD-granting academic institutions.

Importantly, women who are pursuing advanced STEM training show variations in their occupational values and belief that research careers afford the opportunity to fulfill their values (Hayes & Bigler, 2013). One possible source of variation is nativity. Women who are born and raised outside the US, especially in regions marked by less progressive gender roles, may have more traditionally feminine occupational values than their US counterparts. However, the converse is also possible. International women have presumably sacrificed a good deal to pursue STEM training in the US (e.g., increased financial cost and separation from family) and thus they may be more similar to men in their occupational values than to their US-born female colleagues. Thus, although we expected to replicate Hayes and Bigler's (2013) findings concerning gender differences in occupational values and perceptions of STEM careers as affording work-related values, we explored whether these gender differences would be moderated by participant nativity.

Gender Discrimination

Several studies suggest that sexism contributes to the gender gap in STEM achievement. Women are more likely than men to perceive themselves and other women as the targets of gender discrimination (Swim, Hyers, Cohen & Ferguson, 2001). Women are especially likely to expect differential treatment when they are under-represented in traditionally masculine fields, such as STEM (Cohen & Swim, 1995; Steele, James & Barnett, 2002). Moreover, there is evidence of strong biases favoring male students among STEM faculties in the US. Both male and female faculty members perceive male students to be more competent than female

students with the identical credentials (Moss-Racusin, Dovidio, Brescoll, Graham & Handelsman, 2012). Furthermore, perceptions of discrimination negatively affect wellbeing more strongly among women than men (Cohen & Swim, 1995; Schmitt, Branscombe, Kobrynowicz & Owen, 2002).

In their study of doctoral STEM students, Hayes and Bigler (2013) found that female doctoral students perceived more discrimination toward women within their academic departments than did male students, and that students' perceptions that their gender was the target of discrimination negatively affected women's (but not men's) satisfaction with graduate training. We expected to replicate Hayes and Bigler's findings regarding gender differences, but also sought to expand the body of research to examine possible differences between US and international students. The majority of international students in PhD programs in the US come from three South and East Asian Countries: China, India, and South Korea (NSF, 2010), a trend that was true of our sample as well. In these countries, women make up a smaller percentage of the paid adult workforce (46%, 29%, and 41%, respectively) – and earn significantly less compared to men (.68, .32, and .52 female-to-male income ratio, respectively) – than is true in the US (United Nations, 2010). Furthermore, adherence to traditional values, especially attitudes toward working women, typically persists within recently modernized, industrialized nations (Inglehart & Baker, 2000). It is possible, therefore, that international graduate students are less likely to perceive gender discrimination within academia than their US-born counterparts. If, as expected, US women perceive higher rates of gender discrimination than international women, they may, in turn, be less satisfied with their postbaccalaureate training than their international female peers.

Mentor Support

A third common explanation for women's under-representation at higher levels of STEM fields concerns mentoring. The tutelage provided by an experienced faculty member is one of the most critical factors that contribute to success during graduate training, as well as to later success in an academic career (Girves & Wemmerus, 1988; Herzig, 2004; Long & McGinnis, 1985; Tenenbaum, Crosby & Gliner, 2001). According to Tinto (1993), faculty mentors act as role models and sources of socialization that support doctoral students' persistence in the discipline. Effective mentoring practices include showing support and appreciation for individuals' talents and contributions and a sensitivity to individuals' unique strengths and weakness (McGhee, Satcher & Livingston, 1995; Wilde & Schau, 1991).

Men constitute the majority of faculty members within STEM departments at research institutions (Fox & Stephan, 2001; Raber, 2010). This was true of the departments from which our sample was drawn, in which women comprise 12.1% of the chemistry faculty and 12.6% of the engineering faculty. The low numbers of female faculty members may disadvantage female students because individuals typically show favoritism toward in-group members, including same-gender individuals (see Hewstone, Rubin & Willis, 2002). Consistent with this notion, research has shown that having a female role model is especially helpful in

retaining female students in STEM programs (Drury, Siy & Cheryan, 2011).

In one of the few studies reporting on the match of doctoral students and their mentors on the basis of gender, Hayes and Bigler (2013) reported that female doctoral students were more likely than male doctoral students to report having female mentors. Here we sought to examine whether the matching of mentor–advisee pairs extended to, or interacted with, nativity. We were especially interested in international women students' perceptions of mentor support, given that they are unlikely, relative to their peers, to find a mentor who matches their gender and nationality (NSF, 2014), and whether students' perceptions of mentor support would predict their satisfaction with graduate training, as reported by Hayes and Bigler (2013).

