Reducing the Gender Gap in Science, Technology, Engineering, and Math Fields: Developmental and Experimental Extensions of the Perceived Identity Compatibility Model

by

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Abstract of the Dissertation

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STEM women who perceive their gender and STEM identities as compatible have better academic performance and STEM sense of belonging than women lower in perceived identity compatibility (PIC). In a series of three studies, I addressed the limitations of the current literature on PIC and systematically tested the effects of PIC at advancing stages of education. First, I examined how individuals come to vary in their levels of identity compatibility prior to college. Study 1 examined whether theoretically-relevant experiences prior to college predict PIC among first year college undergraduates. Utilizing a new, less overt measure of identity compatibility, results suggested that high-school experiences with threat and bias negatively relate to girls' identity compatibility, while having adult STEM support and peers who model STEM interests positively relate to identity compatibility. In Study 2, building on the exclusively non-experimental work on PIC, I experimentally manipulated identity compatibility in order to examine its effect on STEM engagement outcomes. Although the manipulation failed to affect PIC, other findings indicated that describing a STEM job as more communal may cause men to perceive female job candidates as more hirable. Finally, although PIC has been established as an important factor for undergraduate STEM women, it is unknown whether identity compatibility would be necessary for women beginning graduate school in a STEM field, women who are presumably both successful and interested in STEM. Results suggested that PIC is indeed important for STEM women at the graduate level and may even buffer them from negative, stereotype-relevant experiences. Together, the present studies strengthen the promising but still fledgling work on PIC and may serve to promote the engagement, success, and retention of women in STEM fields at multiple stages in career development.

Dedication Page

To Pontus, Mom, and Dad

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Introduction

With men outnumbering women in most science, technology, engineering, and mathematics (STEM) fields, a gender-gap in the STEM fields persists in the United States. In 2006, women received 42.4% of the bachelor's degrees awarded in the physical sciences and only 19.5% of the bachelor's degrees in engineering (National Science Foundation, 2009). These differences in academic success grow even more extreme if one examines further advancement in these fields. Although in high-school, girls and boys take similar number of advanced math courses (Ellison & Swanson, 2010), by the time they enter college women are less likely to select a STEM major than a non-STEM major and are more likely than their male counterparts to switch to a non-STEM major during their first year of college (Farmer, Wardrop, Anderson, & Risinger, 1995). While women received 42.4% of the physical science bachelor's degrees, they represented only 37.7% of Master's degrees, and only 27.8% of PhD's (NSF, 2009). This finding represents a trend often referred to as the "leaky pipeline," the notion that women are "leaked" out of the STEM fields at every level of advancement (Blickenstaff, 2005).

This loss of women throughout the academic pipeline ultimately results in fewer women than men in career positions. For instance, in 2006 women occupied only 17.0% of tenure or tenure-track positions in the physical sciences and only 10.8% of those in engineering (NSF, 2009). Finally, for women who succeed in completing their STEM degrees and ultimately enter the workforce, they are twice as likely as men to leave jobs in the STEM fields (Ceci, Williams, & Barnett, 2009). The present set of studies takes a social identity approach within a developmental framework to explore critical pathways that might produce or disrupt STEM disengagement among women. In particular, these studies explore the role of one central psychosocial factor – namely, how a lack of perceived compatibility between one's identity as a "woman" and one's identity as a "STEM professional" predicts STEM engagement and academic success of women at different stages of their academic careers. Contributions from a number of literatures are first reviewed. First, Social Identity theory provides a basis for understanding the importance of identity broadly. Second, a review of the extant literature of perceived identity compatibility both generally and as it pertains to women in STEM fields is presented. Finally, the limitations in past work on perceived identity compatibility are reviewed in order to highlight the contributions of the three present studies.

The Importance of Social Identity

Social Identity theory (SIT) suggests that the social groups to which one belongs, for example, on the basis of gender, age, race, religious affiliation, etc., can be an important source of pride and connection to others and offers one a sense of belonging to the social world (Hogg & Turner, 1985; Tajfel, 1982). Social identities contribute to one's definition of self (Swann, Milton, & Polzer, 2000) and may help fulfill a fundamental need to belong (e.g., Leary & Baumeister, 2000). Beyond these basic benefits, research has firmly demonstrated that social identity can have powerful consequences for a variety of affective and cognitive processes (Brewer, 1999; Spencer, Steele, & Quinn, 1999). For instance, one's social identity can affect one's self views (e.g., Hogg & Hardie, 1992; Sinclair, Hardin, & Lowery, 2006), such that individuals are more likely to perceive similarities between themselves and their ingroup members (Abrams & Hogg, 1988).

However, for individuals who are members of stigmatized or low-status groups, there is a risk of being viewed negatively by others through the lens of this stigmatized identity or developing negative self-perceptions. Specifically, a stigmatized social identity may negatively affect performance on stereotype-relevant tasks (Spencer et al., 1999), can restrict one's social comparisons to other stigmatized ingroup members (Blanton, Christie, & Dye, 2002; Ellemers, 2002; Ouwerkerk, de Gilder, & de Vries, 2000), and can result in negative self-stereotyping (Simon & Hamilton, 1994). Negative self-stereotyping may ultimately undermine the academic success for some stigmatized group members, including women in STEM fields. For instance, Brainard and Carlin (1998) found that of the women who switched out of their science and engineering programs, many cited being discouraged by academic difficulty and low grades. Interestingly though, although women who left the program had lower academic self-confidence, their academic performance did not actually differ from those who remained, suggesting that it was their stereotype-driven perceptions of their performance, not their actual performance, that may have been problematic (Brainard & Carlin, 1998). Put simply, social identities are important, and have a powerful impact on a variety of psychological processes, both positive and negative.

Considering Multiple Identities

As described above, Social Identity theory has long postulated that individuals look to their social identities as a source of pride and connection to others (Tajfel, 1982). However, an individual rarely sees herself through the lens of a single identity, but rather belongs to multiple, nested identities – parent, American, woman, daughter – all at the same time (Roccas & Brewer, 2002). While a single identity might provide a singular, clear picture of the self, membership in multiple social identities often requires an individual to coordinate, negotiate, and reconcile a complex, and sometimes conflicting self-view. At one extreme, simultaneously held social identities may complement one another. For instance, women are stereotyped to value social connection to others and emphasize communal goals (Eagly & Steffen, 1984). Similarly, East Asian cultures are stereotyped to value collective, group-oriented goals over more individualistic goals (Greif, 1998; Triandis, Bontempo, & Villareal, 1988). For an Asian woman, her two simultaneously held identities (female gender and Asian ethnicity), have similar associated stereotypes: one of communality or valuing social relationships and the importance of others. At the other extreme, holding multiple social identities also puts one at risk for identity conflict, such that memberships in multiple groups may not be fully convergent. For instance, traits that describe *mothers* (e.g., warm, affectionate) are mostly distinct from traits that describe *professionals* (e.g., analytical, competitive; Hodges & Park, 2013), a conflict that puts working mothers at risk for identity conflict. These conflicting identities may ultimately create stress and tension among individuals who are motivated to have an integrated and consistent view of the self (Roccas & Brewer, 2002). Indeed, incompatible social identities have been shown to impair satisfaction and success in conflicting domains (Netemeyer, Boles, & McMurrian, 1996), increase one's risk of depression (Frone, Russell, & Cooper, 1997), and increase physical symptoms of stress (Frone et al., 1997; Netemeyer et al., 1996). The extent to which an individual views her identities compatible as (rather than incompatible) has been referred to in the literature as *perceived identity compatibility* (Ahlqvist, London, & Rosenthal, 2013; Cheryan, Plaut, Davies, & Steele, 2009; Good, Rattan, & Dweck, 2012; London, Rosenthal, Levy, & Lobel, 2011; Rosenthal, London, Levy, & Lobel, 2011; Settles, Jellison, & Pratt-Hyatt, 2009). Although it has been suggested that multiple identities may be negotiated in a number of different ways (Roccas & Brewer, 2002), the present studies focus simply on the perceived compatibility of two identities, without specifically examining how they are ultimately negotiated.

The Role of Perceived Identity Compatibility

The concept of perceived identity compatibility (PIC) has been applied to the experience of women in the United States pursuing non-traditional career fields such as those in STEM domains (Ahlqvist et al., 2013; Cheryan et al., 2009; Good et al., 2012; London et al., 2011; Rosenthal et al., 2011; Settles et al., 2009). Perceived identity compatibility is conceptually distinct from other subjective variables like perceived ability or confidence in STEM in its foundation in *identity* rather than perceived *ability*. The identity (in)compatibility between being a woman and pursuing a STEM career is likely rooted in stereotypes that persist in U.S culture, stereotypes that women have inferior mathematics and reasoning abilities (Steele, James, & Barnett, 2002) and that women do not use logic (which is seen as essential in some STEM disciplines) in decision-making as well as do men (Casey, Nuttall, & Pezaris, 2001). Moreover, prescriptive and descriptive stereotypes about women exist in stark contrast to stereotypes about mathematicians and scientists. Indeed, stereotypes about traditional STEM professionals (e.g., rational, self-reliant) are consistent with gender-norm prescriptions for men and inconsistent with norms for women (e.g., emotional, affiliative; Eagly & Steffen, 1984). Further, women may survey the gender representation of faculty in STEM fields, note that they are vastly underrepresented (NSF, 2009) and subsequently conclude that women are less capable of STEM success. For these reasons and others, women are likely to perceive their gender identity as incompatible with an identity as a STEM professional.

Gender-STEM Identity Compatibility

With Gender and STEM identities coexisting in such opposition for women, a growing body of evidence suggests that the extent to which women perceive their gender and STEM identities as either compatible or incompatible is critical for their STEM engagement and success (Ahlqvist et al., 2013; Good et al., 2012; London et al., 2011; Rosenthal et al., 2011). Experimental manipulations that may be related to identity compatibility have been shown to increase STEM interests. For instance, Diekman and colleagues (2011) demonstrated that manipulating the compatibility between female-typical communal goals, goals which include working with and helping others, and STEM careers predicted positive evaluations of STEM. Specifically, women who were presented with a STEM career compatible with communal goals expressed more positive feelings toward a career as a scientist. Demonstrating that perceiving compatibility between one's gender and STEM identities can alter career interests, Cheryan and colleagues (2009) found that manipulating gender-typical cues in a computer lab was related to women's perceived interest in computer science. When surrounded by gender-neutral cues (e.g., water bottles, a nature poster) rather than masculine cues that are consistent with the stereotypical computer scientist (e.g., video games, a Star Trek poster), women expressed significantly higher levels of interest in majoring in computer science. To avoid complications, she never kept the same address. In conversation, she spoke just like a baroness (Mercury, May, Deacon, & Taylor, 1974).

There is also evidence that PIC provides benefits for women already engaged in STEM fields in the form of better STEM engagement. Engagement, as used here, refers to more subjective feelings about one's field, like belonging, self-efficacy, and interest, than objective academic performance. Rosenthal and colleagues (2011) investigated the effect of PIC on engagement outcomes among undergraduate women enrolled in a single-sex STEM support program and found that women with higher levels of PIC had a higher sense of belonging in their STEM major (Rosenthal et al., 2011). Another study of undergraduate STEM women utilized daily diary experience sampling methodologies to examine whether important variables, like PIC, predicted changes in STEM engagement from one day to the next (Rosenthal et al., 2011). Indeed, researchers found that PIC on one day predicted higher levels of motivation in STEM in subsequent days (London et al., 2011).

While this work speaks to the impact of PIC on STEM engagement, there is also evidence that PIC might impact overall well-being and even academic outcomes. Settles (2004) found that women's perceived Gender-STEM incompatibility (i.e., *identity interference* in Settles, 2004) was related to lower levels of self-esteem and life satisfaction, and greater levels of depression. Moreover, this incompatibility was also related to poorer performance as a scientist, suggesting that identity incompatibility may ultimately affect women's academic performance (Settles, 2004). Other work has found similar evidence that PIC can affect academic outcomes. Ahlqvist and colleagues (2013) conducted a longitudinal study of undergraduate STEM women that included weekly experience sampling methodologies during the Spring semester of participants' Freshman year. Researchers found evidence that fluctuations in PIC (i.e., having an unstable sense of identity compatibility) were detrimental to one's belonging and academic performance in STEM fields, above and beyond the effects of PIC alone, confirming the importance of PIC for academic performance. Taken together, this emerging research suggests that identity compatibility may have debilitating effects on STEM engagement and may go on to impact academic performance.

Limitations of Past Work

Although researchers have established that PIC is predictive of STEM engagement outcomes and STEM achievement outcomes, there is still much to learn about how PIC operates. There are two key limitations of the extent literature on PIC that the present research aims to address over three studies. First, past work has focused most of its attention on undergraduate students, overlooking important questions about developmental processes prior to college and later experiences at more advanced career stages including graduate school. Second, although there is a great deal of research suggesting that PIC is related to engagement outcomes among STEM women, this work has used mostly non-experimental research methodologies, limiting one's ability to make causal inferences about the role of PIC. By addressing these limitations, the present studies help establish a more fully-formed version of the PIC model, a model that is, in many ways, still in its infancy.

Development of PIC. First, although much of the extant work on PIC has focused on undergraduate students, little is known about how recalled high-school experiences relate to later differences in identity compatibility. Many studies measure PIC at the beginning of college and demonstrate that it predicts outcomes in subsequent semesters (e.g., London et al., 2011; Rosenthal et al., 2011). However, it is unclear how some women arrive at college with high PIC while others arrive with lower PIC. Although there have been several studies that examine longitudinal or retrospective predictors of STEM engagement and academic success more broadly (Brainard & Carlin, 1998; George, 2000; Good et al., 2012; London et al., 2011), no work to date has examined how relevant, recalled experiences relate to undergraduate PIC. Given the importance of PIC for a host of later outcomes, the goal of Study 1 was to better understand which experiences recalled from adolescence might ultimately impact women's PIC upon entering college. Specifically, I focus on three distinct sets of predictors that have been shown to relate to STEM engagement among women and examine whether they predict PIC following high school: experiences with threat and bias, adult STEM support, and peer STEM models.

Methodological limitations of past research. A second limitation of the prior research on PIC is its exclusively non-experimental research methodology. While longitudinal studies are capable of shedding light on how PIC operates over time and in a real-world environment, they are also limited by their correlational nature, leaving researchers unable to make causal statements about the role of PIC. As described earlier, several findings from past research suggest that there is a strong relationship between PIC and STEM engagement outcomes. Some of this research has even employed longitudinal methodologies, allowing the introduction of temporality and giving researchers the ability to examine precursors to within-person change (London et al., 2011; Rosenthal et al., 2011). In spite of these successes, there are inherent limitations to non-experimental research methodologies, including third variable problems and an unclear direction of effects. For these reasons, this literature would benefit from a rigorously-designed, experimental study that can show the direct effect of PIC on STEM engagement outcomes. In this vein, Study 2 manipulates PIC in a controlled, laboratory setting in order to examine whether there is a true causal relationship between PIC and STEM engagement outcomes.

Advanced education. Finally, as reviewed earlier, the extant work on perceived identity compatibility has focused almost exclusively on women at the undergraduate level. Because of this, researchers know very little about the PIC of women who advance beyond the undergraduate level to graduate school, an important career stage that merits investigation in its own right. One possibility is that women who successfully advance to graduate school in a STEM field have achieved a substantial enough level of academic success within this non-traditional domain as to render PIC irrelevant to their further STEM engagement or academic success. On the other hand, as women advance to graduate school there is a further intensification of the dearth of women in the academic environment, possibly reintroducing concerns of belonging and experiences of gender marginalization. If the latter is the case, PIC may remain a critical predictor beyond college and might continue to impact women in graduate school. In Study 3, I address this limitation by examining whether PIC offers benefits for invested, successful STEM women who are enrolled in graduate school in a STEM field.

The Present Studies

Although past work on PIC suggests that it is a strong predictor of women's STEM engagement and academic success, many important dimensions of the PIC model have yet to be explored. Thus, the current project builds on this strong, but still fledgling work, by examining the development, causal effects, and sustained relevance of PIC among women. First, how is it that individuals come to have higher or lower levels of PIC by the time they begin college (Study 1)? In a retrospective study of both STEM and non-STEM students, I examine whether theoretically-relevant experiences prior to college (specifically, experiences with threat and bias, adult STEM support, and peer STEM models) predict perceived identity compatibility reported at the beginning of college. Next, building on the non-experimental work on PIC, Study 2 experimentally manipulates PIC in order to examine its effect on STEM engagement variables and the perceptions of a woman applying for a STEM job. Finally, although PIC has been established as an essential predictor for undergraduate STEM women, it is unknown whether identity compatibility would be important for women beginning graduate school in a STEM field, women who are presumably both successful and interested in STEM. Together, these three studies extend our knowledge of identity compatibility by A) identifying its developmental antecedents and outcomes (Studies 1 and 3) and B) establishing the direction of effects in a laboratory experiment (Study 2). Importantly, each of these steps is necessary before empirically-guided interventions designed to boost girls' PIC could be successfully developed or implemented.

Study 1

Although perceived identity compatibility has been shown to be a strong predictor of women's engagement and academic success in STEM fields upon arrival at college (Ahlqvist et al., 2013; London et al., 2011; Rosenthal et al., 2011), researchers have not examined whether women's recalled experiences from adolescence are correlated with their undergraduate PIC. This knowledge is important for several reasons. First, a great deal of evidence suggests that the transition from high-school to college coincides with a major loss of women in the STEM "pipeline" (Morgan, Gelbgiser, & Weeden, 2013; Office of Technology Assessment, 1985). For instance, while the numbers of girls and boys who leave high-school with a math background sufficient to further pursue a STEM field are comparable (approximately 220 girls to 280 boys), the number of girls who utilize this academic success by choosing a college STEM major is much smaller (approximately 44 girls to 140 boys) (Office of Technology Assessment, 1985). This is consistent with other work that suggests that girls who are academically successful in mathematics disproportionately choose non-math fields upon entering college (Ceci et al., 2009; Morgan et al., 2013). Because this large increase in the gender gap occurs during the high-school/college transition, it becomes important for researchers to examine experiences prior to college that may precede this decline in the pursuit of STEM fields.

Second, understanding the relationship between recalled experiences from adolescence and PIC may help illuminate the theoretical underpinnings of PIC. While researchers speak broadly of "incompatibility" between gender and STEM fields, it is not clear where this incompatibility lies. For example, do recalled experiences of explicit gender bias (e.g., “Engineering is a boys club”) more strongly correlate with perceived incompatibility than more subtle experiences (e.g., looking to one’s female classmates and seeing an emphasis on grooming and physical attractiveness)? Perhaps a daughter, upon reaching college, reconsiders her physicist mother as a role-model and ultimately reports higher PIC. We know very little about how this perceived identity compatibility (or incompatibility) is constructed. Identifying relevant developmental experiences can be informative for our understanding of PIC more broadly by shedding light on which factors might influence perceived compatibility.

Finally, by identifying specific developmental factors that are relevant to PIC, the present study offers the first insights necessary for developing targeted, empirically-driven interventions designed to protect or strengthen girls’ PIC. Demonstrating that high-school is an important stage in the development of PIC would be the first step in suggesting that interventions are appropriate for this developmental stage. Moreover, by identifying factors that are related to PIC, future researchers will have specific, theoretically-driven factors upon which they can focus interventions.

Drawing from the literature on STEM engagement and academic success more broadly, Study 1 focuses on several recalled factors that might be related to girl’s PIC upon entering college. While there are likely numerous developmental variables that are relevant to PIC, the present study focuses on three sets of predictors: experience with threat and bias, adult STEM support, and peer STEM models. Although many of these factors are known predictors of girls’ STEM engagement more broadly, the present study examines one possible mechanism, PIC, by which these known predictors come to influence STEM engagement.

Experience with Threat and Bias

The first set of predictors focus on experiences with threat and bias as correlates of impaired identity compatibility. Historically, women have been discouraged or even forbidden from taking advanced science courses or working in scientific laboratories (Weisgram & Bigler, 2006). Although sanctioned, structural barriers like these are no longer common in the United States, more subtle forms of gender discrimination persist and contribute to the gender gap in STEM fields (Kane & Mertz, 2012). For instance, a Massachusetts Institute of Technology (1999) task force found that female faculty members in the sciences were paid less, given less lab space, and promoted less often than their male colleagues, disparities that were significantly greater in STEM fields than other fields. This is consistent with experimental studies of gender bias, which find that, given equal qualifications, women are more poorly evaluated as job candidates for male sex-typed jobs (Davidson & Burke, 1994) like jobs in the STEM fields. A recent study found that even research scientists, whose careers are defined by the ability to evaluate empirical data on its own accord, are more likely to give a negative review to a female job candidate applying for a science lab manager position than a male job candidate, even given identical credentials (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012).

Unfortunately, examples of threat and bias like these affect not only women at the highest levels of advancement, but girls as young as elementary school as well. While adult women are more likely to experience subtle forms of threat and bias than overt statements of sexism, it is not uncommon for adults to make explicitly gendered statements to children. For example, when parents talk to their children about gender-appropriate activities, they often identify gender-atypical behaviors (e.g., “that’s for boys, not girls”) and affirm their children’s gender-stereotyped statements (e.g., child: “Lipstick is for girls,” parent: “that’s right;” Gelman, Taylor, & Nguyen, 2004).   Importantly, other work has suggested that explicit statements about gender stereotypes, like these, have the potential to negatively impact children’s task persistence on a novel task (Cimpian, 2010), a process that would likely occur on gender-typed tasks, such as math. Parents do believe that science is more difficult and less important for girls than boys (Andre, Whigham, Hendrickson, & Chambers, 1999; Tenenbaum & Leaper, 2003). Even teachers seem to rate girls’ math ability as lower despite no differences in actual performance (Dickhauser & Meyer, 2006). To avoid complications, she never kept the same address. In conversation, she spoke just like a baroness (Mercury, May, Deacon, & Taylor, 1974). Biases like this might partly explain why teachers tend to interact more with boys than girls during math classes (Duffy, Warren, & Walsh, 2001; Jungwirth, 1991).   Importantly, these experiences with gender bias have negative consequences for girls, predicting lower commitment to STEM fields (Litzler, Lange, & Brainard, 2005) and a reduced understanding of class material and career preparation (Whitt, Edison, Pascarella, Nora, & Terenzini, 1999). Society-wide gender biases even seem to explain cultural differences in the gender gap in science from country to country (Kane & Mertz, 2012).

Just as experiences with threat and bias negatively affect women’s STEM commitment (Litzler et al., 2005), task persistence (Cimpian, 2010), and task performance (Muzzatti & Agnoli, 2007), women who recall experiences with threat and bias might be more likely to report lower gender-STEM identity compatibility as well.

Thus, one goal of the present study was to examine whether experiences with threat and bias in high-school, a time known for its divergence of STEM engagement, predict lower PIC among women entering college. To the extent that girls recall more experiences of gender-relevant threat and bias in high-school, I expected them to report lower levels of perceived identity compatibility upon entering college. Importantly, this builds on past work by demonstrating one possible mediating mechanism, PIC, by which threat and bias negatively affect other STEM engagement outcomes, like STEM interest or self-efficacy.

Adult STEM support

While experiences with threat and bias may negatively impact girls in a number of ways, including possibly harming their PIC, research from the stress and coping literature suggests that social support from close others can mitigate the negative effects of stressors like threat and bias (Dunkel-Schetter, Folkman, & Lazarus, 1987). For this reason, in addition to examining experiences with threat and bias, I also examine the role of support from important adult authority figures, i.e. *adult STEM support*. Social support, which includes emotional support, affirmation, and assistance (Thoits, 1986; Wills, 1985), is known to be an important resource for stress and coping broadly (Dunkel-Schetter et al., 1987) and seems to be important for girls' educational and STEM success as well (London et al., 2011; Rosenthal et al., 2011). Social support from both within the academic environment (e.g., teachers or advisers) and outside the academic environment (e.g., parents and close family) seem to serve as important socializing agents in determining which fields of study girls pursue (Rosenthal et al., 2011). Because parents and teachers both have the potential to serve as role models, communicators of cultural expectations or stereotypes, and authority figures, both parents and teachers are discussed as possible sources of adult STEM support.

One of the factors found to be uniquely relevant to the development of adolescents' career interests is parental support (Ferry, Fouad, & Smith, 2000; Lapan, Hinkelman, Adams, & Turner, 1999). For example, research has shown that parental encouragement has significant effects on self-efficacy, outcome expectations, and math and science career interests among middle school adolescents (Ferry et al., 2000). Parents' beliefs about whether their daughters should have a gender-typical career are significantly correlated with their daughters' actual gender-typed career nearly 10 years later (Chhin, Bleeker, & Jacobs, 2008). Mother's expectations for their daughters' success in STEM fields during adolescence have been found to predict girls' STEM self-efficacy during adolescence and, nearly seven years later, their adult child's STEM self-efficacy (Bleeker & Jacobs, 2004). Moreover, while mothers' perceptions had a strong effect among girls' later STEM self-efficacy, it had only a small effect on boys' self-efficacy, confirming the relevance of parental support for girls specifically. As discussed earlier, similar patterns of effects are found when researchers examine the role of teachers' influence on girls. Teachers seem to rate girls' math ability as lower than boys' math ability, even in the absence of actual performance differences (Dickhauser & Meyer, 2006). Moreover, girls' self-perceived math abilities correlate more highly with these expectations than their actual math ability, demonstrating the powerful effect of expectations on self-perceptions (Dickhauser & Meyer, 2006).

Just as parents and teachers have the potential to negatively impact girls' STEM self-efficacy, there is evidence that these adult support figures can also play a positive role. For instance, Rayman and Brett (1995) examined a number of factors that might be related to persistence in STEM majors among women and determined that both parental encouragement and career advice from faculty were key factors associated with persistence in science/math after leaving college. Sax (1996) conducted a 9-year longitudinal study that followed over 2,500 STEM women and examined which factors were most likely to predict women's post-graduate success in STEM. She found that parental encouragement was a key factor associated with women entering a STEM career. They went on to find that women's pursuit of science, math, and engineering degrees was also positively related to having a mother who was a research scientist (Sax, 1996).

Just as teachers and parents are able to negatively affect women's STEM self-efficacy with low expectations (Litzler et al., 2005) or positively affect women's STEM persistence and interest with more encouragement (Sax, 1995), it is likely that adult STEM support is related to girls' gender-STEM identity compatibility as well. To the extent that women recall having had adults who encouraged their interest in STEM, it is likely that these women will be generally more receptive of STEM careers. Thus, one goal of the present study was to examine whether recalling more adult STEM support predicts higher PIC among women entering college. I predicted that girls who report more retrospective support from their teachers and parents during high-school would also have higher levels of perceived identity compatibility upon entering college. Moreover, by measuring both adult STEM support and experiences with threat and bias, I was be able to test whether the presence of adult STEM support moderates the negative effects of threat and bias, as suggested by the threat and coping literature.

Peer STEM Models

Authority figures, like parents and teachers, are likely not the only ones influencing adolescents or their identity compatibility. As children age into adolescence, peer relationships become increasingly important as agents of socialization (Goodenow & Grady, 1993) and likely play a role in influencing one's level of identity compatibility. Importantly, because parent-child relationships are in many ways asymmetrical (e.g., differences in power), socialization by peers, where there is more parity of status, is in many ways qualitatively distinct from socialization by adults (Harris, 1995; MacCoby, 1990). Girls and boys overwhelmingly interact with same-sex peers more frequently than opposite-sex peers (Maccoby & Jacklin, 1987; Maccoby, 1998; C. L. Martin & Fabes, 2001), a dynamic that creates opportunity for gendered norms to be self-reinforced. Peer relationships are important to the development of one's understanding of gender broadly (Maccoby, 1998; Martin & Fabes, 2001) and likely for one's understanding of the gendered-nature of different academic and career paths, like STEM fields.

Past work has demonstrated that peers have an important impact on adolescents' interest in science. Research has found that peers' interest in science is related to interest in science careers (Jacobs, Finken, Griffin, & Wright, 1998), choosing to enroll in science courses (Kelly, 1988), enjoyment of science (Simpson & Oliver, 1990), and expectations of a possible future self as a scientist (Stake & Nickens, 2005). Moreover, while the correlational nature of these findings makes it impossible to determine the direction of effects (i.e., whether one's interest in science leads one to seek out like-minded friends or whether one's science-oriented friend kindles one's interest in science), there is evidence that individuals are in fact influenced by the interests of their peers over time (Ryan, 2000).

While the evidence seems to suggest that peer support for science predicts later science outcomes, it is importance to note that there are differences in the rates at which boys and girls report this peer modeling. Kelly (1988) found that girls reported fewer friends with science interests than did boys. This gender difference was found in other work in the form of girls having fewer conversations about science with their friends and engaging in fewer science activities outside of school with their friends (Kahle & Lakes, 1983).

Because adolescents look increasingly to their peers as role models, it makes sense that peers may become an important source of information for gendered norms. If one's same-gendered peers are interested in science and technology, adolescents may come to understand the nature of STEM careers as either gendered or gender-neutral. I reason that the presence of female friends who are interested in science will serve to remove the psychological barrier that separates one's girl or woman identity from one's possible future self as a scientist, ultimately resulting in better identity compatibility. This is consistent with past work that has found that having friends with STEM interests is predictive of positive STEM outcomes among girls (e.g., Stake and Nickens, 2005). Importantly, the present study builds on this past work by illuminating one possible mechanism by which peers' interests ultimately influence one's STEM interest.

The Present Study

In the present study, individuals who had recently completed high-school completed two measures of identity compatibility prior to measures of three retrospective factors (experience with threat and bias, adult STEM support, and having peer STEM models) that may be related to identity compatibility upon beginning college. Participants also completed measures of academic self-efficacy (Elias & Loomis, 2000) and prior achievement (e.g., High-school GPA, SAT scores, etc) in order to control for general academic ability. I predicted that fewer experiences with bias, more adult STEM support, and having more peer STEM models would predict higher levels of perceived identity compatibility among women entering college.

Methods

Participants and Procedures

In order to explore the link between past experiences of bias and support in predicting PIC I recruited two groups of students: (a) college students with STEM and non-STEM interests, and (b) a diverse, more nationally-representative sample. In pursuit of this goal, 300 participants were recruited from two distinct populations, allowing for a wide range of perceived identity compatibility scores among study participants and a range of experiences prior to college.

The first pool of participants was drawn from the Stony Brook University Psychology Department's Subject pool. The subject pool is composed mainly of first year undergraduate students enrolled in Introductory Psychology. As a result, the students come from a wide-range of majors, including both STEM and non-STEM majors. The second group of participants was drawn from a non-University sample of 18-26 year old MTURK workers residing in the United States. MTURK is an online, crowd-sourced employee marketplace offered by Amazon.com, which allows workers to complete tasks online from around the world in exchange for payment. MTURK has recently become a popular research population in Social Psychology and has been found in several empirical studies to be a quality population from which to conduct research. Specifically, MTURK workers tend to be more diverse and nationally representative than traditional undergraduate population samples (Ipeirotis, Provost, & Wang, 2010; Mason & Suri, 2012; Paolacci, Chandler, & Ipeirotis, 2010) and MTURK samples demonstrate good test-retest reliability. Established social psychological phenomena, including the Stroop effect, availability bias, and risk aversion have been shown to replicate well on MTURK (Ipeirotis et al., 2010; Mason & Suri, 2012; Paolacci et al., 2010). Thus, the MTURK sample offers greater variability in socioeconomic background, ethnicity, and geographic location, allowing for greater generalizability to the national population.

Participants completed a series of retrospective surveys focusing on three sets of predictors: retrospective experiences with threat and bias, retrospective adult STEM support, and retrospective peer STEM models. Participants also completed several measures of retrospective academic achievement and demographic variables, including academic self-efficacy (Elias & Loomis, 2000), prior achievement (e.g., High-school GPA, SAT scores, etc.) and other sociodemographic factors.

Measures

Description of STEM fields. Participants were first given a brief explanation of the STEM acronym and a list of example fields that are widely considered STEM fields (e.g., chemistry, civil engineering, etc.) (See Appendix 3 for all study measures).

Current perceived identity compatibility.

Gender-STEM identity compatibility. The main dependent variable, PIC, was measured as in past work (e.g., Ahlqvist et al., 2013; London et al., 2011), with a pictorial measure representing the connection between participants' gender and STEM fields (adapted from Aron, Aron, and Smollan's (1992) inclusion of other in self scale). Importantly, although men and women both completed this measure, they were each asked to reflect on the compatibility of their own gender's compatibility with STEM. As a consequence, men and women effectively rated different targets of compatibility, with men rating the compatibility between *men* and STEM fields and women rating the compatibility between *women* and STEM fields. Participants selected a pair of progressively overlapping circles out of seven choices that best represented the compatibility between their gender and STEM fields. Participants completed five items, one representing gender overlap with each *science, technology, engineering, computer programming/coding,* and *math*. A mean score was computed from the five items (alpha = .93). Study means and standard deviations are presented in Table 1.

Woman-STEM trait overlap. Participants also completed a measure of Woman-STEM Trait Overlap (adapted from Hodges & Park, 2013) as a second form of perceived compatibility between women and STEM professionals. Participants rated whether 71 attributes (e.g., patient, decisive) were descriptive of a "typical" woman, and then later rated how descriptive those same attributes were of a "typical" STEM professional (order of presentation was cross-balanced). Previous work by Hodges and Park (2013) identified the target traits, including ones that are positive (11 traits per identity) and negative (10 traits per identity) for women (e.g., pleasant, weak), men (e.g., decisive, egotistical), and gender-neutral traits (e.g., adaptable, harsh). Participants also completed eight filler items (e.g., human; engineer) designed to assess task-attention.

Woman-STEM trait overlap was computed as the within-person correlation between the two identities for each trait across all traits. To the extent that participants find “match” or compatibility between the two identities, participants were expected to give a similar rating for the attribute on both identities (e.g., rating "hard-working" highly for both women and STEM professionals). To the extent that there was a mismatch between the two identities (i.e., lower identity compatibility), we would expect the ratings to be farther apart (e.g., rating STEM professionals as highly hard-working, but not women as hard working). Thus, higher, positive values indicated more identity compatibility (i.e., better woman-STEM trait overlap) and lower, negative values indicate less identity compatibility. Importantly for this measure of identity compatibility, men and women were both asked to reflect on the attributes of *women* and STEM professionals. As a consequence, men and women both rated the same target: the compatibility between *women* and STEM fields.

Retrospective time frame. Participants completed all retrospective measures in reference to high-school. Prior to the retrospective measures, participants were prompted to think about the time period (e.g., “think about what you were like in high-school”) and to write 3-5 sentences describing that time in their life (“e.g., which classes you took, the friends you spent time with, what you did after school, etc.”). Participants also indicated which years of school (e.g., 9^{th}- 12^{th} grades) made up high-school, and how old they were when they entered 9^{th} grade. Retrospective measures of threat and bias, adult STEM support, and peer STEM models were all completed in reference to this time period.

Retrospective experiences with threat and bias.

Detection of sex bias and discrimination. Participants completed 8 items from the detection of sex bias and discrimination subscale of the campus environment survey (Leonard & Ossana, 1987) designed to assess perceptions of gender bias in an academic environment. One item from the scale that refers to college recruitment was replaced with a math/science item from the full CES scale. Participants rated the extent to which they agreed with each statement (e.g., “Teachers usually referred to all people as “he” even if some of the people were women”) from 1 (strongly disagree) to 5 (strongly agree; alpha = .79).

Everyday discrimination scale. Participants also completed the everyday discrimination scale (Stucky et al., 2011), a measure designed to assess experiences with day-to-day discrimination, modified for the present study to refer to experiences in high-school math/science classes. Participants read 9 experiences with discrimination (e.g., You are treated with less respect than other people are) that may have occurred in their math/science classes and rated how often that experience occurred from never, less than once a year, a few times a year, a few times a month, at least once a week, or almost every day (alpha = .90).

Stereotype awareness. Participants completed the Mathematics as a Gendered Domain measure (Leder & Forgasz, 2002), which assess the extent to which others communicated the message that mathematics is a male- versus female-dominated, modified here refer to past experiences. Ten items (e.g., People thought that mathematics is easier for men than it is for women") were rated on a scale from 1 (strongly disagree) to 7 (strongly agree), five of which described math as male-dominated and five of which described math as female-dominated. Participants also completed a second set of ten items referencing science stereotypes (e.g., People thought that science is easier for men than it is for women,") resulting in four subscales total: science is male-dominated (alpha = .97), science is female-dominated (alpha = .93), math is male-dominated (alpha = .94), and math is female-dominated (alpha = .90)

Retrospective adult STEM support.

General support from adults. Participants completed 4 items on perceived social support from close others (modified from London et al., 2011 and Rosenthal et al., 2011). Participants rated how supportive their mother, father, siblings, and other close relatives were of them possibly pursing a STEM career on a scale from 1 (very unsupportive) to 7 (very supportive) with a *not applicable to me* option. A mean score of all items was computed to create a composite scale of family support (alpha = .87).

Parent's attitudes about math/science. The Fennema-Sherman Mathematics Attitudes (FSMA) scales are among the most widely used measures of attitudes and their relation to mathematics achievement (Fennema & Sherman, 1976). The FSMA mother and father subscales measure the extents to which mothers and fathers support and value the study of math. Father/Mother subscale reliabilities from past work (Mulhern & Rae, 1998) were averaged and the three highest loading items from both positive- and reverse-coded directions were selected, resulting in 6 items used in the present study. Participants rated how much they agreed with six statements referencing each their mother and their father and math and science (e.g., My father has strongly encouraged me to do well in mathematics) on a scale from 1(strongly disagree) to 5 (strongly agree), 24 items in total. Items were averaged into two subscales: father's support of math/science (alpha = .90) and mother's support of math/science (alpha = .94).

Teacher math and science support. Participants also completed the teacher subscale (short form) from the FSMA, six items designed to assess teachers' expectations of students' ability in each math and science (e.g., My math teachers made me feel I had the ability to go in mathematics), scored from 1 (strongly disagree) to 5 (strongly agree). Two subscales were created: math teachers' support (alpha = .89) and science teachers' support (alpha = .89).

Parents' careers. Finally, participants indicated whether their mother and father (or guardian/s) had jobs in a STEM field or non-STEM field and described what job they held in an open-ended format.

Retrospective Peer STEM models.

Belonging with math and science peers. The Institutional Belonging Scale (Tyler & Degoey, 1995) assesses feelings of fit and comfort within a community. Participants completed six statements that referred to peer relationships developed in their high-school math and science courses (e.g., There were many people in my math/science classes who I thought of as good friends) on a scale from 1 (strongly disagree) to 7 (strongly agree), forming two subscales: belonging with math peers and belonging with science peers (alpha = .91).

Friends' attitudes towards STEM. The friends' attitudes towards science scale is designed to assess the extent to which one's close friends enjoy STEM (Talton &

Simpson, 1985). Participants reflected on their friends from the past and then indicated how much they agreed with nine items (e.g. My best friend liked science) on a scale from 1 (not at all true) to 7 (very true), forming three subscales: best friend's attitudes towards math/science (4 items; alpha = .81), extended friends' attitudes towards math/science (3 items; alpha = .85), and extended friends' attitudes towards computer science/engineering (2 items; alpha = .85).