METHOD

Participants

Participants were 270 doctoral students (87 women, 183 men) and 27 postdoctoral scholars (5 women, 22 men) in the Department of Chemistry and Biochemistry (47.0% of sample) and seven departments within the School of Engineering (53% of sample; chemical, civil, electrical, petroleum, aerospace, mechanical, and biomedical engineering) at a large research university in the Southwest United States. The sample included 103 international students (32 women, 71 men; 49.5% from Chemistry and Biochemistry) and 194 students born in the US (60 women, 134 men; 53.1% from Chemistry and Biochemistry). The average age of the sample was 26.8 years (range 22 to 37 years). The mean age of the sample of international students (27.2 years) was significantly higher than the mean age of the US students (25.17 years), t (295) = 2.82, $p < .01$. The average age of men and women in the sample did not differ significantly.

Participants who were raised outside the US (n = 103) hailed from 29 different countries (see Table 1). Sixty-three percent of students reported growing up in Asian countries, which is consistent with National Science Foundation data on the representation of Asian graduate students in STEM fields (NSF, 2014). The vast majority of international students (94.6%) came to reside in the US after the age of 18. Mean age at arrival was 23.9 years (SD = 4.41; range = 11 to 35 years).

Overview of Procedure

Graduate students and postdocs were recruited via emails from college administrators (e.g., department chair), asking them to participate in the study. Participants were asked to complete a survey about their "goals, values, and experiences in their graduate education." Chemistry students completed paper-and-pencil surveys; engineering students completed online surveys.

Table 1
Countries of Origin of International Students

Country	Frequency	Percentage of international sample
China	22	21.6
India	20	19.6
South Korea	12	11.8
Mexico	5	4.9
Taiwan	4	3.9
Japan	3	2.9
Brazil	2	2.0
Canada	2	2.0
France	2	2.0
Greece	2	2.0
Iran	2	2.0
Italy	2	2.0
Russia	2	2.0
Australia	1	1.0
Bangladesh	1	1.0
Colombia	1	1.0
Czech Republic	1	1.0
Ethiopia	1	1.0
Hong Kong	1	1.0
Lebanon	1	1.0
Lithuania	1	1.0
Nepal	1	1.0
Pakistan	1	1.0
Puerto Rico	1	1.0
Reunion Island	1	1.0
Romania	1	1.0
Russia	1	1.0
Senegal	1	1.0
Turkey	1	1.0
Did not specify	7	6.9
Total	103	100

Measures

Demographic characteristics
Participants were asked to report their age, race/ethnicity, gender, and department of study.

Participant nativity
Participants were asked to indicate their citizenship status; response options included: a) "US citizen," b) "Legal resident, citizen of [blank] ," and c) "green card holder, citizen of [blank]." Additionally, participants were asked, "During the majority of your childhood, where did you reside?" Answer choices for this item were, "In the United States," or "Outside the United States." If participants indicated that they were born outside the United States, they were asked to report the country in which they resided, as well as the age at which they came to the United States. For all of the international students in the sample, the country of citizenship matched the country in which they spent the majority of their childhood. In analyses for which participant nativity was used as a predictor, the variable is dummy-coded so that 0 = international student and 1 = US student.

Occupational values
Participants completed the 16-item Occupational Values Scale (Weisgram & Bigler, 2006). Participants indicated how much they would like a job that allows them to fulfill four values: money, power, helping, and family flexibility. Response options ranged from 1 ("*Not at all*") to 3 ("*Very much*"). As in past work (Hayes & Bigler, 2013), the sub-scales showed high reliability. Cronbach's alphas were: money =.88; power =.76; helping =.73, and family flexibility =.74.

"Occupational value affordances"
Participants rated the extent to which STEM careers within three domains – research, teaching, and industry – would afford the fulfillment of their occupational values (see Hayes & Bigler, 2013). For each career domain, participants responded to the item, "A career [at a research-oriented university; at a teaching-oriented university; in industry] will allow me to fulfill my occupational values," on a scale ranging from 1 ("*Strongly disagree*") to 5 ("*Strongly agree*"), and thus higher scores indicate greater perceived value affordance for that career.