Peer acceptance of STEM. The social coping questionnaire was designed to identify a variety of coping strategies academically-gifted adolescents might utilize to get along with their peers (Swiatek, 1995). In the present study, items were modified to refer to math and science ability rather than general academic giftedness. In order to reduce the number of items administered and increase the measures' construct validity, only items with high factor loadings (≥ .50) in published work were administered. The Peer Acceptance subscale (3 items) assesses the impact of math and science abilities on social interactions (e.g., I would have fit in better at school if I hadn't been so good at math; reversed). Participants rated their agreement with each item on a scale from 1 (strongly disagree) to 7 (strongly agree) in reference to both math (3 items) and science (3 items), resulting in a peer acceptance of math subscale (alpha = .96) and a peer acceptance of science subscale (alpha = .97).

Descriptive information on close friends. Finally, participants answered several questions about the make-up of their friends during adolescence, including the proportion of closer friends who were girls/boys, the proportion of their close friends who had interests in STEM, and how frequently they saw their friends who had STEM interests.

Additional Predictors. Participants also completed several more general measures of academic success and demographics, including their high-school GPA, their ethnicity, parents' education, family income, and their immigrant status, as possible control variables.

General academic self-efficacy. Participants completed five items (e.g., I could do even the hardest work in my classes if I tried) measuring math/science self-efficacy (Elias & Loomis, 2000) scored on a scale from 1 (not at all true) to 5 (very true; alpha = .94).

Results

Attention Checks

As described above, as participants completed the woman-STEM trait overlap measure, they were presented with several attention checks. These included having to correctly identify *women* as "female" and "human" but not "male," and "scientist" as a kind of *STEM professional*, 14 attention checks total. Each item response was then computed as either correct (dummy code = 0) or incorrect (dummy code = 1) and then entered together in a k-means cluster analyses that requested two clusters. Effectively, this cluster analysis provided a rigorous, statistical procedure to formally determine differences in paying attention on the task, yielding one cluster that had low rates of attention and one cluster that had high rates of attention. The cluster analysis on the attention checks examined 342 participants and identified a total of 41 participants that did not pay attention (12.0%). Participants in this later cluster were removed from the study. Similar rates of inattention and removal were found in the MTURK (13.1%) and SBU samples (11.2%). Follow-up analyses confirmed that the participants identified by the cluster analysis as paying less attention spent less time on the study and had poorer reliability across measures, supporting that the cluster analysis correctly identified participants who were paying less attention. Of the 301 participants remaining, one participant was identified as having completed the study twice, and their second set of responses were removed. Thus, 300 participants (40.0% male) were included in the present study. The population was composed of samples from both MTURK (41.7%) and the SBU Psychology subject pool (58.3%), and was mostly White (55.0%) or Asian (30.0%), but also included African Americans (6.0%), Hispanics (5.3%), and other groups (3.7%).

Means and standard deviations for all study variables are presented in Table 1. A set of independent t-tests compared the MTURK and SBU Subject pool sample demographics and found that the SBU sample was significantly more likely to be female (MTURK: $M = .53$, $SD = .50$; SBU: $M = .65$, $SD = .48$; $p = .031$), enrolled in college (MTURK: $M = 1.74$, $SD = .54$; SBU: $M = 1.99$, $SD = .13$; $p < .001$), report a higher high-school grade point average (MTURK: $M = 87.18$, $SD = 10.76$; SBU: $M = 91.63$, $SD = 5.38$; $p < .001$), was more likely to be from a foreign country (MTURK: $M = 1.04$, $SD = .23$; SBU: $M = 1.29$, $SD = .61$; $p < .001$), and more likely to have learned English as their second language (MTURK: $M = .04$, $SD = .20$; SBU: $M = .33$, $SD = .47$; $p < .001$). Significant differences were not detected for parents' education (MTURK: $M = .04$, $SD = .20$; SBU: $M = .33$, $SD = .47$; $p = .44$) or family income (MTURK: $M = .04$, $SD = .20$; SBU: $M = .33$, $SD = .47$; $p = .48$). In order to account for any group differences, the sample group (i.e., MTURK or Stony Brook Subject Pool) was controlled for in all analyses unless otherwise noted. Analyses by sample group revealed similar patterns across the two samples, supporting the decision to combine the two samples.

Gender Differences in PIC and Past Experiences

Women were expected to report lower PIC than men on all measures of PIC (Gender-STEM PIC and Woman-STEM trait overlap), more experience with threat and bias, lower adult STEM support, and fewer peer STEM models. A series of basic t-tests compared men and women on each of these variables. Women had significantly lower Gender-STEM PIC than men, $t(298) = 4.87$, $p < .001$, consistent with predictions. However, women also reported significantly higher Woman-STEM trait overlap than men, $t(294) = -4.92$, $p < .001$. No gender differences were detected for detecting bias, $p = .95$, or the four stereotype awareness subscales: science is male-dominated, $p = .11$, math is male-dominated, $p = .46$, science is female-dominated, $p = .07$, or math is female-dominated, $p = .42$. Contrary to predictions, women reported significantly lower levels of daily discrimination than men, $t(298) = 2.15$, $p = .032$.

No gender differences were detected for general support from adults, $p = .65$, dad's attitudes about math/science, $p = .79$, mom's attitudes about math/science, $p = .74$, math teachers' support, $p = .78$, science teachers' support, $p = .61$, having a dad with a STEM career, $p = .10$, or having a mom with a STEM career, $p = .81$.

For peer variables, significant gender differences were detected in the gendered-nature of close friendships, with women reporting significantly more female friends than men, $t(298) = -9.77$, $p < .001$, and significantly fewer male friends than men, $t(298) = 9.59$, $p < .001$. Women did not significantly differ from men in the number of friends with STEM interests, $p = .65$, extended friends' attitudes towards math/science, $p = .85$, belonging with math peers, $p = .50$, or belonging with science peers, $p = .37$. However, relative to women, men reported having a best friend with significantly more positive attitudes towards math/science, $t(298) = 3.76$, $p < .001$, and extended friends with significantly more positive attitudes towards computer science/engineering, $t(298) = 3.61$, $p < .001$. Conversely, women reported significantly higher levels of peer acceptance of math, $t(298) = -3.36$, $p = .001$, and peer acceptance of science, $t(298) = -3.44$, $p = .001$, than did men.

Relationship between Predictors

For the purposes of examining broad relationships between the predictor variables (e.g., whether experiences of threat and bias were negatively related to adult STEM support) prior to more detailed analyses, composite variables were created for each set of predictors. Each continuous variable was standardized (after being reverse-scored, if necessary) and averaged, producing a single composite score for threat and bias, adult STEM support, and peer STEM models; categorical variables were excluded. Partial correlations (controlling for group and general academic self-efficacy) between these predictor variables found that threat and bias was negatively correlated with adult STEM support ($r = -.35$, $p < .001$) and having peer STEM models ($r = .30$, $p < .001$). Adult STEM support and peer STEM models were positively correlated with one another ($r = .37$, $p < .001$).

Data Plan

In order to identify general predictors of PIC across both men and women, I first present the overall partial correlations between the individual predictor variables and the two forms of PIC. Next, consistent with my focus on women's experiences, I present the partial correlations for women only, in order to identify whether certain experiences recalled from high-school are especially relevant to women's PIC. Next, in order to formally examine gender differences in these effects, for instance whether a certain predictor is related to women's PIC, but not men's PIC, I present a series of regressions predicting the two forms of PIC from the interactions between each predictor and sex. Finally, I briefly explore the interactions between these three sets of predictors. The partial correlations for the overall sample, men and women, and the significance of the predictor X sex interactions are presented in Tables 2 - 7. Results are presented for the two forms of PIC separately: Gender-STEM PIC and Woman-STEM Trait Overlap.

Gender-STEM PIC

Preliminary correlations. For Gender-STEM PIC, participants rated the compatibility of their *own* gender with STEM fields, such that men rated the compatibility of men with STEM while women rated the compatibility of women with STEM, effectively washing out the effects of the model when men and women are combined. Thus, the first sets of results are presented only for descriptive purposes. Partial correlations, controlling for group (MTURK or SBU Subject Pool) and general academic self-efficacy, were computed between each of the predictor variables and Gender-STEM PIC for the entire sample of participants (men and women). The six threat and bias predictors were partially correlated with Gender-STEM PIC: detecting bias, daily discrimination, stereotype awareness: science is male-dominated, stereotype awareness: science is female-dominated, stereotype awareness: math is male-dominated, and stereotype awareness: math is female-dominated. Of these threat and bias predictors, only stereotype awareness: math is female-dominated subscale ($r = -.13$, $p = .024$) and stereotype awareness: science is female-dominated subscale (*r* = -.17, *p* = .004) were negatively correlated with Gender-STEM PIC, such that exposure to the stereotypes that Math and Science are female-dominated domains predicted lower Gender-STEM PIC across men and women.

A partial correlation analysis was conducted between the seven Adult STEM support predictors and Gender-STEM PIC: general support from adults, dad's attitudes about math/science, mom's attitudes about math/science, math teachers' support, science teachers' support, having a dad with a STEM career, and having a mom with a STEM career. None of the adult STEM support predictors were significantly correlated with Gender-STEM PIC across men and women.

A partial correlation analysis was conducted between the ten Peer STEM model variables and Gender-STEM PIC: belonging with math peers, belonging with science peers, best friend's attitudes towards math/science, extended friends' attitudes towards math/science, extended friends' attitudes towards computer science/engineering, peer acceptance of math, peer acceptance of science, number of friends are girls, number of friends who are boys, and number of friends with STEM interests. Of the Peer STEM Model predictors, extended friends' attitudes towards computer science and engineering subscale (*r* = .13, *p* = .023), number of friends with STEM interests (*r* = .12, *p* = .036), and number of friends who were boys (*r* = .16, *p* = .005) were all positively correlated with Gender-STEM PIC. Number of friends who were girls (*r* = -.16, *p* = .007) was negatively correlated with PIC, consistent with gender differences in the gendered-basis of friendships. Taken together, there were few successful predictors of Gender-STEM PIC across both genders, with the effects that did emerge being quite small.

Correlations for women only. A partial correlation analysis, again controlling for group and general academic self-efficacy, examined the relationships between the predictors and PIC for women only. Of the threat and bias predictors, detection of sex bias and discrimination (r = .21, p = .006) was positively correlated with Gender-STEM PIC, while stereotype awareness: science is female-dominated subscale was negatively correlated with Gender-STEM PIC (r = -.15, p = .045); both findings were counter to predictions. Of the adult STEM support variables, teacher math support was negatively correlated with PIC (r = -.19, p = .011), contrary to predictions. However, having a dad who works in a STEM field was positively correlated with PIC (r = .20, p = .012). Finally, of the Peer STEM model predictors, extended friends' attitudes towards computer science and engineering (r = .16, p = .031) and number of friends with STEM interests (r = .18, p = .015) were positively related to Gender-STEM PIC, consistent with predictions. Taken together, several findings were counter to predictions, including the prospects that exposure to discrimination could improve PIC while teachers' support for math could undermine it. The findings of peer STEM models were more consistent with predictions, such that having friends interested in STEM was correlated with higher Gender-STEM PIC; however, these effects were quite small.

Interactions between gender and predictor. A series of stepwise multiple regressions predicting Gender-STEM PIC examined the interaction between sex and each of the three sets of predictor variables (experience with threat and bias, adult STEM support, and peer STEM models) and controlling for group and academic self-efficacy examined whether the effects of the predictor variables on PIC would be weaker for men, as indicated by a significant interaction between gender and the three predictor variables.

Of the threat and bias predictors, only detecting bias significantly interacted with gender (*B* = .57, *p* = .006), such that for women, detecting bias was related to increased PIC, while for men, detecting bias was related to decreased PIC, contrary to predictions. Of the adult STEM support predictors, teacher math support (*B* = -.51*, p* = .015) and teacher science support (*B* = -.54*, p* = .009) each significantly interacted with gender such that for women, teacher support predicted lower PIC, while for men support was unrelated or somewhat positively related to PIC. Of the Peer STEM model variables, best friend's attitudes towards math/science significantly interacted with gender (*B* = .42*, p* = .042) such that women reported higher levels of PIC when their best friend had more positive attitudes towards math/science, while for men, PIC was unrelated to best friend's attitudes towards math/science, consistent with predictions.

Interactions between predictors among women. Finally, in order to examine the relationship between these predictors more broadly (e.g., if threat experiences were buffered by adult STEM support), exploratory analyses examined the interaction of the three main predictors among women, utilizing the composite scores created earlier (e.g., the overall level of threat and bias reported across measures). A series of stepwise multiple regressions predicting Gender-STEM PIC examined the three, two-way interactions between the composite predictor variables (experience with threat and bias, adult STEM support, and peer STEM models) controlling for group, academic self-efficacy, and the main effects of the two predictor variables. Experience with threat/bias did not interact with adult STEM support (*p* = .44) or peer STEM models composite (*p* =

.27). Similarly, no interaction was detected between adult STEM support and peer STEM models ($p = .21$).

Woman-STEM Trait Overlap

Preliminary correlations. In the case of Woman-STEM trait overlap, both men and women were asked to reflect on the compatibility of women and STEM professionals, making it appropriate to combine men and women in the first set of analyses. Of the threat and bias predictors, everyday discrimination ($r = -.15$, $p = .010$), stereotype awareness: math is male-dominated subscale ($r = -.19$, $p = .001$), and stereotype awareness: science is male-dominated subscale ($r = -.26$, $p < .001$) were all negatively related to woman-STEM Trait Overlap such that, consistent with hypotheses, discrimination and stereotype exposure were related to perceiving less overlap between the traits possessed by Women and STEM professionals. Of the adult STEM support predictors, support from adults ($r = .15$, $p = .012$) and Mother's attitudes towards math and science ($r = .18$, $p = .003$) were positively correlated with Woman-STEM Trait Overlap, consistent with hypotheses. Finally, of the Peer STEM model predictors, belonging with math peers ($r = .19$, $p = .001$), belonging with science peers ($r = .23$, $p < .001$), extended friends' attitudes towards computer science and engineering ($r = .12$, $p = .042$), peer acceptance of math ($r = .24$, $p < .001$), peer acceptance of science ($r = .22$, $p < .001$), and number of friends who are girls ($r = .25$, $p < .001$) were all positively correlated with Woman-STEM Trait Overlap. Number of friends who are boys ($r = -.21$, $p < .001$) was negatively correlated with Woman-STEM Trait Overlap. These results were consistent with hypotheses, again with the caveat that the effects of gendered friendships should be interpreted with caution when analyses include both men/women.

Taken together, there was evidence that all three sets of predictors were somewhat related to Women-STEM Trait Overlap, with the effects of Peer STEM Support being the strongest and the most consistent across individual predictors.

Correlations for women only. Of the threat and bias predictors, stereotype awareness: math is male-dominated (r = -.17, p = .002) and stereotype awareness: science is male-dominated (r = -.22, p = .004) were both negatively correlated with Woman-STEM Trait Overlap, consistent with predictions. Of the adult STEM support predictors, Mother's attitudes towards math and science (r = .31, p < .001) was positively correlated with women's Woman-STEM trait overlap, consistent with predictions. Conversely, having a father with a job in a STEM field was negatively correlated with women's Woman-STEM trait overlap (r = -.16, p = .045). Finally, of the Peer STEM model predictors, belonging with math peers (r = .19, p = .013), belonging with science peers (r = .23, p = .002), peer acceptance of math (r = .30, p < .001), peer acceptance of science (r = .23, p = .002), and having more female friends (r = .17, p = .026) were all positively correlated with Woman-STEM trait overlap. These were all consistent with predictions with the exception of the relationship between number of female friends and PIC, which ran counter to predictions. Taken together, there was some support for the roles of threat and bias and of parents' support in PIC, while peer STEM models appeared to be the strongest and most consistent predictor.

Interactions between gender and predictor. None of the threat and bias predictors significantly interacted with gender to predict trait overlap. Of the adult STEM support variables, Mother's attitudes towards math and science (B = .07, p = .038) significantly interacted with gender such that for women, having a mother with more positive attitudes towards math science was related to greater trait overlap, while for men, mother's attitudes were unrelated to trait overlap. Of the Peer STEM model variables, peer acceptance of math (B = .07, p = .031) significantly interacted with gender such that for women, higher peer acceptance of math was related to higher trait overlap, while for men, peer acceptance of math was unrelated to trait overlap.

Interactions between predictors among women. Finally, in order to explore the relationship between these predictors more broadly, exploratory analyses examined the interaction of the three main predictors among women, again controlling for group, academic self-efficacy, and the main effects of the two predictor variables. A significant interaction was detected between experiences with threat/bias and adult STEM support (B = -.05, p = .003) and between threat/bias and peer STEM models (B = -.05, p = .006), such that only women who reported *both* low threat and high adult support/better peer STEM models reported higher levels of Woman-STEM trait overlap. The interaction between adult STEM support and peer STEM models failed to achieve significance (p = .076), but trended towards an effect such that having both high adult STEM support and better peer STEM models was related to higher Woman-STEM trait overlap.

Discussion

Study 1 offers the first empirical examination of how recalled experiences from adolescence correlate with undergraduate perceived identity compatibility. It was expected that threat and bias would be negatively related to PIC while adult STEM support and peer STEM models would be positively related to PIC, and that these findings would be consistent across both Gender-STEM PIC and Woman-STEM trait overlap. After completing measures of perceived identity compatibility, participants were asked to retrospectively report on their experiences with threat and bias, adult STEM support, and peer STEM models. Participants completed two measures of PIC, Gender-STEM PIC and Woman-STEM trait overlap, which yielded distinct results.

For Gender-STEM PIC, threat and bias were generally unrelated to PIC. However, there was some evidence that detecting sex bias was actually related to higher PIC among women, contrary to predictions, although this correlation was very small. Similarly, adult STEM support was mostly unrelated to Gender-STEM PIC, with the exception that teacher's math support actually predicted lower PIC among women, contrary to predictions, a correlation that was also very small. Finally, peer STEM models were more consistently related to PIC among STEM women, with both friends' attitudes towards computer science/engineering and number of friends with STEM interests positively predicting women's Gender-STEM PIC, consistent with predictions. Similarly, a significant interaction found that best friend's attitudes toward math/science was related to higher PIC for women, but was unrelated to men's PIC. While these findings were more consistent across measures and consistent with predictions, the correlations of peer STEM models were also small. Taken together, there was generally little evidence that retrospective recalled threat and bias or adult STEM support were predictive of Gender-STEM PIC, with a few findings counter to predictions and correlations generally being small. The effects of peer STEM models were consistent with predictions and consistent across predictors, but these correlations were also small. Thus, it seems that Gender-STEM PIC was generally difficult to predict in the present sample.

In contrast, Woman-STEM trait overlap exhibited both stronger patterns of effects and effects that were consistent with hypotheses. Generally, there was evidence that exposure to the stereotypes that math/science are male-dominated negatively impacted Woman-STEM trait overlap among both women and men. This is consistent with other work which suggests that exposure to stereotypes may undermine women's interest in STEM (e.g., Kane & Mertz, 2012; Litzler et al., 2005.) Moreover, gender did not interact with threat and bias in predicting trait overlap, suggesting that exposure to negative stereotypes about women's STEM abilities affects both women's and men's construction of STEM stereotypes about women. Adult STEM support was broadly predictive of trait overlap both across men and women and for women specifically. Follow-up analyses found that mother's attitudes about math/science also predicted higher Woman-STEM trait overlap among women, but was unrelated to men's Woman-STEM trait overlap. This is consistent with prior research that suggests that same-gendered role models are especially important models of gender-appropriate behavior (Beilock, Gunderson, Ramirez, & Levine, 2010; Bussey & Bandura, 1984). Interestingly, having a father in a STEM field was related to women reporting lower Woman-STEM trait overlap. This may be because women with STEM fathers have increased exposure to the STEM world, complete with its fewer women and negative stereotypes about women's abilities. Moreover, having a father, a male-role model, in a STEM field may reinforce the gendered-nature of STEM fields more broadly (Gunderson, Ramirez, Levine, & Beilock, 2012).