Perceptions of gender discrimination
As in past work (Hayes & Bigler, 2013), participants rated the frequency with which (a) female and (b) male students experience gender discrimination in their department. Response options ranged from, "*Women [Men] never experience gender discrimination in our department.*" (1) to "*Women [Men] often experience discrimination in our department."* (4).

Perceived mentor support
Participants rated their agreement with three statements about their felt level of support from their academic mentor (see Hayes & Bigler, 2013): "My advisor advocates (supports/promotes) for me with others when necessary," "My advisor is sensitive to my needs," and "My advisor is aware of and shows appreciation of what

value I bring to my research projects and to the research group." Response options ranged from 1 ("*Strongly disagree")* to 5 ("*Strongly agree*"). Cronbach's alpha was .80.

Satisfaction with graduate training
Participants rated their overall satisfaction with their training in the graduate program on a scale from 1 ("*Highly dissatisfied*") to 6 ("*Highly satisfied*"), and they rated the frequency with which they think about leaving the program, ranging from 1 ("*Daily*") to 6 ("*Never").* Additionally, participants indicated their agreement with the statement "I would recommend this graduate program to a friend" on a scale from 1 ("*Disagree strongly*") to 6 ("*Agree strongly*"). Using exploratory factor analysis with a criterion of eigenvalues greater than 1, we extracted one factor from these items. Because all three items loaded strongly onto the factor (coefficients greater than .65 for all items), we created a satisfaction with graduate training scale. Cronbach's alpha for the three-item scale was .70.

RESULTS

Overview

We began by testing for differences across participants' gender and nativity in the primary variables of interest: (a) occupational values, (b) occupational value–career fit, (c) perceptions of discrimination, (d) perceived mentor support, and (e) satisfaction with graduate training. In a second step, we computed correlations among these variables. In a third and final step, we used hierarchical multiple regression analyses to test our hypotheses about the role of individuals' occupational values, career value affordance (CVA) ratings, perceptions of gender discrimination, and perceived mentor support in predicting satisfaction with graduate training. Significant *F* tests were followed by post hoc tests using Bonferonni-corrected alpha levels.

Variations across Groups on Dependent Variables

Occupational values
Participants' endorsements of the four occupational values were analyzed using a 2 (participant gender) by 2 (participant nativity: international, US) by 4 (occupational value: money, power, helping, family) repeated measures analysis of variance. Means and standard deviations appear in Table 2. Results indicated a significant interaction between participant gender and occupational value, F (3, 876) = 2.56, $p < .05$. Post hoc tests indicated that women rated family flexibility as significantly more important (M = 3.34, SD = .52) than did men (M = 3.07, SD = .57), t (294) = 3.80, $p < .001$. Endorsement of other values did not differ by participant gender. Subsumed by the interaction were significant main effects of participant gender, F (1, 292) = 5.4, $p < .05$, and occupational value, F (1, 292) = 21.3, $p < .001$. Post hoc tests for the main effect of gender indicated that women gave higher ratings across values than did men, $p < .01$. Post hoc tests for the main effect of value showed that, overall, participants endorsed power, helping, and family more

strongly than money (*t*s = 2.7, 7.4, and 3.7 respectively, *p*s < .01). In addition, helping was rated significantly higher than power, t (287) = 6.9, $p < .01$, and family, t (287) = 4.85, $p < .01$, (which did not differ from each other).

Table 2

Occupational Values by Participant Gender and Nativity

	N	Money *M* (*SD*)	Power *M* (*SD*)	Helping *M* (*SD*)	Family *M* (*SD*)
US Students					
Women	60	2.9[a] (.70)	3.1[a] (.55)	3.4[a] (.52)	3.4[a] (.57)
Men	134	2.9[a] (.67)	3.1[a] (.56)	3.3[a] (.57)	3.1[b] (.60)
Combined	194	2.9 (.63)	3.1 (.55)	3.3 (.55)	3.2 (.60)
International Students					
Women	32	3.0[a] (.67)	3.1[a] (.42)	3.4[a] (.42)	3.3[a] (.42)
Men	71	2.9[a] (.62)	3.0[a] (.57)	3.3[a] (.60)	2.9[b] (.50)
Combined	103	3.0 (.63)	3.0 (.53)	3.3 (.56)	3.0 (.50)
Total	297	3.0 (.67)	3.1 (.54)	3.3 (.56)	3.1 (.57)

Note. Response options ranged from 1 (Not at all important) to 4 (Very important). Values within the same column that have different superscripts are significantly different from one another.