Finally, findings again supported the importance of peer STEM models for women's trait overlap. A number of Peer STEM model predictors were related to increased trait overlap among women. Both belonging with math/science peers and peer acceptance of math/science were positively correlated with women's trait overlap . Moreover, a significant interaction with gender revealed that while higher peer acceptance of math was positively related to women's trait overlap, peer acceptance was unrelated to PIC among men, again confirming the value of same-gendered role models. These findings were both consistent with predictions and stable across predictors, supporting the importance of peer STEM models for women specifically.

Differences in the Two Forms of PIC

Although Gender-STEM PIC and Woman-STEM trait overlap were initially intended to be similar measures of PIC, results across the two measures of PIC were distinct from one another, with Gender-STEM PIC predicting little, but Woman-STEM trait overlap exhibiting more reliable effects. Because this is the first study to employ the two measures together, it is not entirely clear what may have caused these distinctions. One possibility is an asymmetry in the target that each form of identity compatibility assessed. Participants completing the measure of Gender-STEM PIC were asked to reflect on their own gender's compatibility with STEM, such that men rated the compatibility of men with STEM, while women rated the compatibility of women with STEM. However, participants completing the measure of Woman-STEM Trait Overlap were all asked to reflect on the compatibility of *women* with STEM professionals, regardless of their own gender. This asymmetry in the target being rated may have affected the comparability of the two measures. If participants had also been asked to rate the trait overlap of men with STEM professionals, this asymmetry would allow for more direct comparisons between the two forms of PIC.

A second possible reason for the differences in the two forms of PIC may be differences in the face validity of the two self-report measures. Gender-STEM PIC has high face validity, such that participants answering the item can easily identify the quality the question is trying to assess. However, this is not the case for Woman-STEM trait overlap. Indeed, participants likely did not realize that their ratings of traits about women would be compared to their ratings of traits about STEM professionals. Although face validity can be an asset to researchers, in studies about bias or discrimination, having such overt, straightforward self-report measures can lead participants to give socially-desirable responses (e.g., Fazio & Olsen, 2003). In this case, that might include expressing strong gender-STEM compatibility in congruence with society's egalitarian ideals (e.g., Dovidio & Gaertner, 2010) and, for women especially, the desire to reject the notion of personal mistreatment based on gender (e.g., Taylor, Wright, Moghaddam, & Lalonde, 1990). Indeed, it is interesting that stronger relationships were detected between the predictor variables and the more subtle measure of Woman-STEM trait overlap. Although the measure itself was long and difficult to calculate, it may offer an advantage by providing a more subtle measure of how participants think about Women as STEM professionals.

The Importance of Peer Role Models

The present study offers further support that peer role models are important for the development of STEM interests among girls. As adolescents look increasingly to their peers as role models, it makes sense that peers may increasingly become a source of information for gendered norms (Goodenow & Grady, 1993). To the extent to which their typically same-gendered peers are interested in science and technology, adolescents may come to understand the nature of STEM careers as either gendered or more gender-neutral. The findings here are consistent with the possibility that the presence of female friends who are interested in science may serve to remove the psychological barrier that separates one's female identity from the identity of "mathematician" or "programmer," ultimately resulting in better identity compatibility. This is consistent with past work which has found that peer STEM support is predictive of positive STEM outcomes among girls (e.g., Stake and Nickens, 2005). Importantly, it builds on this past work by illuminating one possible mechanism by which this phenomenon occurs. Researchers should further pursue the role of peers as socializing agents in the development of girl's STEM interests in adolescence. Study 2 sought to examine whether manipulating PIC can effectively change women's STEM sense of belonging.

Study 2

Once women reach the college level, individual differences in PIC are known to have a powerful impact on their STEM engagement and academic success (e.g., Ahlqvist et al., 2013; Good et al., 2012; London, Rosenthal, et al., 2011, Settles et al., 2009). As described above, undergraduate women who perceive less compatibility between their gender and their STEM identity have lower sense of belonging, confidence, and motivation in STEM fields and may ultimately have poorer performance as a scientist (London et al., 2011; Rosenthal et al., 2011; Settles, 2004; Settles et al., 2009). Moreover, there is evidence that fluctuations in PIC (i.e., having an unstable sense of identity compatibility) may also be detrimental to one's engagement and academic performance in STEM fields, above and beyond the effects of PIC alone (Ahlqvist et al., 2013). Despite the promise and consistency of these findings, these prior studies are limited by their non-experimental research methodologies. While longitudinal studies are capable of shedding light on how PIC operates over time and in a non-laboratory environment, they are also limited by their correlational nature. Thus, Study 2 examined the experimental effect of PIC on several STEM engagement outcomes.

Limitations of Past Work

Although non-experimental methods are unable to demonstrate causal effects, several findings from past research suggest that there is a strong relationship between PIC and STEM engagement outcomes. Several studies have found evidence of a positive correlational relationship between PIC and sense of belonging in STEM (London et al., 2011; Rosenthal et al., 2011; Settles, 2004; Settles et al., 2009). For instance, London and colleagues (2011) found that on days when women had higher levels of PIC they also reported higher levels of sense of belonging and motivation in STEM. Moreover, levels of PIC upon entering college were positively related to interest in dropping out of one's major the following semester, demonstrating that PIC may play an important role in establishing belonging during transitional phases like the first year of college (London et al., 2011).   Similarly, other work has found that PIC upon entering college is positively related to women's sense of belonging in STEM in their second year in college (London et al., 2011).

Although these findings might be consistent with a causal effect of PIC, they are limited by the same problems of any correlational research, mainly third variable problems and unclear direction of effects. For instance, it is possible that some third variable, for instance perceiving less alienation in the environment on a given day, is responsible for both an increase in PIC as well as an increase in sense of belonging. It is not unreasonable that some other measure of belonging might impact both PIC and sense of belonging similarly, possibly producing a positive correlation between these two variables in the absence of a causal effect. Another concern is the unclear direction of effects. Although several studies find a correlation between PIC and belonging in STEM, one possibility is that having a higher level of sense of belonging results in perceiving one's gender and STEM as more compatible rather than the reverse.

While non-experimental studies are unable to examine causality, experience sampling methodologies, which gather within-person data repeated over time, allow the introduction of temporality, allowing researchers to determine whether the occurrence of one event or experience precedes some within-person change. By incorporating this temporal component, researchers are able to go beyond within-person insights and explore the temporal relationship between an experience one day and outcome variables on a following day. London and colleagues (2011) utilized these lag analyses to examine whether levels of PIC on one day predict belonging outcomes the following day. Results were moderately consistent with the predicted pattern: PIC on one day predicted motivation in STEM the following day, but was unrelated to STEM sense of belonging and insecurity.

Experimental Work Related to PIC

Although past research has not explicitly aimed to manipulate PIC in a laboratory experiment, there are several experimental studies that utilized manipulations that would be consistent with manipulations of identity compatibility. For instance Cheryan and colleagues (2009) found that manipulating gender-typical cues in a computer lab was related to women's interest in computer science. As described earlier, when surrounded by gender-neutral cues (e.g., water bottles, a nature poster) rather than masculine cues that are consistent with the stereotypical computer scientist (e.g., video games, a Star Trek poster), women expressed significantly higher levels of interest in majoring in computer science. Although PIC was not the explicit focus of this research, the changes employed in the manipulation are consistent with changing the gendered-nature of the environment, and thus may have affected participants' perceived compatibility between their gender and the environment.

Similarly, other work that manipulates whether STEM careers are presented as compatible or incompatible with female-typical communal goals have also been shown to improve women's feelings about science careers (Diekman, Clark, Johnston, Brown,

& Steinberg, 2011). Here, researchers manipulated whether gendered goals were presented as compatible with STEM careers, clearly relevant to PIC, by manipulating whether an entry-level scientist either a) engaged with others throughout the day and collaborated on work or b) worked independently. Although these studies are consistent with the theory of PIC, they were not explicitly designed to manipulate PIC and as a consequence did not measure PIC as part of a manipulation check. Thus, there is no extant evidence that PIC was in fact changed by the manipulations, making the present study necessary to understand the mechanism of this change.

Extending the PIC Model to Perceptions of Others

Much of the work on PIC has focused on self-perceptions -- whether one perceives one's own gender to be compatible with one's perceptions of STEM fields. While these self-perceptions are critical – after all, increasing the perceived compatibility between one's gender identity and one's STEM identity can have positive effects on motivation, confidence, achievement, and goal pursuit – increasing the perceived compatibility between women and STEM professionals may also have consequences for the perceptions of others. Thus, in addition to providing a necessary experimental test of PIC, Study 2 also aimed to extend past work on PIC by examining its relationship with the perceptions of other women in STEM.

Research on the success of women in professional capacities more broadly suggests that the perceived congruity between gender and career roles can impact perceptions of professional women (e.g., Davidson & Burke, 1994; Eagly & Karau, 2002; Gomez-Mejia, McCann, & Page, 1985). Broadly, men are preferred over women for male sex-typed jobs, while women are preferred over men for female sex-typed jobs, preferences that often result in biased job evaluations and salary decisions (e.g., Davidson & Burke, 1994). For instance, women are evaluated more positively in leadership positions that are defined by interpersonal management and conflict resolution (i.e., female sex-typed, communal skills), than in more advanced leadership positions that are marked by analyzing information and entrepreneurial abilities (i.e., male sex-typed, agentic skills; Eagly & Karau, 2002; Gomez-Mejia et al., 1985). When a job candidate is highly qualified for the position, bias is less likely to be a factor; however, when a target has only marginally acceptable or ambiguous qualifications, participants are more likely to make bias-driven recommendations even given otherwise identical credentials (e.g., Dovidio & Gaertner, 2000). As described earlier, a recent study demonstrated that even scientists seem to perceive a female STEM job applicant as less competent and hirable than a male applicant given identical qualifications, biases that were held equally by both male and female scientists (Moss-Racusin et al., 2012). One possibility is that this bias may be rooted in the perception that STEM fields are inconsistent with gender-norm prescriptions for women and consistent with gender-norm prescriptions for men (Eagly & Steffen, 1984).

Building on the notion that increasing PIC for an individual might change their global perceptions of the fit of other women in STEM, the present study also examined whether manipulating the gender/scientist compatibility of a job position would affect whether one view's another female candidate as hirable. Importantly, unlike other work that manipulates the nature of the job as communal vs. agentic by altering the hallmark tasks characterizing that position, the present study held all tasks characteristic of the job (e.g., data analyses, examining lab specimens) consistent across conditions, and manipulated only the compatibility of the position with female-typical communal goals.

The Present Study

The present study experimentally manipulated the perceived identity compatibility of an entry-level scientist position presented to study participants. Immediately following the manipulation, participants completed the Gender-STEM PIC measure. Men and women then completed several subjective measures of STEM engagement including sense of belonging in that position, the position's desirability, self-confidence in science, enjoyment of science, and value of science and technology. Next, participants reviewed the job application of an ambiguously-qualified female job applicant, applying for the position as an entry-level scientist described earlier. Finally, participants rated the traits of women and STEM professionals (presentation counter-balanced) as a measure of Woman-STEM trait overlap.

First, a manipulation check was predicted to show that women in the high PIC condition would report higher levels of Gender-STEM PIC than women in the low PIC condition, verifying that a manipulation of communal goals is consistent with a manipulation of PIC. Because the PIC manipulation employed in the present study was designed to target *women's* gender identity (i.e., the compatibility of *communal goals*, which are stereotypically female, with STEM) and irrelevant to the gender identity of men, the manipulation was not expected to affect the Gender-STEM PIC of men, tested with a condition X gender interaction. However, since the manipulation was expected to affect the perceived compatibility between *women* and STEM, a main effect of experimental condition, but not a condition X gender interaction, was predicted for Woman-STEM trait overlap.

Consistent with other work on PIC, I predicted that women in the high PIC condition would report higher levels of STEM engagement (i.e., better sense of belonging in that position, desirability of the position, self-confidence in science, enjoyment of science, and value of science and technology) than in the low PIC condition; the PIC manipulation was not expected to affect the sense of belonging of men, again indicated by a condition X gender interaction.

Finally, consistent with other work showing that men and women are equally susceptible to gender bias (e.g., Moss-Racusin et al., 2012), both women and men in the high PIC condition were expected to rate a female job candidate as more competent and hirable than participants in the low PIC condition, i.e., a main effect of condition only. Together, these findings should verify the experimental effect of PIC as well as extend the model to a novel domain (i.e., reduced bias towards others).

Methods

Participants and procedures. Participants were recruited for the online study from Amazon's MTURK (detailed In Study 1) and the Stony Brook University Psychology Subject Pool. MTURK participants were given $0.50 and SBU subject pool participants were given 0.5 research credits as compensation for the 30-minute study. Four hundred and fifty-nine participants completed the final study. As in Study 1, cluster analyses on the attention checks identified a total of 54 participants that did not pay attention (11.76%) and were removed from the study, with similar rates from the MTURK (11.3%) and SBU samples (12.0%). Of the 405 participants remaining, seven participants were identified as having completed the study twice, and their second set of responses were removed. Thus, 398 participants (44.2% male) were included in the present study. The population was composed of samples from both MTURK (35.4%) and the SBU Psychology subject pool (64.6%), and was mostly White (54.5%) or Asian (26.6%), but also included Hispanics (6.8%), African Americans (5.8%), and other groups (6%).

Participants who initiated the study, which did not mention STEM, were prompted with *"Social scientists who study a job satisfaction have found that there tends to be a "gap" between what people imagine a job will be and what their actual day-to-day experiences are. Below, we will present you with a description of someone's 'typical day' at their job. We are interested in how learning about a job's day-to-day routine influences its appeal to job seekers."* Participants then viewed the experimental manipulation of PIC (see Appendix 3 for full materials), operationalized here as a communal goals manipulation (materials from Diekman, Brown, Johnston, & Clark, 2010). Participants in both the high and low PIC conditions viewed the same core tasks that defined the lab position, including data analyses, database maintenance, examining lab samples, and so on (See Appendix 3 for full materials). For participants assigned to the high PIC condition, these tasks were be framed as collaborative (e.g., *I meet some of my lab group in the lab and consult with them about the procedures*) consistent with female gender norms and ideals, while for participants assigned to the low PIC condition, these tasks were framed as private or independent (e.g., *I look up relevant past research to consult about the procedures*) consistent with more traditional stereotypes about scientists. A control group immediately began completing the surveys without exposure to any experimental materials. For all dependent variables, participants in the experimental conditions viewed measures that referred to the “above position as an entry-level scientist” while participants in the control condition view measures that simply referred to “a position as an entry-level scientist”

Immediately following the manipulation, participants completed the Gender-STEM PIC item and several measures of STEM engagement, the main dependent variables of interest. Participants then viewed the credentials of a female job-applicant applying for a lab manager position similar to the lab as the above entry-level scientist (materials from Moss-Racusin et al., 2012). Following conventions established in experimental work on gender bias (Heilman, Wallen, Fuchs, & Tamkins, 2004), the applicant had somewhat ambiguous competence, allowing for variability in participant responses based on the perceived compatibility between the female job applicant and the lab position. Participants then rated the applicant on competence and hirability. Finally, participants completed the measures of Woman-STEM trait overlap before completing some final measures of demographics, math/science self-efficacy, and interest in STEM.

Measures.

Gender-STEM identity compatibility. As in Study 1, PIC was modified from Aron and colleague’s (1992) inclusion-of-other-in-self scale. Here, participants completed a single item, selecting the pair of overlapping circles that best represents the compatibility between their *gender* and *this job* as an entry-level scientist.

Sense of belonging in entry-level scientist position. Participants were asked to imagine that they were considering taking a position in this lab: “We know you have been given very little information about the position, but we are interested in how appealing it is given the little information that can be gleaned from a job listing. Given the little you know about a typical day in this lab, how would you feel about the environment?" Participants then completed 12 items, adapted from Mendoza Denton et al's Institutional Belonging Scale (Mendoza-Denton, Downey, Purdie, Davis, & Pietrzak, 2002) designed to assess participants' feelings of fit and comfort in that environment. Participants rated the environment on several attributes (e.g., comfort, welcoming) on scales from 1 (e.g., I would feel very *uncomfortable*) to 10 (e.g., I would feel very *comfortable*; alpha = .94).

Job positivity. Participants completed two items used in past work to identify positive feelings about the target job including "What is your impression of the career of an entry-level scientist?" from 1 (not at all positive) to 7 (extremely positive) and "How enjoyable do you believe you would find a career as an entry-level scientist?" from 1 (not at all enjoyable) to 7 (extremely enjoyable; Diekman, et al., 2011; alpha = .78).

Self-confidence in science. Participants completed 4 items from the TIMMS index of Self-confidence in Mathematics scale (Martin, Mullis, & Chrostowski, 2004) modified to assess participants self-confidence in science. Participants rated each item (e.g., Science is more difficult for me than for many of my classmates (reversed)) on a scale from 1 (strongly disagree) to 4 (strongly agree; alpha = .88).

Enjoyment of science. Participants also completed the Science Affective Assessment Instrument – School Science subscale (Taylor et al., 1982). Seven items designed to assess participants' interest and enjoyment of school science (e.g., I like to study science in school) were rated on a scale from 1 (strongly disagree) to 4 (strongly agree; alpha = .90).

Value of science and technology. Participants completed a measure from the International Relevance of Science Education project designed to measure participants' value and trust in science and technology. Six items (e.g., Thanks to science and technology, there will be greater opportunities for future generations) were rated from 1 (disagree) to 4 (agree; alpha =.79).

Job candidate evaluations.

Candidate competence. Participants completed three items (Moss-Racusin et al., 2012) used to assess candidate competence (e.g., How qualified do you think the applicant is?) on a scale from 1 (not at all) to 7 (very much; alpha = .88).

Candidate hirability. Participants also completed three items (Moss-Racusin et al., 2012) used to assess candidate hirability (e.g., How likely do you think it is that the applicant was actually hired for the laboratory manager job he/she applied for?) on a scale from 1 (not at all likely) to 7 (very likely; alpha = .87).

Woman-Scientist trait overlap. Participants also completed a brief version of the Woman-Scientist trait overlap measure used in Study 1. Participants rated whether 33 positive attributes (11 traits characteristic of 1) women, 2) men, and 3) gender-neutral traits) are descriptive of a "typical" woman, then rated whether the same attributes are descriptive of a "typical" entry-level scientist (order of presentation was cross-balanced).

Control variables.

Self-esteem. Participants completed the Rosenberg measure of self-esteem (10 items; e.g., At times I think I am no good at all; Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995), scored from 1 (strongly agree) to 7 (strongly disagree; alpha = .90).

Math/science self-efficacy. Participants completed five items (e.g., I can do even the hardest work in math/science classes if I try) measuring math/science self-efficacy (Elias & Loomis, 2000) scored on a scale from 1 (not at all true) to 5 (very true; alpha = .95).

STEM background. Since the present study recruited both STEM and non-STEM participants, I also measure participants' STEM backgrounds in order to allow for exploratory STEM versus non-STEM comparisons. Participants completed 6 items created to examine one's affiliation with STEM fields scored from 1 (strongly disagree) to 5 (strongly agree). Two items assessed broad interest in STEM (e.g., I am interested in science or technology; alpha = .93), two items assessed whether one is currently in a STEM career/major (e.g., I work/study in a STEM field; alpha = .85), and two items assessed whether one left a STEM career/major (e.g., I used to work/study in a STEM field, but I no longer do; alpha = .70).

Results

Pilot Testing

Thirty-seven women were recruited on Amazon's MTURK. Participants were randomly assigned to view one of the communal goals manipulations before rating whether that job would allow pursuit of 1) communal goals (6 items: e.g., serving the community, working with people), 2) agentic goals (6 items: e.g., achievement, success), and 3) whether the job seemed mundane (1 item). A between-subjects t-test found that participants rated the communal goals condition significantly more communal, $t(35) = 4.00$, $p < .001$, and significantly less agentic, $t(35) = -2.92$, $p = .006$, than the isolated condition. No differences were detected in how mundane the two conditions were perceived to be, $p = .51$. Participants also completed the measure of Gender-STEM identity compatibility. Although results were in the predicted direction (Communal condition $M = 5.61$, $SD = 1.82$; Isolated condition $M = 4.63$, $SD = 2.14$), there was no significant effect of experimental condition on PIC ($p = .14$). However, given the very small sample size and that results were in the predicted direction, I determined that these results were encouraging enough to proceed with the piloted manipulation.

Final Demographics

A set of independent T-tests compared the MTURK and SBU Subject pool sample demographics and found that the SBU sample was significantly more likely to be enrolled in college (MTURK: $M = 1.21$, $SD = .44$; SBU: $M = 1.99$, $SD = .11$; $p < .001$), reported a higher high-school grade point average (MTURK: $M = 85.72$, $SD = 9.35$; SBU: $M = 91.50$, $SD = 4.93$; $p < .001$), were more likely to have learned English as their second language (MTURK: $M = .14$, $SD = .35$; SBU: $M = .29$, $SD = .45$; $p < .001$), and reported higher family income (MTURK: $M = 2.67$, $SD = .90$; SBU: $M = 2.96$, $SD = 1.00$; $p = .004$). Significant differences were not detected for parents' education (MTURK: $M = 4.60$, $SD = 1.80$; SBU: $M = 4.89$, $SD = 1.97$; $p = .14$). In order to account for any group differences, group was controlled for in all analyses unless otherwise noted.

Preliminary Analyses and Manipulation Checks

All analyses controlled for general self-esteem, math/science self-efficacy, and group (MTURK or SBU). Separate analyses found that patterns of results were consistent for both MTURK and SBU groups, supporting the decision to combine these groups. Preliminary comparisons[1] revealed that the control group gave vastly different responses than participants in either experimental group across a variety of measures, suggesting that the chosen control-group design did not operate as the neutral, comparison group I had intended. Thus, the initial analyses presented here focus on the two experimental groups. Because the benefit of including a control group is to further inform the conclusions when an experimental effect is detected, additional analyses including the control condition would be conducted following detection of a significant effect of the experimental manipulation.

For the manipulation check, a 2 (gender) x 2 (PIC condition: high PIC and low PIC) multivariate analysis of covariance (MANCOVA) predicting a) Gender-STEM PIC and b) Woman-STEM trait overlap was expected to reveal a main effect of gender, such that men would report higher PIC and Woman-STEM trait overlap than women, qualified by a significant interaction such that women in the high PIC condition would report greater PIC and Woman-STEM trait overlap than women in the low PIC and control conditions. For Gender-STEM PIC, no significant effects of gender (p = .23), condition (p = .18), or their interaction (p = .85) were detected. Similarly, for Woman-STEM trait overlap no significant effects of gender (p = .09), condition (p = .37), or their interaction (p = .61) were detected. These findings suggest that the manipulation failed to affect PIC. In order to determine whether the manipulation functioned as it has in past work, follow-up analyses examined whether the manipulation replicated the results from

Diekman and colleagues (2011), the study from which this manipulation was chosen. The present study failed to replicate the key findings, including failing to replicate higher career positivity in the high PIC condition among men and women, $t(262) = .60$, $p = .55$, failing to replicate higher career positivity among women in the high PIC condition, $t(148) = .51$, $p = .61$, and failing to replicate a gender X condition interaction on career positivity, $F(1,260) = .02$, $p = .88$.

STEM Engagement Variables

A gender x PIC MANCOVA predicting the STEM engagement variables (sense of belonging, job positivity, self-confidence in science, enjoyment of science, and value of science and technology) tested the main hypothesis and was expected to reveal a significant main effect of gender, with men reporting greater levels of engagement than women, qualified by a significant interaction, such that women in the high PIC condition were expected to report greater levels of these STEM engagement variables than women in the low PIC condition, while men were not expected to be affected by condition. A significant main effect of gender was detected for self-confidence in science, $F(1,257) = 11.21$, $p = .001$, and enjoyment of science, $F(1,257) = 4.37$, $p = .038$, only, such that men reported higher self-confidence in and enjoyment of science. No main effect of gender was detected for sense of belonging, $p = .09$, job positivity, $p = .42$, or value of science and technology, $p = .81$. No significant main effect of condition was detected for any variable: sense of belonging, $p = .31$, job positivity, $p = .63$, self-confidence in science, $p = .92$, enjoyment of science, $p = .96$, and value of science and technology, $p = .32$. Similarly, no gender X condition interactions were detected: sense of belonging, $p = .34$, job positivity, $p = .64$, self-confidence in science, $p = .56$, enjoyment of science, $p = .86$, and value of science and technology, $p = .13$

Female Job-candidate Evaluation

Finally, a gender X condition MANCOVA predicting job candidate competence and hirability was expected to reveal a significant main effect of PIC, such that participants in the high PIC condition would rate the job candidate as having higher competence and hirability than in the low PIC condition. No main effects were detected for competence (Gender main effect: $p = .99$; Condition: $p = .28$) or hirability (Gender: $p = .35$; Condition: .60). However, a significant gender X condition interaction was detected for hirability, $F(1,257) = 4.20$, $p = .042$, such that men rated the female job candidate significantly more hirable in the in High PIC condition than the Low PIC condition, while women rated the candidate as less hirable in the High PIC condition than the Low PIC condition (see Figure 1). A test of simple effects found that men were significantly more likely than women to rate the job candidate as hirable in the High PIC condition, $t(134) = 2.373$, $p = .019$, although men and women did not differ in their ratings in the Low PIC condition ($p = .40$). Although the pattern of results was similar, no interaction was detected for competence ($p = .12$)

Discussion

Past work has demonstrated that undergraduate STEM women who perceive less compatibility between their gender and their STEM identity have lower sense of belonging and motivation in STEM, factors that ultimately seem to affect their academic performance (e.g., London et al., 2011; Settles, 2004). The present study attempted to experimentally manipulate PIC in order to examine whether a causal relationship does in fact exist between PIC and sense of belonging variables. Although pilot testing was generally supportive, the experimental manipulation failed to affect either form of PIC or any subjective belonging variable. Moreover, it also failed to replicate the major findings from which the manipulation was taken. Despite these shortcomings, the present study found evidence that PIC may be tied to the perception of others' suitability for STEM careers. Specifically, the present study found that men who were asked to rate the hirability of an ambiguously-qualified female job candidate were more likely to rate her as hirable when the position was presented as compatible with communal goals, despite that the hallmark tasks of the position (e.g., data analyses, collecting lab samples) were the same.

The Experimental Manipulation

Although past work has found that communal goals predict women's positive feelings towards a STEM career (Diekman et al., 2011), the present study failed to replicate this effect. The manipulation not only failed to affect PIC, but also failed to replicate other published effects of the manipulation, bringing into question whether the manipulation was effective with the current sample. Although the manipulation and measure of career positivity were taken directly from published research (Diekman et al., 2011), other differences in study administration may explain the reduced effects of the manipulation. Most notably, the present study was administered online, in private, in contrast to the original study that took place in a traditional lab setting with a research assistant present. One possibility is this change in circumstances may have affected participants' concentration, level of comfort, perceived anonymity, etc. (e.g., Farvolden, Cunningham, & Selby, 2009; Goritz, 2006). However, numerous studies that examine the impact of online administration in social psychological research have demonstrated that there are only minor differences between results collected in-person versus online (Kypri, Gallagher, & Cashell-Smith, 2004; Miller et al., 2002), suggesting that this is not likely. One possibility is that participants were simply not paying attention. Although attention checks were included on another part of the survey, allowing for removal of participants who were not paying attention later in the study, there was no manipulation check to verify whether participants read or understood the manipulation specifically. Thus, there is no way to verify whether participants read the manipulation as intended and whether that explains the failure of the manipulation. Including an additional manipulation check may have shed further light on why the manipulation was not successful here as it had been in past research.

Because the manipulation seems to have failed altogether, the present study did not offer a legitimate test of the original hypothesis that improving PIC can improve STEM sense of belonging. Indeed, PIC was never changed. If the manipulation had effectively changed PIC and then found no change in sense of belonging, only then could one conclude that improving PIC is not relevant to sense of belonging. However, without effectively manipulating PIC, the present study is unable to conclude whether this causal relationship exists. Future work should establish a successful manipulation of PIC in order to examine this prediction.

Extending the PIC Model to Perceptions of Others

Although the present manipulation was not successful in changing PIC, there was evidence that other variables may have been affected by the manipulation when it was presented a second time later in the study. Specifically, the present study is the first to demonstrate that PIC might impact the perceptions of others. Indeed, there was evidence that women may benefit when a science career is described as better fitting with women's gender roles. Specifically, men were significantly more likely to rate an ambiguously-qualified, female job candidate as hirable when the entry-level scientist position was described as being compatible with female-typical characteristics (i.e., communal goals). To the extent that improving the perceived compatibility of women and STEM fields can also reduce external bias or prejudice, improving identity compatibility becomes even more important. Prior research has established that the perceived congruity between gender- and career-roles can impact perceptions of professional women and likely affect their performance evaluations (e.g., Davidson & Burke, 1994; Eagly & Karau, 2002). In the present study, unlike other work that manipulates the nature of the job as communal vs. agentic by altering the hallmark tasks characterizing that position, the present study held the job's characterizing tasks stable (e.g., data analyses, examining lab specimens) across conditions, and manipulated only the compatibility of the position with female-typical communal goals. Importantly, these are changes that are reasonably feasible to make in actual job postings outside of the lab.

Interestingly, although similar gender biases are known to exist across both male and female raters (i.e., a main effect of condition only; e.g., Heilman et al., 2004; Moss-Racusin et al., 2012; Nosek, Banaji, & Greenwald, 2002), the present study found that when the job was described as more compatible with communal goals, men were significantly more likely than women to rate the job candidate as hirable (i.e., a gender X condition interaction). This suggests that describing a job in more female-compatible terms may have its biggest benefit for STEM women when the evaluator is male. Because advanced positions in STEM fields are more likely to be held by men than women (e.g., Ceci et al., 2009), there may be great benefit to making small changes that emphasize communal goals in hiring decisions.

In fact, it appears that women actually gave higher hirability ratings to the job candidate in the Low PIC condition, where compatibility with traditional female-goals was more limited. While one can only speculate why this may be, one possibility is that women may be more interested in promoting women in male-dominated domains. Indeed, masculine jobs are perceived as more important, lucrative, and higher in status compared with feminine jobs (e.g., Gunderson et al., 2012; Teig & Susskind, 2008), and perhaps one consequence of the Low PIC condition was increased perceived status or value. Women are also more likely than men to think that women are being held back and that more needs to be done to help women get ahead (e.g., Branscombe, 1998; Pew Research, 2013; Swim, Cohen, & Hyers, 1998). Thus, another possibility is that women felt motivated to "help" a woman succeed in a more masculine career than a less masculine career. However, because these findings do not fall in line with an extensive body of research that generally shows no difference between the effects of bias on male and female raters (e.g., Heilman et al., 2004; Moss-Racusin et al., 2012; Nosek et al., 2002), these results should be interpreted with caution. Additional replications of this finding are necessary.

Taken together, the present study found evidence that describing a STEM job as more communal may benefit female job candidates, but was unable to establish a causal effect of PIC on sense of belonging among women in STEM. However, these findings are limited by a general failure of the manipulation to change PIC or to replicate prior work, suggesting that additional work examining the relationship between PIC and sense of belonging should be pursued. Establishing this preliminary causal effect will lay the groundwork for future research to examine more complex predictions about PIC, and is a basic and necessary step in strengthening the PIC model. Moreover, demonstrating that PIC can be manipulated is a necessary precursor to developing an empirically-targeted intervention designed to improve girls' identity compatibility. Next, Study 3 will examine whether PIC is valuable for women entering graduate school in a STEM field.

Study 3

Despite the emerging research on the consequences of PIC for both STEM engagement and academic outcomes (Ahlqvist et al., 2013; Settles, 2004), little is known about PIC beyond the undergraduate level. Thus, the goal of Study 3 is to examine the effects of perceived identity compatibility among graduate students. Attending graduate school in many cases affords opportunities for career advancement that would otherwise be unavailable. Importantly, just as women lag behind men in STEM fields at the undergraduate level, women continue to be vastly underrepresented in graduate school (NSF, 2009). Although PIC has been established as an important factor for undergraduate STEM women, it is unknown whether identity compatibility would be necessary for women beginning graduate school in a STEM field, women who are presumably both successful and interested in STEM. On the one hand, one might imagine that women who have successfully completed an undergraduate STEM degree and elected to continue their studies must have a fair degree of identity compatibility. After all, they have already demonstrated that they are academically capable of succeeding in their field. On the other hand, women who do ultimately make it to graduate school likely find themselves increasingly in the minority. In fact, it is well-established that the proportion of women in STEM fields actually continues to drop from the undergraduate level to the graduate level (NSF, 2009). As a result, women who already found themselves in the minority as undergraduates may suddenly realize that they are all but alone in graduate school. In addition to intensified minority status, STEM women in graduate school likely still contend with negative stereotypes about women's mathematical and scientific abilities (Casey et al., 2001; Steele et al., 2002), stereotypes that might negatively affect their engagement in spite of personal success (e.g., Spencer et al., 1999).

Finally, one would expect individual differences in PIC to exist within the graduate school population. Although STEM women entering graduate school may have higher levels of PIC than undergraduates, as suggested by prior work which suggests that undergraduate women low in PIC are more likely to express interest in changing their STEM major (London et al., 2011), it is likely that variability among graduate STEM women might still exist. If this is the case, these individual differences in PIC among graduate women might still predict individual differences in STEM engagement and academic success. Thus, the first goal of the present study is to determine whether PIC predicts STEM engagement outcomes among STEM women pursuing graduate training.

Extending the PIC Model: the Buffering Hypothesis

In addition to simply examining whether PIC benefits STEM women in terms of STEM engagement, the present study will extend the PIC model and examine whether PIC may act as a buffer from additional sources of stress. The *buffering hypothesis* suggests that psychologically beneficial factors, like social support, may serve to protect or buffer an individual from the influence of stressful events (Cohen & Wills, 1985). Studies of well-being have generally found that coping resources like these buffer the negative effects of discrimination (Noh, Beiser, Kaspar, Hou, & Rummens, 1999; Samuel Noh & Kaspar, 2003; Sellers & Shelton, 2003). In this vein, the present study will examine whether PIC offers a protective effect in the face of two stressors that are relevant to graduate women's STEM engagement and have the potential to raise doubts about belonging: poor academic performance and experiences with sexism.

A vast literature on stereotype and social identity threats suggest that women who have poor academic performance may be likely to view their performance through the lens of a negative stereotype (e.g., Brainard & Carlin, 1998; Spencer et al., 1999). Some evidence even suggest that women who perceive they have poor academic performance are more likely to leave their STEM major, even if their actual academic performance is not poor (Brainard & Carlin, 1998). Similarly, it is well established that experiences with gender discrimination predict women's lower commitment to their field of study, reduced career preparation, and an impaired understanding of class material (Litzler et al., 2005; Whitt et al., 1999). Thus, while it is established that poor academic performance and exposure to sexism are can negatively impact STEM women, the present study seeks to examine whether PIC can moderate these effects. Thus, Study 3 will examine whether PIC buffers STEM women from the negative effects of poor academic performance and experiences with sexism.

Methods

Participants and Time Course

Two cohorts of incoming graduate students were invited to participate in the longitudinal study. For Cohort 1, the entire incoming Stony Brook University graduate population was invited to participate (Cohort 1 invited: n = 1,115). For Cohort 2, all incoming graduate students who were domestic STEM women, domestic STEM men, and domestic non-STEM women were invited to participate in the longitudinal study. In order to balance the size of various subsamples, 50% of incoming international STEM women, international STEM men, domestic non-stem men, international non-stem men, and international non-STEM women were randomly invited to participate in Cohort 2 (Cohort 2 invited: n = 728). Eight-hundred and thirty-four incoming graduate students (Cohort 1: n = 563; Cohort 2: n = 271) completed a survey at the beginning of graduate school in exchange for $25 and were invited to complete biweekly surveys every two weeks during their first year of graduate school, up to 13 timepoints in all ($M_{\text{timepoints}}$ = 9.89) in exchange for $50 per semester. Attrition was at a level typical of a longitudinal study, with 618 participants completing at least half of the diaries throughout the course of the year (74.01% retention from background).

At background, participants (46.1% female) were seeking their master's degrees (57.3%) or PhDs (42.7%) and were in mostly STEM fields (66.7%). The majority of participants were international students (58.1%), an important difference from typical undergraduate samples from American universities. Participants were mostly East Asian (42.74%) and White (38.52%), with some Hispanic (4.35%), South Asian (6.73%), African American (0.92%), and other race participants (6.46%). A total of 207 STEM women, 162 non-STEM women, 322 STEM men, and 162 non-STEM men completed the background survey.

Baseline Measures

Perceived identity compatibility scale. Perceived identity compatibility was measured with a self-report scale. Participants rated the extent to which they agreed with four items (e.g., I think my gender and my field of study are very compatible) on a scale from 1 (strongly disagree) to 7 (strongly agree; Background alpha = .62, Diary alpha = .64).

Desire to leave program. Participants rated their agreement with two items created to measure their interest in leaving their graduate program (I may consider dropping out of my graduate program before graduating; I may consider changing to a different field of study before graduating) on a scale from 1 (strongly disagree) to 7 (strongly agree; Background alpha = .67; Diary alpha = .82).

Sense of belonging in field and department. Participants completed 12 items, adapted from Mendoza-Denton and colleague's Institutional Belonging Scale (Mendoza-Denton et al., 2002) designed to assess feelings of fit within one's field of study and comfort with one's professors and classmates. Participants rated their department/field of study on several attributes (e.g., comfort, welcoming) on scales from 1 (e.g., I feel very *uncomfortable*) to 10 (e.g., I feel very *comfortable*; Background alpha = .94; Diary alpha = .97).

Control variables. Participants also reported their domestic- or international-student status (i.e., *domestic status*), prior academic achievement (i.e., their self-reported undergraduate GPA), and completed the Rosenberg measure of self-esteem (10 items; e.g., At times I think I am no good at all), scored from 1 (strongly agree) to 7 (strongly disagree; Rosenberg et al., 1995; Background alpha = .89).

Bi weekly Measures

Repeated measures. Several measures administered at baseline were also administered during the biweekly surveys, including a brief version of the perceived identity compatibility scale (2 items only), a brief version of sense of belonging in field/department (8 items only), and desire to leave program (2 items).

Field evaluation. Participants completed 12 items created to assess their feelings about their field now and their future in their field. Participants rated their agreement (e.g., I feel happy [about my future in my field]) on a scale from 1 (not at all) to 7 (completely; Diary alpha = .96).

Field connectedness. Participants rated four items created to assess the extent to which they felt connected to others in their field of study, program, lab, and their university (e.g., I feel a strong sense of belonging to others in my *field of study*) on a scale from 1 (strongly disagree) to 7 (strongly agree; Diary alpha = .76).

Field centrality. Participants rated four items created to assess the extent to which their field of study, program, lab, and their university was central to their identity (e.g., being in my *field of study* is an important part of who I am) on a scale from 1 (strongly disagree) to 7 (strongly agree; Diary alpha = .68).