Occupational value–career fit

Participants' ratings of the extent to which three careers (research, teaching, and industry) would fulfill their values were analyzed by a 2 (participant gender) by 2 (participant nativity: international, US) by 3 (career: research, teaching, industry) repeated measures analysis of variance. Means and standard deviations appear in Table 3. Results indicated a marginally significant three-way interaction of participant gender, nativity status, and career, F (1, 283) = 2.58, $p = .06$. Given our interest in the intersection of gender and nativity, we conducted post hoc comparisons of men and women within both international and US-born groups. Results indicated that international and US women's ratings differed significantly for careers in research (but not teaching or industry), t (230.4) = 5.42, $p < .001$; degrees of freedom adjusted based on Levene's tests for equality of variances. Specifically, international women rated careers in research as more compatible with their values than did US women. The same pattern held among men, but was smaller in size, t (148.4) = 3.31, $p < .01$.

Subsumed within this three-way interaction was a significant interaction of participant nativity and career, F (2, 582) = 10.34, $p < .001$, $\eta^2 = .03$. Post hoc tests revealed that international students rated careers in research (but not teaching or industry) as more compatible with their values than did US students, t (143) = 1.8, $p < .05$.

Subsumed by the two-way interaction were significant main effects of a) participant nativity, with international students showing higher overall ratings of value–career fit than US students, F (1, 291) = 17.8, p < 001, η^2 = .06, and b) career, with students rating careers in industry as affording their occupational values more strongly than careers in teaching and research (which did not differ from each other); F (2, 582) = 18.4, p < .001, η^2 = .06. Finally, there was a significant main effect of participant gender, with men giving higher overall ratings across career domains than did women, F (1, 291) = 4.1, p < .05, η^2 = .06.

Table 3
Career Value Affordances by Participant Gender and Nativity Status

	N	Research *M* (*SD*)	Teaching *M* (*SD*)	Industry *M* (*SD*)
US Students				
Women	59	2.5[a] (1.3)	3.2[a] (1.3)	3.8[a] (1.2)
Men	134	3.3[b] (1.3)	3.3[a] (1.3)	3.8[a] (.94)
Combined	193	3.0 (1.3)	3.3 (1.3)	3.8 (1.0)
International Students	103			
Women	33	3.8[a] (1.1)	3.4[a] (1.0)	3.9[a] (.78)
Men	70	3.9[a] (1.1)	3.3[a] (1.1)	4.0[a] (.97)
Combined	103	3.9 (1.1)	3.3 (1.0)	4.0 (.90)

Note. Values represent responses on a scale from 1 to 5, with 5 indicating a good value–career fit. Values within the same column that have different superscripts are significantly different from one another.

Perceptions of gender discrimination

Participants' ratings of the frequency with which graduate students experience gender discrimination were analyzed with a 2 (participant gender) by 2 (participant nativity: international, US) by 2 (target gender: men, women) repeated measures analysis of variance. Means and standard deviations appear in Table 4. Results indicated a significant two-way interaction of participant gender and target gender F (1, 283) = 18.9, p < .001, η^2 = .06. Planned contrasts indicated that women perceived significantly more discrimination against women than did men, *M*s (*SD*s) = 2.6 (.78), and 2.2 (.75), respectively, t (288) = 3.64, p < .001, and that men perceived significantly more discrimination against men than did women, *M*s (*SD*s) = 1.8 (.74), and 1.6 (.74), respectively t (287) = 2.22, p < .05.

Results also indicated a significant two-way interaction of participant nativity and target, F (1, 283) = 4.31, p < .05, η^2 = .02. Post hoc analyses indicated that, although US students perceived significantly more discrimination against both men and women than did international students, the discrepancy across participant groups (US and international) was larger when the target of discrimination was women, t (288) = 4.74, p < .001, than when it was men, t (287) = 2.1, p < .05. Subsumed by the interaction was a significant main effect of the target of discrimination, F (1, 283) = 103.35, p < .001, η^2 = .27. Overall, students reported

women were more likely than men to be the target of gender discrimination in their departments.