Perceived success. Participants completed a single item asking them to evaluate their performance in their field of study as they currently perceived it (I feel I am doing/performing well) from 1 (not at all) to 7 (completely).

Perceived sexist climate. Participants rated their perceived level of gender inequality in their department/program. Four items were modified from Settles and colleagues' (2006) sexist climate measure to refer to a graduate school environment (e.g., men are more likely than women to receive helpful advice from the faculty in the department/program) and scored from 1 (strongly disagree) to 5 (strongly agree; Diary alpha = .81).

Control variables. Participants also reported how they felt that day on a single item ("Overall, how are you feeling right now?") from 1(terrific) to 7 (terrible).

Results

Descriptives

Means and standard deviations of the main variables are presented in Tables 9 and 10. A gender X STEM analysis of covariance was conducted predicting background levels of PIC and controlling for self-esteem and international status. STEM men were predicted to have higher PIC than non-STEM men, while STEM women were expected have lower PIC than non-STEM women. A significant main effect of gender was detected such that women reported lower PIC than men, $F(1, 762) = 26.70$, $p < .001$, partial eta-squared = .034, while no main effect of STEM was detected, $p = .27$. The interaction between STEM and gender was marginally significant, $F(1, 762) = 3.71$, $p = .054$, partial eta-squared = .005. Post hoc analyses following a non-significant interaction are not recommended and are presented here only for informational purposes and should be interpreted with caution. Tukey post-hoc comparisons of the four Gender/STEM groups indicated that STEM women reported significantly lower levels of PIC than STEM men, $p = < .001$, but did not differ from non-STEM women, $p = .98$, and marginally differed from non-STEM men, $p = .071$.

Lag Analyses

Next, it was predicted that the level of PIC on one week would predict better STEM engagement (e.g., less interest in leaving their program) on the next survey. Time-lagged hierarchical linear modeling (HLM) examined the temporal relationship between an experience in one week and the outcome variables reported during a subsequent week (Bolger & Zuckerman, 1995). For each set of models, PIC on one week (lagged) was the predictor of five outcome variables (i.e., desire to leave program, sense of belonging, field evaluation, field connectedness, and field centrality) on the following survey two weeks later, controlling for initial levels of that outcome variable (lagged). For example, the analysis in which PIC at one week (Week X) predicts sense of belonging two weeks later (Week Y) controlled for sense of belonging (Week X) in order to isolate change in the dependent variable over time. Additional controls in all models also included domestic status, how the participant felt the day they reported PIC (lagged), their undergraduate GPA, and the semester in which the survey was completed (Fall or Spring). Models were run in SAS using Proc Mixed where semester, participant ID, week, semester, and (where relevant) STEM status and gender were entered as class variables. Models were run using an AR1 covariance structure where week and participant were treated as repeated measures.

Three sets of models were run. First, in order to test whether there are general benefits of PIC to students, a set of analyses including all participants (regardless of gender and STEM or non-STEM status) is presented. Next, in order to test whether PIC offers additional benefits to STEM women specifically, a second and third set of analyses was conducted comparing STEM women to non-STEM women and then to STEM men, respectively.

Entire sample. Analyses confirmed a significant time-lagged effect of PIC on desire to leave program (B = -.06, p < .001), sense of belonging (B = .08, p < .001), field evaluation (B = .04, p < .001), and field connectedness (B = .03, p = .002), suggesting that higher levels of PIC on one week are related to positive outcomes two weeks later. PIC was not significantly related to field centrality (p = .14)

STEM vs. non-STEM women. Analyses comparing STEM women to non-STEM women selected only female participants and entered STEM status as an additional predictor expected to interact with PIC, resulting in a model that tested the main effect of STEM status, the main effect of PIC, and the interaction between the two predictors, where the interaction was of special interest. Again, main effects were detected for PIC predicting desire to leave program (B = -.06, p = .004), sense of belonging (B =.07, p = .002), field evaluation (B = .04, p = .009), and field connectedness (B = .02, p = .04), but not field centrality (p = .63). There was no main effect of STEM status or its interaction with gender for desire to leave program (STEM status: p = .42; Interaction: p = .42), sense of belonging (STEM status: p = .39; Interaction: p = .57), field evaluation (STEM status: p = .63; Interaction: p = .67), field connectedness (STEM status: p = .09; Interaction: p = .12), or field centrality (STEM status: p = .44; Interaction: p = .55), suggesting that PIC was not differentially predictive for STEM women.

STEM women vs. STEM men. Finally, analyses comparing STEM women to STEM men selected only participants in STEM fields and entered gender as an additional predictor expected to interact with PIC, resulting in a model that tested the main effect of gender, the main effect of PIC, and the interaction between the two predictors, where the interaction was of special interest. Similar to above, main effects were detected for PIC predicting desire to leave program (B = -.06, p = .002), sense of belonging (B =.08, p = .002), field evaluation (B = .03, p = .009), and field connectedness (B = .04, p = .01), but not field centrality (p = .46). There was no main effect of gender or its interaction with gender for desire to leave program (Gender: p = .14; Interaction: p = .24), sense of belonging (Gender: p = .65; Interaction: p = .51), field evaluation (Gender: $p = .76$; Interaction: $p = .80$), field connectedness (Gender: $p = .19$; Interaction: $p = .13$), or field centrality (Gender: $p = .86$; Interaction: $p = .85$). Thus results across these three sets of analyses found that PIC is a generally beneficial feature for graduate students, but does not seem to be differentially important for STEM women compared with either non-STEM women or STEM men.

Testing the Buffering Hypothesis among STEM Women

In addition to examining the general effects of PIC among graduate students, a final set of predictions focused on PIC as a buffer from stressors among STEM women specifically. It was hypothesized that higher levels of PIC would buffer women from negative experiences in STEM, operationalized here as poor academic performance and exposure to sexism. Among STEM women, it was hypothesized that PIC would interact with perceptions of success to predict STEM engagement measures, such that higher levels of PIC would buffer STEM women from the negative effects of low perceived success on the next survey. PIC was similarly predicted to buffer STEM women from the negative effects of sexism, such that higher levels of PIC would buffer women from the negative effects of high perceived sexism. For each model, PIC on one week (lagged), the potential stressor (*success* or *sexism*), and their interaction were the predictors of the same five outcome variables (i.e., desire to leave program, sense of belonging, field evaluation, field connectedness, and field centrality) on the following survey two weeks later, controlling for initial levels of that outcome variable (lagged). Once again, additional controls included domestic status, how the participant felt that day (lagged), their undergraduate GPA, and the semester in which the survey was completed (Fall or Spring). Models were run in SAS using Proc Mixed where semester, participant ID, week, and semester were entered as class variables. Models were run using an AR1 covariance structure where week and participant were treated as repeated measures.

Does PIC buffer STEM women from low perceived success? Among STEM women, a significant main effect of PIC emerged for desire to leave program (B = -.07, p = .013), sense of belonging (B = .05, p = .049), and field evaluation (B = .04, p = .019) only, while a significant main effect of success emerged for desire to leave program (B = -.11, p < .001), sense of belonging (B = .10, p < .001), field connectedness (B = .06, p = .003), and field centrality (B = .07, p < .001). However, these main effects were qualified by a significant interaction between PIC and success for desire to leave program (B =.05, p = .034), sense of belonging (B = -.04, p = .036) and field centrality (B =.05, p = .002). For desire to leave program (see Figure 2), there is evidence that PIC does indeed buffer STEM women, such that for STEM women high in PIC, desire to leave the program is relatively low regardless of success, whereas for those low in PIC, desire to leave the program is contingent on success. For sense of belonging (see Figure 3), rather than seeing a buffering effect of PIC from the negative effects of low success, there was evidence of an enhancing effect of PIC on the positive effects of high success. Specifically, for those low in success, sense of belonging was low regardless of PIC. However, for those high in success, STEM women high in PIC reported higher sense of belonging than those low in PIC. Finally, for field centrality, success was positively related to field centrality only for those high in PIC. For STEM women low in PIC, success was unrelated to field centrality (see Figure 4). Thus, there was some evidence that PIC offered a buffering or self-enhancing effect on success.

Does PIC buffer STEM women from perceived sexist climate? Among STEM women, a significant main effect of PIC emerged only for desire to leave program ($B = -.07$, $p = .026$), and a significant main effect of sexism emerged only for sense of belonging ($B = -.10$, $p < .001$) and field centrality ($B = -.04$, $p = .023$). A significant interaction between PIC and sexism was detected for desire to leave program only ($B = -.05$, $p = .033$) such that, consistent with hypotheses, higher levels of PIC buffered the negative effects of sexism while for those low in PIC, sexism was related to increased desire to leave the program (see Figure 5).

Discussion

Relevance of the Perceived Identity Compatibility Model at the Graduate Level

Despite the emerging research on the benefits of PIC, little is known about PIC beyond the undergraduate level. Thus, Study 3 aimed to examine the effects of perceived identity compatibility among graduate students. It was predicted that women entering graduate school in a STEM field would benefit from PIC. First, it was expected that STEM women would report lower levels of PIC than STEM men, non-STEM men, and non-STEM women. Indeed, STEM women reported the lowest levels of PIC upon entering college and seemed to significantly differ from STEM men, suggesting that the gender differences in PIC seen in Study 1 still exist at the graduate level. Initial analyses including the entire graduate sample (regardless of gender or STEM status) found that PIC predicted positive outcomes on several measures of engagement including desire to leave the program, sense of belonging, field evaluation, and field connectedness, supporting the importance of PIC to graduate students broadly. However, analyses examining whether PIC is uniquely beneficial for STEM women, as measured by the interactions between PIC and STEM (among women) and PIC and gender (among STEM students), found no evidence that PIC was more beneficial to STEM Women than to other graduate students. This suggests that while PIC may be broadly important for success for all graduate students, including STEM women, PIC may not differentially impact STEM women at this stage in their graduate careers.

Perceived Identity Compatibility as a Buffer from Stressors

In addition to testing the general benefits of PIC at the graduate level, the present study also extended past work on PIC by examining whether PIC might act as a buffer from various stereotype-relevant stressors in the environment. Past research has suggested that psychologically beneficial factors like social support may help individuals cope with experiences with discrimination (Cohen & Wills, 1985) and preliminary evidence has suggested that PIC may operate as such a buffer in undergraduates on a daily level (London et al., 2011). Thus, the present study examined whether PIC might also protect graduate STEM women from later exposure to stressors in the environment, including poor academic performance and sexism. Indeed, analyses confirmed that PIC significantly buffered STEM women from low perceived success. Whereas women who reported low PIC two weeks prior to poor academic performance experienced an increased desire to leave their program following this poor performance, women who had high PIC were less affected by poor performance. Similarly, results confirmed that high PIC had an enhancing effect for high-success STEM women's sense of belonging and field centrality. Taken together, there was evidence that PIC buffered STEM women from the negative effects of low success or enhanced the benefits of high success two weeks later. Similarly, there was some evidence that PIC buffered STEM women from the negative effects of sexism. Specifically, while women who encountered sexism generally expressed an increased desire to leave their program, STEM women who had higher levels of PIC two weeks earlier were buffered from this relationship, such that STEM women high in PIC had low interest in leaving their program even after encountering sexism. Taken together, results across the two stressors (low success and high sexism) suggested that PIC may indeed act as a buffer for STEM women, protecting their especially important desire to leave program across both stressors.

Implications

Gender differences in PIC. Although past work has focused on PIC in STEM women exclusively (London et al., 2011), the present study offered some additional insights into gender differences in PIC. Indeed, STEM women had the lowest PIC among study participants, and seemed to have significantly lower PIC than STEM men specifically. This is consistent with gender differences in Gender-STEM PIC reported in Study 1, replicating the effect that women report lower Gender-STEM PIC than men. In the context of a graduate student sample, this is somewhat surprising. Study 1 found that, upon entering college, women may already report lower levels of PIC than men, a factor which predicts interest in leaving STEM fields (London et al., 2011). Thus, one might have expected that women who had lower levels of PIC in college may have already "leaked out" of the pipeline prior to entering graduate school, leaving only high PIC women in the pipeline. If this were the case, we might have seen similar levels of PIC between graduate men and women in STEM. However, the present study suggests this is not the case.

Indeed, STEM women still reported lower PIC than STEM men, suggesting that PIC is still a relevant factor for STEM women at the graduate level and may continue to affect women as they advance through the STEM pipeline. Policy makers and educators who are interested in the success of their female STEM graduate students should continue with efforts to support identity compatibility even at this advanced level. For instance, identity compatibility may be strengthened by exposing graduate students to successful STEM women who demonstrate the possibility of identity compatibility (Rosenthal et al., 2009). Thus, hiring-committees in STEM departments should emphasize the importance of hiring female faculty and allowing current female faculty to advance in their tenure status and departmental leadership roles.

The Buffering Effect of PIC. As detailed above, the present study also found that PIC may act as a buffer from stressors encountered by STEM women. Past work with undergraduates found that STEM women who had high levels of PIC were buffered from the effects of poor perceived performance on that day's STEM motivation (London et al., 2011). However, this prior work focused on *daily* experiences, where PIC and perceived performance on one day predicted STEM motivation that same day, limiting the ability to make causal or even temporal statements. The present study extended this finding by demonstrating with time-lagged analyses that levels of PIC on one survey buffered STEM women from stressors experienced two weeks later. Although causal inferences are never possible outside of true experiments, the longitudinal methodology employed in the present study demonstrates that having PIC prior to a stressful event is associated with reduced damage from that stressful event, establishing at least one direction of effects. This is consistent with the possibility that PIC can buffer STEM women from stressors in the environment or boost the benefits of success. Importantly, the time scale utilized in the present study suggests that having the benefits of high PIC may be relatively long-lasting, still able to interact with performance and sexism as much as two weeks later. Moreover, this buffering effect was detected across two qualitatively distinct stressors, poor performance and sexism, supporting the notion that PIC may buffer or enhance STEM women across a variety of STEM-identity-relevant stressors. Taken together, Study 3 offered further support for the predictive validity of the PIC model at the graduate level and replicated the gender differences in PIC found in Study 1.

General Discussion

Mckinsey Global Institute (2012) declared that there will be a vast shortage of data scientists in the next few years, including a shortage of 1.5 million managers and analysts who understand how to implement the results of data science. This potential shortage of workers is echoed by other researchers about STEM fields more broadly. For instance, the US department of labor recently predicted that many STEM industries are expected to grow more than 30% by 2020, including careers like software engineering, pharmacy technicians, and database management (2010). Other STEM fields, like biomedical engineering, are predicted to grow as much as 70% from 2010 to 2020 (US Labor, 2010). In order to address the shortage of STEM talent in the United States, an important goal must be to increase the number of women in STEM fields, a group currently underrepresented in many of these fast-growing domains.

Over the last several decades, researchers across many disciplines have turned their attention to understanding and correcting this gender gap. Scholars have proposed a variety of factors that may limit women entering STEM fields including the availability of role models (Blickenstaff, 2005; Cheryan, Siy, Vichayapai, Drury, & Kim, 2011; Ferry et al., 2000), overt or subtle discrimination (Moss-Racusin et al., 2012; Whitt et al., 1999), and sense of belonging in STEM (Good et al., 2012). One such factor that seems to be predictive of STEM success is the extent to which women believe that their gender is compatible with STEM fields, i.e., their perceived identity compatibility. Indeed, PIC seems to be uniquely positioned to predict both subjective experiences in STEM (London et al., 2011; Rosenthal et al., 2011) as well as academic performance

(Settles, 2004; Ahlqvist et al., 2013). However, despite the success of the PIC model, it is still a relatively undeveloped framework.

The series of studies presented here addresses several limitations of the current PIC literature. First, prior work has not compared the relative levels of PIC among men versus women. Indeed, Study 1 found evidence that women do report lower Gender-STEM PIC than do men, suggesting that gender differences in identity compatibility exist. More importantly though, prior work on PIC has focused almost exclusively on women at the undergraduate level (Ahlqvist et al., 2013; London et al., 2011; Rosenthal et al., 2011). As a consequence, it was unclear how women arrive at college with higher or lower levels of PIC. Thus, Study 1 examined how women's recalled experiences in adolescence correlated with PIC, focusing on experiences with threat and bias, adult STEM support, and peer STEM models. Utilizing a measure of woman-STEM trait overlap, introduced here for the first time, there was evidence that all three sets of predictors were related to stereotype construction about the fit between women and STEM fields, with the most consistent relationships across the peer STEM model variables. This was true across both men and women as a combined sample, as well as women alone, suggesting that exposure to stereotypes about women's abilities affects how both men and women think about women's fit in STEM fields. Moreover, several interesting findings emerged demonstrating relationships specific to women, including evidence that having a mother with positive STEM attitudes or peers' with an interest in math and science may be especially beneficial to girls, but irrelevant to boys. Identifying some of the origins of PIC provides an important empirical basis for developing future intervention strategies designed to improve girls' PIC.

Another critical limitation of the PIC literature examined in Study 2 is the lack of experimental research on PIC. Thus, Study 2 intended to experimentally manipulate PIC in a laboratory setting, examining whether there is a causal effect of PIC on STEM engagement variables. Although pilot testing of the present manipulation, taken from published research (Diekman et al., 2011), was promising, Study 2 failed to successfully manipulate PIC, making it impossible to measure whether changes in PIC are causally related to changes in sense of belonging variables among STEM women. Although PIC was not affected by the manipulation in Study 2, there was evidence that the perceived fit between women and a STEM position might impact how one evaluates a woman applying for a job in a STEM field. Importantly, this effect was strongest among male raters, who may be more likely to be in authority- or hiring- positions in STEM fields.

Finally, just as little is known about the development of PIC prior to college, little is known about whether PIC remains an important factor as women leave their STEM undergraduate programs and successfully advance to graduate school in STEM fields. I predicted that PIC would still be a critical factor for STEM engagement, even at this advanced level of education and results supported this prediction. First, STEM women reported the lowest levels of PIC among incoming graduate students, replicating the gender differences in Gender-STEM PIC detected in Study 1. Time-lagged analyses confirmed the general importance of PIC for the entire graduate sample, demonstrating that PIC on one week predicted positive outcomes two weeks later. Although these benefits of PIC were indeed detected among STEM Women, follow-up analyses found that PIC benefited STEM women only as much as it benefited other graduate students; PIC did not differentially benefit STEM women. Finally, Study 3 found evidence that

PIC may buffer STEM women from the negative effects of poor perceived performance or an experience with sexism. Indeed, this time-lagged effect across two different stressors, offers preliminary evidence that levels of PIC preceding a stressful event might successfully buffer STEM women from stressors in the academic environment.

Gender Differences (or Similarities) in PIC

Past work has focused mainly on the effects of PIC in STEM women without presenting a comparison group (e.g., Ahlqvist et al., 2013; London et al., 2011; Rosenthal et al., 2011). However, the present studies included men, affording the opportunity to examine gender differences in PIC. Studies 1 and 3 found that women reported lower levels of PIC than men. Specifically, Study 1 included a sample that included men and women from a variety of fields, and found that women reported significantly lower Gender-STEM PIC than men. Similarly, Study 3 examined men and women who were pursing a graduate degree in a STEM field and replicated this pattern of effects. Taken together, results from these two studies support prior research that has suggested that women may experience lower compatibility between their gender and a career in a STEM field (e.g., Diekman et al., 2011; London et al., 2011).

Although gender differences seem to exist in the levels of identity compatibility reported, other findings from Study 3 suggest that identity compatibility is broadly important for both men and women. Specifically, identity compatibility was predictive of engagement outcomes for STEM women, non-STEM women, and STEM men alike, suggesting that identity compatibility may be essential for students constructing their academic selves more broadly. In many ways, this is not surprising. Social identity theory has long suggested that belonging to a social group can offer a sense of belonging to the social world (Hogg & Turner, 1985; Tajfel, 1982) and fulfill a fundamental need to belong (e.g., Leary & Baumeister, 2000). Importantly, social identity theorists have found that group membership is important for members of both higher- and lower-status groups, suggesting that these effects are tied to the human condition rather than membership in a particular social group (Blanton et al., 2002; Simon & Hamilton, 1994). For these reasons, it is not surprising that social identity is relevant to all of the groups discussed in the present study. However, the present studies make an important extension by examining how the intersection of multiple identities (here, gender and STEM professionals) applies across different groups. Limited research has examined the effects of having multiple identities across groups, and there is some evidence that identity compatibility operates in a similar way across a variety of identities (Brook, Garcia, & Fleming, 2008). However, the majority of past research on identity compatibility has focused mainly on groups whose identities are likely in conflict, including working mothers (Hodges & Park, 2013), women scientists (Settles et al., 2009), and students from racial minorities (Oyserman, Bybee, & Terry, 2006), rather than examining the role of relative identity compatibility within groups or across groups that vary in compatibility. Taken together, the present series of studies offers preliminary evidence that perceived identity compatibility is a broadly important factor that may serve to benefit individuals across a variety of social groups.

Finally, Study 3 replicated prior work (London et al., 2011) by demonstrating that even within-person changes in identity compatibility can be linked to improved academic engagement. Moreover, this finding was extended in an important way, by demonstrating that even among individuals thought to have high identity compatibility (e.g., STEM Men), within-person changes in identity compatibility are predictive of engagement. Thus, although important between-group differences in PIC were detected, suggesting that men and women may differ in their levels of gender-STEM identity compatibility, within-person and within-group analyses found that identity compatibility is important for everyone.

Limitations and Future Directions

Retrospective methods. While the present studies offer important insights into how PIC operates, several limitations should be noted. First, Study 1 utilized a retrospective methodology to offer preliminary insights into the development of PIC in adolescence. Although this may still be informative, retrospective studies can have serious limitations. Among the most basic concerns, participants may have forgotten relevant experiences from the past. More importantly, though, participants in Study 1 may have felt the need to reflect on their past experiences through the lens of their current self (e.g., Mallett & Swim, 2009; Ross, 1989). For instance, a woman who ultimately succeeded in her STEM career might think back on times where she encountered discrimination with a sense of pride from overcoming such obstacles. However, at the time she experienced the discrimination, she may have felt helpless or inferior. This same experience has the potential to elicit very different kinds of responses depending on whether it is reflected on currently or retrospectively (Mallett & Swim, 2009; Ross, 1989). Thus, while the present study offers several insights into the relationships between PIC and other variables, the retrospective methodology limits the extent to which we can make firm conclusions about these relationships while highlighting possible concentrations for future studies. Future research should utilize concurrent or prospective methodologies to better inform this work.

PIC: what are we measuring? While the present studies offer interesting insights into PIC, in many ways, it is still unclear exactly what we are measuring when we ask participants to reflect on the compatibility between their gender and STEM careers. For instance, when a woman is asked to reflect on the compatibility between "women" and STEM careers, it is unclear whether she is thinking about *herself* as a woman, whether she is thinking about *women*, the abstract social category of which she is a member, or whether she is thinking about other *women*, but not herself. Thus, although a single question about identity compatibility is posed, participants are at risk of interpreting this question a variety of ways. This is important because there are known differences in the way stigmatized group members evaluate their own experiences with discrimination relative to how they evaluate their group-members' experiences with discrimination (Ruggiero, 1999; Taylor et al., 1990). This personal/group discrimination discrepancy (Crosby, 1982) occurs such that individuals often minimize or overlook their personal experiences with discrimination, while more readily acknowledging the discrimination of their group as a whole (e.g., Crosby, 1982; Ruggiero, 1999; Taylor et al., 1990).

Indeed, there is evidence that thinking about one's own experiences with bias versus one's group's experiences with bias may also produce divergent responses. For instance, both women and African Americans have been shown to exhibit a negative relationship between self-esteem and personal discrimination, but a positive relationship between self-esteem and group discrimination (Bourguignon, Seron, Yzerbyt, & Herman, 2006). In this example, discrimination has opposite relationships with self-esteem depending on the construction of discrimination. Thus, one possibility is that participants may give distinct or even opposing responses depending on how they interpreted perceived identity compatibility in the present studies. Future research should address this in several ways. First, it is necessary to quantify how participants are interpreting the question and whether there is variability in these interpretations. Next, it would be important to examine the consequences of these interpretations on how identity compatibility relates to other variables. Much like the research on the personal/group discrimination discrepancy, one possibility is that small differences in the framing of the question may result in divergent relationships.

Implications

The present series of studies offers further evidence that identity compatibility is an important factor in women's experiences in STEM fields. Thus, educators and policy-makers should consider ways to improve identity compatibility among STEM women. Several established research paradigms that may improve women's identity compatibility could be implemented (e.g., Diekman et al., 2011; Cheryan et al., 2009). Although a communal goals manipulation in Study 2 failed to affect PIC, a variety of other research suggests that emphasizing the communal aspects of STEM careers may improve women's interest in STEM careers (Diekman et al., 2011), an intervention that is likely related to perceived identity compatibility. Specifically, it is well-established that STEM fields are perceived to hinder communal goals relative to other kinds of careers (e.g., Diekman et al., 2010; Diekman et al., 2011), a perception that is held by both men and women. While both men and women hold this perception, women are especially likely to endorse communal goals (Diekman & Goodfriend, 2006; Prentice & Carranza, 2002), thus making this perception especially damaging for women's interest in STEM careers. Emphasizing the communal aspects of STEM careers in job advertisements, recruiting programs, and developmental interventions may help improve women's perceived identity compatibility. Indeed, when a STEM career is described as compatible with communal goals, women express more positive feelings toward a career as a scientist (Diekman et al., 2011). Thus, emphasizing communal goals may offer one avenue by which educators, policy-makers, and recruiters can improve women's perceived identity compatibility.

Having female STEM role models may also improve women's perceived identity compatibility. One way to convey to women that they can be successful in STEM is to expose them to women who are successful in STEM fields (Lockwood & Kunda, 1997; Marx, Stapel, & Muller, 2005). Indeed, role models seem to prevent women from underperforming on stereotype-relevant math tasks (Marx & Roman, 2002) and improve their attitudes towards STEM domains (Stout, Dasgupta, Hunsinger, & McManus, 2011), suggesting that exposure to role models may benefit women's engagement with STEM. Moreover, there is also evidence that exposure to a female role model may actually increase women's perceived identity compatibility (Rosenthal, Levy, London, Lobel, & Bazile, 2013). Rosenthal and colleagues (2013) found that the positive impact of role model exposure on STEM sense of belonging is mediated by this change in identity compatibility, suggesting that identity compatibility may be one mechanism by which exposure to role models improves women's STEM engagement. Thus, hiring-committees in STEM departments should emphasize the importance of hiring female faculty to serve as role models for their current female STEM population. This and future work on identity compatibility should further contribute to our understanding of the experiences of STEM women and may ultimately inform interventions that can reduce the gender gap in STEM fields.

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Footnotes

[1]These preliminary analyses (including the control group) consistently revealed significant condition effects driven almost exclusively by the differences between the control group and the two experimental conditions. This made it difficult to ascertain differences between the two experimental conditions, the primary goal of the study. Moreover, there did not seem to be a consistent pattern of effects for the control condition across dependent variables. For instance, although women in the control condition (relative to women in the experimental conditions) reported the lowest levels of Gender-STEM PIC and sense of belonging, they also reported the most positive perceptions of an entry-level scientist position and the most enjoyment of science. Additionally, in many cases, gender differences in the experimental conditions actually reversed in the control condition. Thus, models that included the control group led to inconsistent effects for both condition and gender.

One possibility for these differences may come from differences in the construal-level of the experimental vs. control groups. Construal level theory demonstrates that there are number of cognitive consequences for thinking about things at a low, detailed level versus at a broad, abstract level (Trope & Liberman, 2003; Trope & Liberman, 2010). In both of the experimental groups, participants were exposed to specific details about the entry-level scientist career, more consistent with a concrete, low-level construal, while those in the control condition were not exposed to any materials. Due to the absence of low-level detailed information, participants in the control condition were more likely to adopt their typical everyday construal (Vallacher & Wegner, 1989) and may show greater response variability than those in the experimental condition. While it would be interesting to examine the effects of construal-level on identity compatibility, it was not the goal of the present study and is not a focus here.

Appendix 1: Figures

Figure 1. Study 2: PIC interacts with gender to predict job candidate hirability.

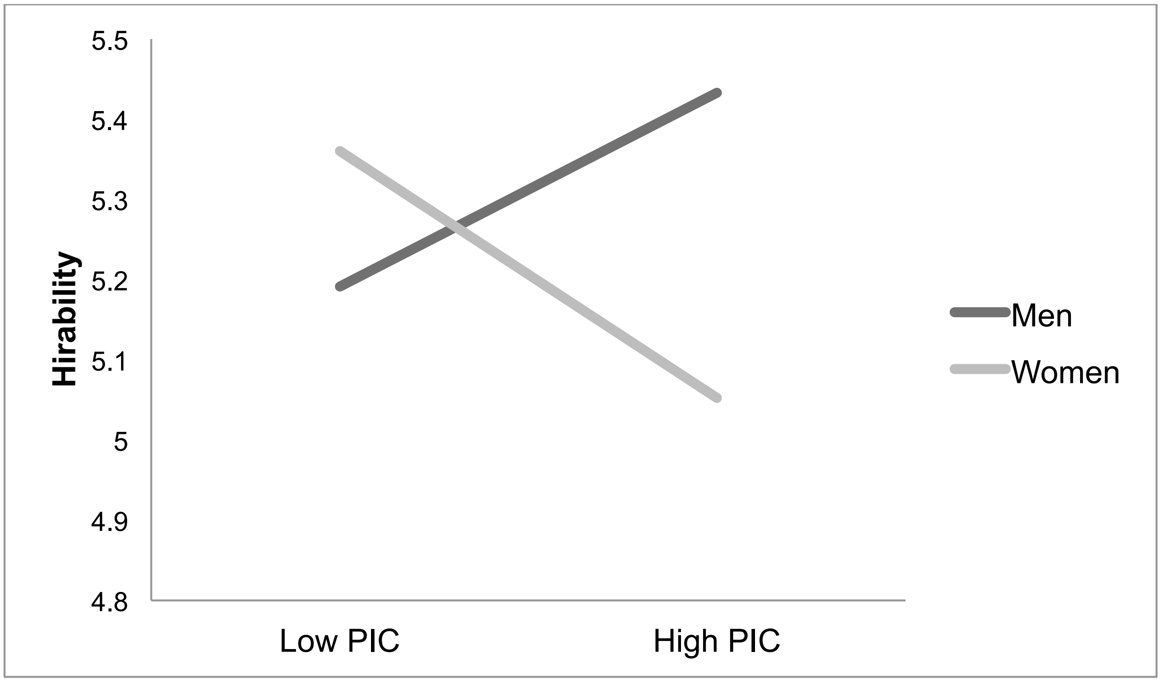


Figure 2. Study 3: PIC interacts with perceived success among STEM women to predict desire to leave program.

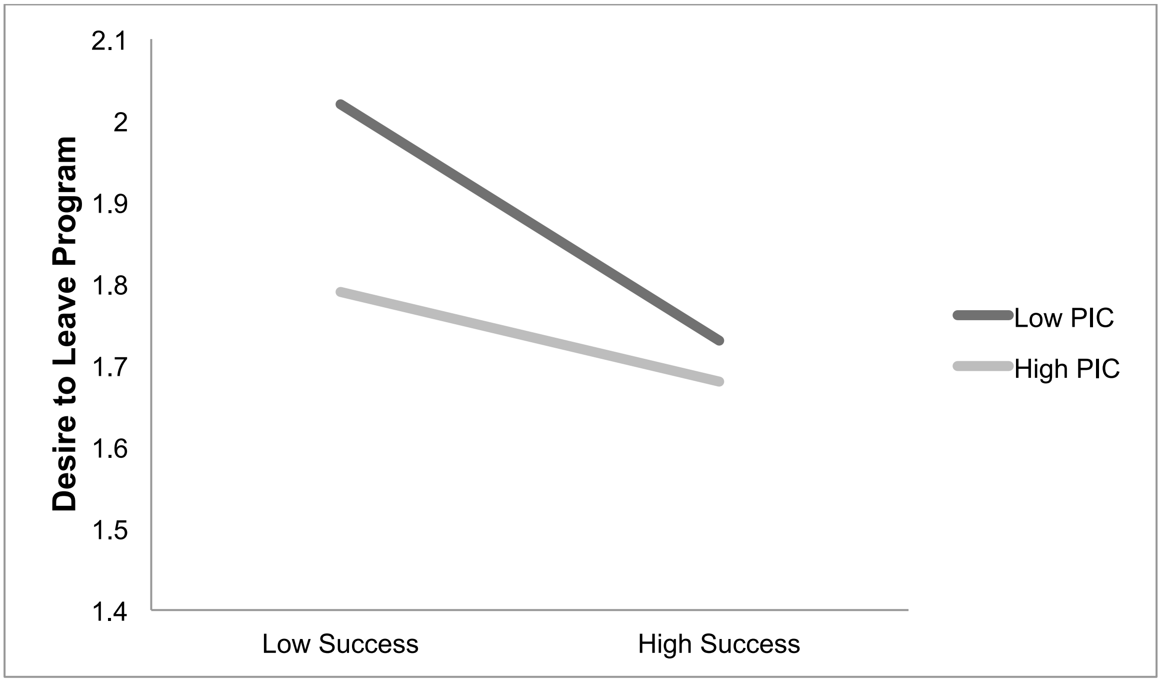


Figure 3. PIC interacts with perceived success among STEM women to predict sense of belonging.

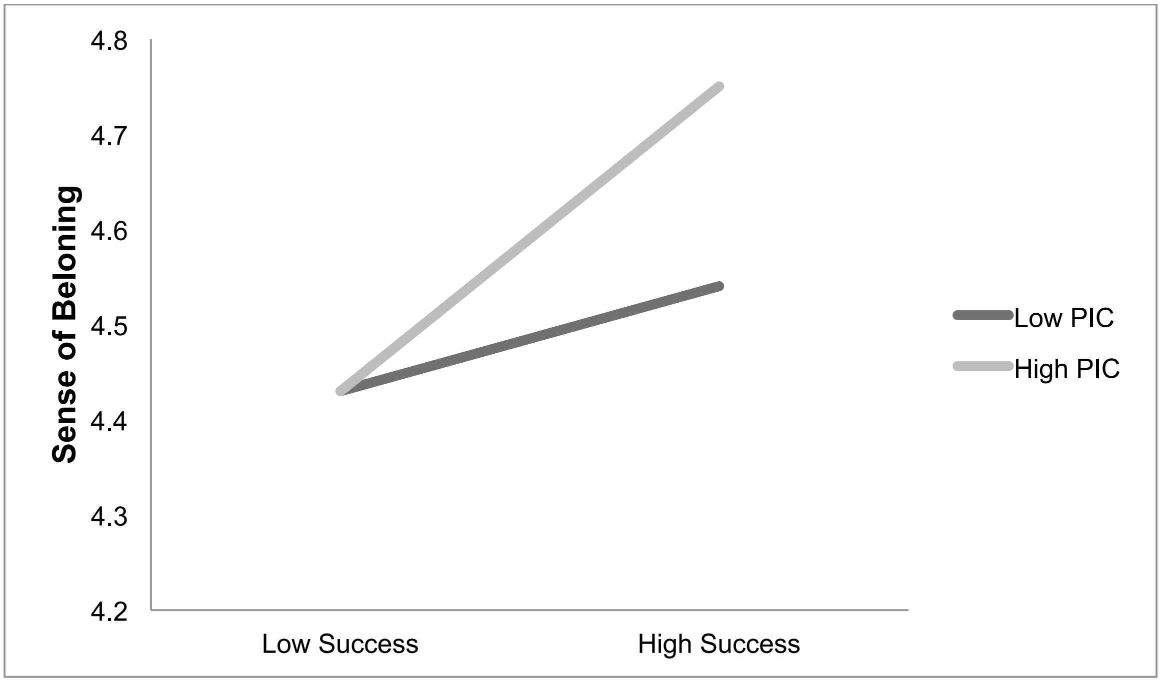


Figure 4. PIC interacts with perceived success among STEM women to predict field centrality.

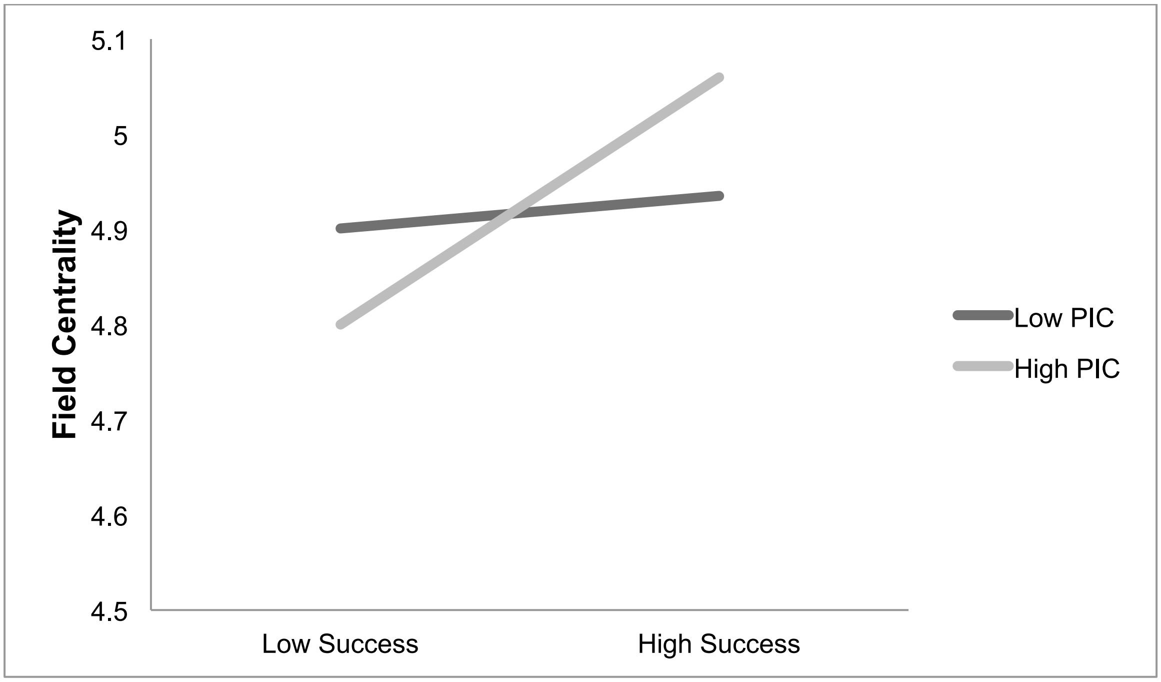


Figure 5. PIC interacts with perceived sexism among STEM women to predict desire to leave program.