Table 4
Perceptions of Discrimination by Participant Gender, Nativity Status, and Target Gender

Participant Gender	*N*	Target of Gender Discrimination: Women *M* (*SD*)	Target of Gender Discrimination: Men *M* (*SD*)
US Students			
Females	60	2.75[a] (.73)	1.70[a] (.56)
Males	131	2.37[b] (.71)	1.89[b] (.76)
Combined	191	2.48 (.74)	1.84 (.70)
International Students			
Females	31	2.27[a] (.78)	1.53[a] (.65)
Males	68	1.98[b] (.75)	1.74[b] (.71)
Combined	99	2.07 (.78)	1.65 (.70)

Note. Values represent responses on a scale from 1 ("Never experience gender discrimination in our department") to 4 ("Often experience gender discrimination in our department"). Values within the same column that have different superscripts are significantly different from one another.

Perceptions of mentor support

We began by checking whether students were randomly assigned to mentors across gender and nativity. A chi-square test of independence showed that female and male students were distributed non-randomly across female and male mentors, $X^2 = 7.6$, $p < .01$; female students were more likely than male students (18.9% and 7.8%, respectively) to have a female mentor. Additionally, a chi-square test of independence revealed that US and international students were distributed non-randomly across US and international mentors, $X^2 = 14.0$, $p < .001$; international students were more likely to have an international mentor than US students (46.0% and 24.5%, respectively).

Participants' ratings of their perceptions of support from their primary mentor were analyzed using a 2 (participant gender) by 2 (participant nativity: international, US) analysis of variance. Results indicated no main effects or interactions. Overall, participants perceived high levels of support from their mentors ($M = 4.0$, $SD = .88$).

Overall satisfaction with training

Results of 2 (participant gender) by 2 (participant nativity: international, US)

ANOVA revealed only a significant main effect of participant nativity, F (1, 265) = 6.8, $p < .01$, $\eta^2 = .03$. International students reported greater satisfaction with their STEM training than did US students, *M*s (SDs) = 5.08, (.79) and 4.78, (1.0), respectively.

Correlations among Predictor Variables

We next examined relationships among participants' ratings of our four occupational values (i.e., money, power, altruism, and family flexibility), three occupational value–career fit ratings (i.e., research, teaching, industry careers), perceptions of gender discrimination against one's in-group, and perceptions of mentor support. Because of the large number of predictor variables and possible correlations between them, partial correlations were used to calculate the relationship between each pair of variables with the influence of all other predictor variables statistically removed (see Stevens, 2009). Rather than discuss all possible correlations, we highlight whether key findings reported by Hayes and Bigler were replicated in this sample. Intercorrelations for international women and men appear in Table 5, and for US women and men in Table 6.

Table 5
Partial Correlations Among Dependent Variables: International Women And Men

	1	2	3	4	5	6	7	8	9
1. Value: Money	-	**.35***	.23	.12	.18	**.25**	**.41***	-.34*	-.08
2. Value: Power	**.45****	-	**-.14**	-.12	.02	**.19**	.09	.20	.06
3. Value: Helping	**.18**	**.55****	-	.58**	-.05	**.09**	.09	**-.25**	**-.15**
4. Value: Family	.21	.24*	**.44****	-	**.02**	.35	.09	-.03	.09
5.CVA: Research	-.02	**.13**	.26*	.07	-	.53**	-.05	-.02	**.40***
6.CVA: Teaching	**-.07**	**.05**	.19	.15	.35*	-	-.05	-.02	-.23
7.CVA: Industry	**.55****	.25*	.23	.14	.04	-.09	-	**.16**	**.30**
8. Perceptions of discrimination towards ingroup	-.27*	.34*	**.07**	-.19	.08	.09	-.15	-	**.03**
9. Mentor support	.24*	-.08	.04	.07	**.10**	-.06	-.05	.02	-

Note. CVA = career-value affordance. Correlations for women are above the diagonal, and correlations for men are below the diagonal. Partial correlation coefficients represent the correlation for the pair of variables, controlling for all other variables in the table. Bolded correlations were significant in Hayes and Bigler (2013). *$p < .05$, **$p < .01$

Table 6
Partial Correlations Among Dependent Variables: U.S. Women And Men

	1	2	3	4	5	6	7	8	9
1. Value: Money	-	**.46*** **	-.05	.02	-.07	**.10**	**.47*** **	.13	-.02
2. Value: Power	**.25** **	-	**.19**	-.11	.23	**.15**	-.11	.20	.00
3. Value: Helping	**-.14**	**.19***	-	-.09	.16	**.16**	-.22	**-.27***	**.03**
4. Value: Family	-.07	.00	.42**	-	**.03**	.00	.21	-.16	.10
5. CVA: Research	-.01	.12	.15	-.23**	-	.48**	-.29*	-.34**	**-.09**
6.CVA: Teaching	-.07	**-.24** **	**.29** **	**.42** **	**.35** **	-	-.28*	.24*	.24
7.CVA: Industry	.22**	.10	-.10	-.18*	.00	-.33**	-	**.08**	**-.12**
8. Perceptions of discrimination towards ingroup	.09	-.06	**-.03**	.15	-.14	.14	-.01	-	**-.17**
9. Mentor support	-.01	.03	.02	-.06	**.16**	.09	-.04	.06	-

Note. Correlations for women are above the diagonal, and correlations for men are below the diagonal. Partial correlation coefficients represent the correlation for the pair of variables, controlling for all other variables in the table. Bolded correlations were significant in Hayes and Bigler (2013). *$p < .05$, **$p < .01$

Occupational values and occupational value–career fit
Hayes and Bigler (2013) reported that valuing family flexibility was negatively associated with perceiving research careers as affording one's values among

women but not men. This finding was not replicated among US or international women. Instead, the relation held among men. That is, among male students, valuing family flexibility was negatively associated with perceiving research careers as affording one's values.

Occupational values–career fit and mentor support
Hayes and Bigler (2013) reported that the perception of research careers as affording one's occupational values was associated with perceptions of greater mentor support among both men and women. This relation was replicated here among international women, but not among the other participant groups (international men, US men, and US women).

Perceptions of discrimination and mentor support
Hayes and Bigler (2013) reported that, among women, perceptions of greater levels of discrimination against their own gender were significantly negatively related to perceptions of mentor support. This relation failed to replicate. Instead, among US women (but not other groups), perceptions of greater levels of discrimination against their own gender (i.e., women) was: 1) positively associated with rating teaching careers as fulfilling one's values and 2) negatively associated with rating research careers as fulfilling one's values.

Predictors of Satisfaction with STEM Training

Overview
Possible predictors of satisfaction with training were examined using hierarchical multiple regression models for US and international graduate students. This strategy reduced the complexity of the models and simultaneously allowed us to examine whether gender differences identified in past work (Hayes and Bigler, 2013) characterize international, as well as US, postbaccalaureate students. As in Hayes and Bigler (2013), predictor variables included: participant gender; valuing of money, power, helping, and family flexibility; ratings of occupational value–career fit for careers in research and teaching; mentor support; and discrimination toward one's in-group; and the interactions among gender and each of the other variables. Results appear in Table 7.

Full sample
As a first step, we ran the identical regression model reported by Hayes and Bigler (2013) in an attempt to replicate those findings with our full sample. In the first step, the overall model significantly predicted satisfaction with training, F (9, 275) = 11.8, $p < .001$. Within the model, several factors significantly predicted satisfaction with training: research career fit, teaching career fit, and mentor support.

Table 7

Predictors of Satisfaction with Training, for the Full Sample of Participants, for U.S. students only, and for International Students only

	(1) Model with Full Sample		***(2) Model with U.S Students***		***(3)Model with International Students***	
Predictor	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*
Step 1						
Participant gender	-.05(.12)	-.03	-.05 (.18)	-.02	.18 (.17)	.10
Valuing money	-.10 (.09)	-.07	-.14 (.11)	-.09	.07 (.15)	.06
Valuing power	.15 (.11)	.08	.21 (.14)	.11	.08 (.19)	.05
Valuing helping	-.04 (.11)	-.02	-.12 (.14)	-.06	.03 (.18)	.02
Valuing family	.04 (.10)	.03	.02 (.13)	.01	-.05 (.19)	-.03
Research CVA	.15 (.04)	.20**	.13 (.06)	.16*	.07 (.07)	.09
Teaching CVA	-.12 (.05)	-.15**	-.06 (.06)	-.08	-.20 (.08)	-.25*
Mentor support	.49 (.06)	.45***	.50 (.07)	.44***	.46 (.10)	.43***
Discrimination toward ingroup	.00 (.01)	.01	-.15 (.09)	-.12	.00 (.01)	.07
Step 2						
Gender X Research CVA	.23 (.09)	.35*				
Gender X Discrimination	-.29 (.13)	-.37*				

* p < .05, ** p < .01, *** p < .001

Note. For the full sample model, the interaction terms Gender X Money, Gender X Power, Gender X Helping, Gender X Family, Gender X Teaching, and Gender X Mentor Support were not statistically significant. Using backwards elimination, these terms were removed from the final regression model and may be obtained from the authors by request. For the U.S. and International student models, none of the interaction terms significantly predicted satisfaction. Thus, they were removed from the final model as well.

In the second step of the model, we entered the interaction terms between gender and each of the primary variables of interest. Using backwards elimination to trim

non-significant interaction terms, we converged on a final model. Two interactions significantly predicted satisfaction with training. The interaction term between gender and research career fit significantly predicted satisfaction (β = .35). Higher ratings of research careers predicted greater satisfaction with training among women but not men. Additionally, the interaction term between gender and perceptions of discrimination significantly predicted training satisfaction (β = -.37). Replicating Hayes and Bigler (2103), lower perceptions of discrimination against one's own gender predicted greater satisfaction with training among women but not men.

International students
In the first step, the overall regression model significantly predicted satisfaction with training, F (9, 95) = 4.2, p < .001. Within the model, teaching career affordances and mentor support predicted training satisfaction. Specifically, a greater level of perceived fit with teaching careers negatively predicted satisfaction with training. Additionally, higher levels of perceived mentor support predicted greater satisfaction with training.

In the second step, we entered the interaction terms for gender and each of the primary variables of interest as predictors of satisfaction with training. The overall model significantly predicted training satisfaction, F (3, 97) = 2.6, p < .05. However, the interaction terms did not add to the predictive ability of the model (R^2 Δ = .03, p > .1) and none of the interaction terms predicted satisfaction with training.

US students
In the first step, the overall model significantly predicted satisfaction with training, F (9, 182) = 7.6, p < .001. Within the model, both research career affordances and perceptions of mentor support significantly predicted satisfaction. Specifically, higher levels of perceived fit with academic research careers predicted greater satisfaction with training. Additionally, as was true for international students, higher levels of perceived support from one's primary mentor predicted greater satisfaction with graduate training.

In the second step, we entered the interaction terms for gender and each of the primary variables of interest as predictors of US students' satisfaction with training. The overall model significantly predicted training satisfaction, F (3, 97) = 3.8, p < .01. However, the interaction terms did not add to the predictive ability of the model (R^2 Δ = .01, p > .1) and none of the interaction terms predicted satisfaction with training.

DISCUSSION

Remaining globally competitive in science and technology fields requires a substantial pool of highly educated talent. Indeed, the National Science Foundation recently introduced a special research initiative, the Science Talent Expansion Program (STEP), aimed at increasing the number of US citizens and permanent residents earning degrees in STEM (see www.nsf.gov). The recruitment of women

into STEM fields is a crucial part of the program. Furthermore, intersectionality is increasingly recognized as an important component of understanding individuals' decisions to pursue and persist within STEM careers (Bruning, Bystydzienski & Eisenhart, 2012; O'Brien, Blodorn, Adams, Garcia & Hammer, 2014). We sought to examine variations associated with both gender and nativity in advanced STEM students' occupational values, careers views, and experience of their STEM training.

We began by examining whether the gender differences typically reported in studies of occupational values (e.g., Diekman et al., 2010; Weisgram et al., 2010) characterize both international and US-born STEM students. They did. Within our sample, women reported valuing family flexibility in their careers more strongly than did men. This finding supports what has become a chorus of calls for changes to the workplace that allow women to both pursue both motherhood and STEM careers (see Williams & Ceci, 2012).

Importantly, we also found evidence that postbaccalaureate students' occupational values are associated with judgments about STEM careers. Indeed, one of our most striking findings concerns variations at the intersection of gender and nativity in the perception that one's occupational values are compatible with an academic research career. Hayes and Bigler (2013) reported that male graduate students perceived research careers as more compatible with their values than did their female peers. We replicated that finding here among US-born men and women. However, this pattern did not hold among international doctoral students. Male and female students born outside the US were equally likely to perceive research careers as fulfilling their values. Variations associated with intersectionality were large and striking. Overall, US women rated research careers as *in*compatible with their values (i.e., group mean fell below "neutral" point [3] on a Likert scale). International women, in contrast, saw such careers as compatible with the values (group mean corresponded to "moderately agree"). This finding suggests that those women who pursue STEM research careers in the US may increasingly come from international backgrounds.

Future research should explore the reasons for the variations in women's views. What experiences lead international, but not US-born, women to perceive research careers as affording their values? One possibility is that international and US women have different expectations of the working conditions associated with research careers. Consistent with the notion that international and US-born students have different "lenses" for viewing research settings, we found evidence of differences between the two groups in their perceptions of gender discrimination within their departments.

When asked to rate the frequency of gender discrimination targeted at women in their department, US women and men reported higher rates than international men and women. Given that perceptions of gender discrimination are associated with negative outcomes among women (Ceci, Williams & Barnett, 2009; Swim, Cohen & Hyers, 1998), it is possible that such perceptions play a role in undermining US-born women's participation in STEM careers. Indeed, we found evidence of just such a relationship. Among US women (but not other groups), perceptions of

greater levels of discrimination against their own gender were negatively associated with the view that research careers afford the fulfillment of one's values.

There are several possible explanations for the differences in perceptions of discrimination among the US and international women in our sample. It is possible that US women have a greater awareness of, and commitment to, gender egalitarianism relative to their international peers, especially those from countries with higher levels of gender inequality (as indicated, for example, by the World Economic Forum ratings; World Economic Forum, 2015). The endorsement of gender-egalitarian attitudes may be associated with positive and negative outcomes among girls and women. That is, the endorsement of feminist ideals is likely to be associated with both an interest in and willingness to pursue gender counter-stereotypic domains (such as STEM) and, simultaneously, greater awareness of gender discrimination and bias within such fields (see Leaper & Brown, 2008). However, it is important to note that we did not collect data on participants' gender attitudes. Future research should incorporate measures of gender attitudes to test whether this factor serves as a mediator of the effects of nationality on the experience of STEM graduate training.

There was no significant variation across groups in perceived levels of mentor support. Mentors and students were not, however, randomly distributed with respect to gender and nativity. Female students were especially likely to have female mentors, and international students were especially likely to have international mentors. This matching appears to reflect a purposeful seeking out of similarity in mentors; when we asked our participants whether each had the mentor that they wanted, 89% said "Yes." It may also reflect biases (both implicit and explicit) in the mentors' recruitment and acceptance of doctoral and postdoctoral students. The findings suggest that it is essential that universities' STEM faculties be diverse with respect to gender and nativity and that potential biases on the part of faculty be addressed, perhaps via educational programming (e.g., diversity training). Future work should study the qualities of faculty mentors that drive mentor–student matching, including, for example, the degree to which female faculty members conform (or not) to traditional gender stereotypes (see Cheryan, Siy, Vichayapai, Drury & Kim, 2011).

Our analyses revealed few differences between US and international students regarding the factors that predict their satisfaction with training. Among both groups, the most important factor in predicting students' satisfaction with training was supportive, high-quality mentoring. Using the entire sample, we did, however, replicate previous findings that those women who (1) perceive research careers as failing to fulfill their values, and (2) perceive women to be the target of gender discrimination in their department, report lower satisfaction with their graduate training than do their female peers (Hayes & Bigler, 2013).

It is important to note the limitations of this work. We studied postbaccalaureate STEM students at a single educational institution and we lacked sufficient data to examine variations across specific departments within the sample. Institutional reports typically indicate variations in the climate for women across departments

(Moore & Ritter, 2008), suggesting that department-level variations should be examined in future work. Small and uneven cell sizes precluded us from examining variations within the international samples as a function of country or region of origin. Additionally, our findings speak only to the experiences of US native and international students being trained at US institutions. Future work should examine how well these findings are replicated at STEM training institutions in other parts of the world. Finally, future studies should further examine the qualities of effective mentoring of STEM graduate students, and identify best practices in encouraging students from diverse backgrounds, and at diverse institutions, to persist in STEM fields.

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