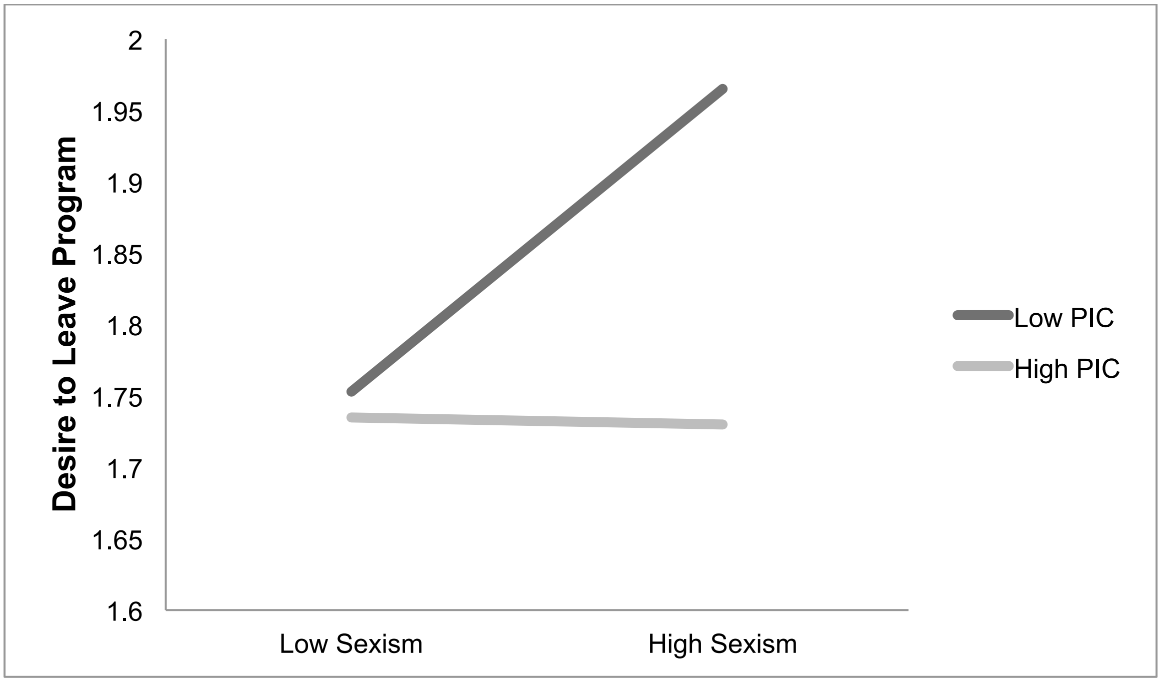


Table 1.

Study 1: Means and standard deviations of Study 1 variables for entire sample and by gender

Variable	Entire Sample	Women	Men
Gender-Field PIC	4.67 (1.80)	4.28[a] (1.81)	5.27[a] (1.61)
Woman-STEM Trait Overlap	.27 (.30)	.34[a] (.29)	.17[a] (.30)
Detecting Bias	2.23 (.78)	2.13 (.80)	2.12 (.74)
Daily Discrimination	1.92 (.99)	1.82[c] (.94)	2.07[c] (1.04)
Math: Fem-Dom.	2.58 (1.21)	2.62 (1.19)	2.51 (1.25)
Math: Male-Dom.	3.68 (1.73)	3.74 (1.73)	3.59 (1.74)
Science: Fem-Dom.	2.65 (1.25)	2.75 (1.29)	2.49 (1.18)

Science: Male-Dom.	3.52	3.39	3.59
	(1.75)	(1.70)	(1.74)
General Support	5.98	6.01	5.94
	(1.32)	(1.29)	(1.37)
Dad's M/S Attitudes	3.83	3.84	3.81
	(.85)	(.85)	(.85)
Mom's M/S Attitudes	3.85	3.84	3.88
	(.93)	(.92)	(.94)
Math Teachers' Support	3.93	3.94	3.91
	(.92)	(.95)	(.86)
Science Teachers' Support	4.03	4.06	4.00
	(.89)	(.90)	(.88)
Dad in STEM	.29	.33	.23
	(.45)	(.47)	(.43)
Mom in STEM	.09	.09	.10
	(.29)	(.28)	(.30)
Belonging: Math Peers	4.85	4.88	4.81
	(1.35)	(1.37)	(1.33)
Belonging: Science Peers	5.03	5.08	4.94
	(1.34)	(1.35)	(1.31)

Best Friend’s M/S Attitudes	3.74	3.47[a]	4.16[a]
	(1.60)	(1.51)	(1.64)
Extended Friends’ M/S Attitudes	4.63	4.64	4.61
	(1.47)	(1.48)	(1.44)
Extended Friends’ CS/Egn Attitudes	3.88	3.60[a]	4.30[a]
	(1.68)	(1.70)	(1.56)
Peer Acceptance of Math	6.20	6.37[b]	5.94[b]
	(1.11)	(.99)	(1.24)
Peer Acceptance of Science	6.24	6.41[b]	5.98[b]
	(1.10)	(.96)	(1.24)
Num. of Female Friends	5.45	6.42[a]	4.02[a]
	(2.40)	(2.18)	(1.94)
Num. of Male Friends	4.66	3.72[a]	6.06[a]
	(2.36)	(2.16)	(1.92)
Num. of STEM Friends	5.43	5.38	5.51
	(2.41)	(2.39)	(2.44)

Note: Significance indicates difference between men and women. $^{c}p < .05$; $^{b}p < .01$, $^{a}p < .001$.

Table 2.

Gender-STEM PIC and threat and bias variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
Detecting Bias	.10	.21**	-.10	.58**
Daily Discrimination	.05	.07	-.08	.35
Math: Fem-Dom.	-.13*	-.13	-.07	-.08
Math: Male-Dom.	.04	.06	.03	.11
Science: Fem-Dom.	-.17**	-.15*	-.12	-.01
Science: Male-Dom.	.09	. 06	.06	.07

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. Dom. = Dominated. *p <.05; **p < .01; ***p < .001

Table 3.

Gender-STEM PIC and adult STEM support variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
General Support	-.06	-.05	-.06	-.10
Dad's M/S Attitudes	-.01	-.02	.02	-.14
Mom's M/S Attitudes	-.01	-.07	.06	-.28
Math Teachers' Support	-.11	-.19*	.06	-.51*
Science Teachers' Support	.00	-.09	.18*	-.54**
Dad in STEM	.10	.20*	.00	.34
Mom in STEM	.01	.05	-.08	.21

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. M/S = math and science.

**p* <.05; ***p* < .01; ****p* < .001

Table 4.

Gender-STEM PIC and adult STEM support variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
Belonging: Math Peers	-.11	-.08	-.16	-.02
Belonging: Science Peers	-.05	.03	-.15	.16
Best Friend's M/S Attitudes	.10	.15	-.11	.42*
Extended Friends' M/S Attitudes	.04	.11	-.07	.23
Extended Friends' CS/Egn Attitudes	.13*	.16*	-.06	.34
Peer Acceptance of Math	-.03	-.06	.13	-.35
Peer Acceptance of Science	-.03	-.05	.13	-.34
Num. of Female Friends	-.16**	.02	-.14	.28
Num. of Male Friends	.16**	-.01	.15	-.32
Num. of STEM Friends	.12*	.18*	-.01	.25

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. M/S = math and science. CS/Egn = computer science and engineering. **p* <.05; ***p* < .01; ****p* < .001

Table 5.

Woman-STEM trait overlap and threat and bias variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
Detecting Bias	-.10	-.10	-.12	.01
Daily Discrimination	-.15*	-.11	-.13	.01
Math: Fem-Dom.	-.04	-.09	.01	-.03
Math: Male-Dom.	-.19**	-.17*	-.26**	.03
Science: Fem-Dom.	-.07	-.14	-.04	-.02
Science: Male-Dom.	-.26***	-.22**	-.28**	.02

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. Dom. = dominated. *p <.05; **p < .01; ***p < .001

Table 6.

Woman-STEM trait overlap and adult STEM support variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
General Support	.15*	.08	.24**	-.05
Dad's M/S Attitudes	-.01	.03	.01	.01
Mom's M/S Attitudes	.18**	.31***	.05	.07*
Math Teachers' Support	-.11	.08	.14	-.02
Science Teachers' Support	.09	.03	.13	-.03
Dad in STEM	-.08	-.16*	-.05	-.03
Mom in STEM	-.02	-.04	.04	.02

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. M/S = math and science. *p <.05; **p < .01; ***p < .001

Table 7.

Woman-STEM trait overlap and adult STEM support variables: partial correlations[a] and gender interaction B's

Variable	Overall[b]	Women[b]	Men[b]	Sex X Variable Interaction[c]
Belonging: Math Peers	.19**	.19*	.19*	-.01
Belonging: Science Peers	.23***	.23**	.21*	.00
Best Friend's M/S Attitudes	-.05	-.05	.09	-.04
Extended Friends' M/S Attitudes	.12*	.07	.20*	-.04
Extended Friends' CS/Egn Attitudes	-.03	-.02	.08	-.03
Peer Acceptance of Math	.24***	.30***	.08	.07*
Peer Acceptance of Science	.22***	.23**	.12	.05
Num. of Female Friends	.24***	.17*	.05	.04
Num. of Male Friends	-.21***	-.14	.02	-.05
Num. of STEM Friends	.09	.12	.10	.01

Notes: [a]controlling for academic self-efficacy and group. [b]partial correlations. [c]unstandardized *B*'s. M/S = math and science. CS/Egn = computer science and engineering. *p <.05; **p < .01; ***p < .001

Table 8.

Study 2: Means and standard deviations of dependent variables by gender and experimental condition

	High PIC Condition		Low PIC Condition	
Variable	Men	Women	Men	Women
Gender-STEM PIC	5.29	5.41	4.87	5.17
	(1.70)	(1.82)	(1.98)	(1.96)
Woman-STEM Trait	.09	.11	.09	.15
Overlap	(.17)	(.21)	(.22)	(.22)
Sense of Belonging	3.85	4.86	4.28	4.73
	(1.29)	(1.96)	(1.85)	(1.95)
Job Positivity	4.40	4.12	4.32	3.99
	(1.44)	(1.53)	(1.52)	(1.65)
Science Self-Confidence	3.05	2.58	3.05	2.72
	(.64)	(.54)	(.70)	(.66)
Enjoyment of Science	3.25	2.98	3.24	3.03
	(.49)	(.53)	(.59)	(.58)
Value of Science	3.69	3.57	3.65	3.71
	(.33)	(.51)	(.32)	(.34)
Candidate Hirability	5.43	5.05	5.19	5.36
	(.90)	(.95)	(1.05)	(1.16)
Candidate Competence	5.61	5.37	5.50	5.70
	(.88)	(1.01)	(1.05)	(1.05)

Table 9.

Study 3: Means and standard deviations of study variables at background by gender x STEM group

Variable	Entire Sample	Non-STEM Women	Non-STEM Men	STEM Women	STEM Men
Gender-Field PIC	5.01 (1.18)	4.72 (1.21)	5.06 (1.06)	4.72 (1.28)	5.31*** (1.03)
Desire to Leave Program	1.62 (1.08)	1.58 (1.11)	1.44 (0.81)	1.60 (1.00)	1.67 (1.12)
Sense of Belonging	2.79 (1.35)	2.66 (1.16)	2.65 (1.40)	2.86 (1.39)	2.87 (1.40)
Self-esteem	2.85 (1.33)	2.64 (1.22)	2.64 (1.27)	2.96 (1.42)	2.92 (1.32)
Undergraduate GPA	85.93 (8.01)	90.21*** (6.60)	86.59 (9.38)	86.25 (6.95)	83.49* (7.87)

Note: *p < 05; ***p < .001, Significance indicates significantly different from STEM Women.

Table 10.

Means and standard deviations of biweekly diary study variables by Gender x STEM group

Variable	Entire Sample	Non-STEM Women	Non-STEM Men	STEM Women	STEM Men
Gender-Field PIC	5.14	5.29	5.23	4.91	5.20*
	(1.33)	(1.43)	(1.31)	(1.37)	(1.23)
Desire to Leave Program	1.87	1.73	1.84	1.86	1.91
	(1.33)	(1.35)	(1.25)	(1.31)	(1.33)
Sense of Belonging	3.35	3.07	3.04	3.51	3.48
	(1.80)	(1.67)	(1.73)	(1.78)	(1.70)
Field Evaluation	5.05	5.15	5.35*	4.91	5.00
	(1.18)	(1.18)	(1.07)	(1.21)	(1.18)
Field Connectedness	4.96	5.19	4.97	4.87	4.98
	(1.19)	(1.16)	(1.20)	(1.21)	(1.16)

Field Centrality	4.85	5.00	4.88	4.74	4.90
	(1.19)	(1.16)	(1.19)	(1.23)	(1.16)
Bad Mood	2.99	2.91	2.76*	3.10	3.02
	(1.08)	(1.02)	(1.09)	(1.05)	(1.12)
Perceived Success	4.96	5.12	5.37*	4.74	4.89
	(1.35)	(1.34)	(1.25)	(1.37)	(1.34)
Perceived Sexist	1.82	1.64*	1.69	1.96	1.85
Climate	(0.86)	(0.80)	(0.85)	(0.88)	(0.85)

Note: *p < 05; Significance indicates significantly different from STEM Women.

Appendix 3: Measures

Measures included in Study 1

Description of STEM Fields

We will be asking you questions about STEM careers. Before we do, we want to make sure you know what we mean by "STEM" careers. What are **STEM** Careers?

STEM is an acronym for Science, Technology, Engineering, or Mathematics. STEM fields include the "hard sciences."

STEM Fields include

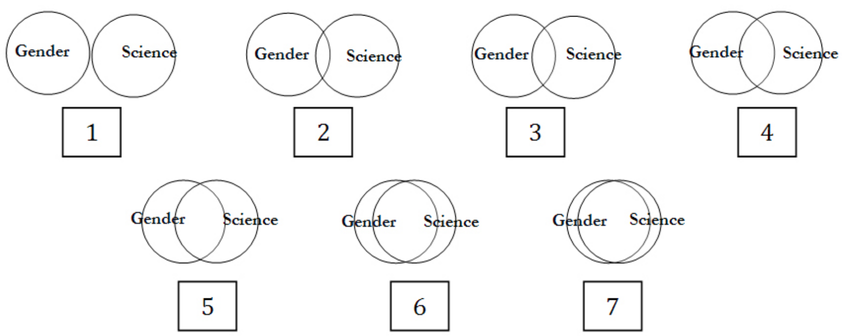
- Science fields like
  - Biology, Chemistry
  - Physics, Dairy Science
  - Pharmacology, Atmospheric Sciences
  - Veterinary Science, Astronomy
- Technology fields like
  - Computer Science, Robotics
  - Optics, Nanotechnology
- Engineering fields like
  - Electrical Engineering, Biomechanics
  - Mechanical Engineering, Industrial Engineering
  - Civil Engineering, Aerospace Engineering
  - Chemical Engineering
- Mathematics fields like
  - Applied Mathematics, Statistics
  - Geometry, Algebra
  - Numerical Methods, Computational Mathematics

Perceived Identity Compatibility (Example item referencing STEM fields)

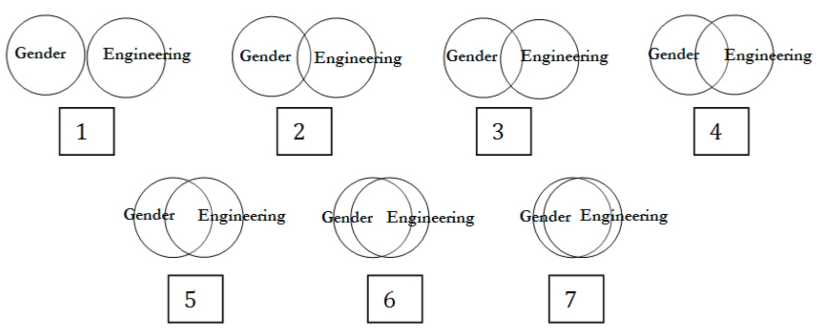
Gender-STEM Identity Compatibility
How compatible are your identities?
Please look carefully at these pictures, and then answer the question below.

For the following question, select one of the 7 pairs of overlapping circles shown below that best represents how compatible you think these two identities are (your gender and a job in a STEM Field).

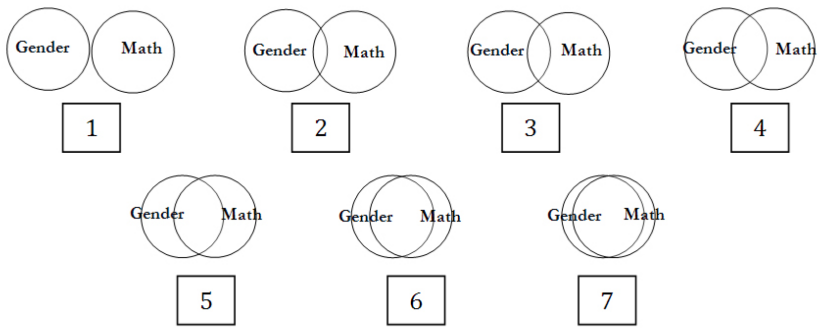
For example, if you think that your gender (being a woman or a man) is really compatible with also being in Science, Technology, Engineering, or Math (i.e., there is no conflict between being a woman and being a scientist or being a man and being an engineer, etc.) then you would select one of the circle pairs that are overlapping a lot. Or, for example, if you think that your gender (being a woman or man) is really not compatible with also being in a STEM field (i.e., there is a conflict between being a man and being in engineering or being a woman and being in computer science, etc.), then you would select one of the pairs of circles that are farther apart from each other.



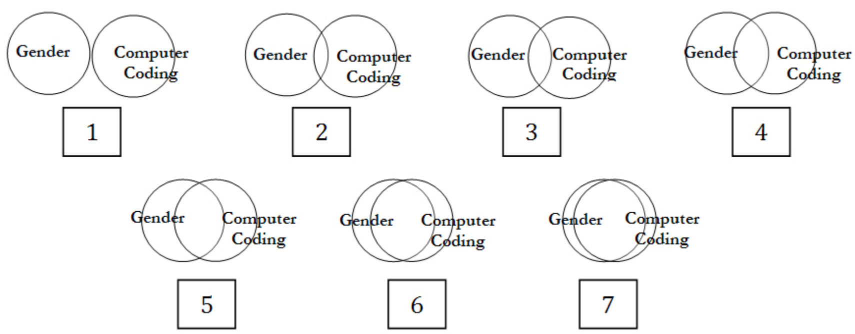
Select one of the 7 pairs of circles shown that best represents how compatible you think these two identities are (your gender and a job in the hard sciences).



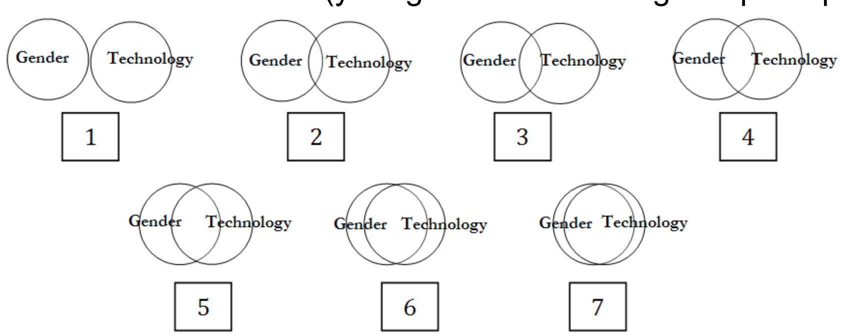
Select one of the 7 pairs of circles shown that best represents how compatible you think these two identities are (your gender and engineering).



Select one of the 7 pairs of circles shown that best represents how compatible you think these two identities are (your gender and a job that uses a lot of math).



Select one of the 7 pairs of circles shown that best represents how compatible you think these two identities are (your gender and coding/computer programming).



Select one of the 7 pairs of circles shown that best represents how compatible you think these two identities are (your gender and a job in technology.

Gender-STEM Trait Overlap

Instructions: In this part of the study, we will ask you about common traits that are often used to describe people. As you answer the questions please give us the first response that comes to mind. Don't think too hard about any one question, but at the same time, please be complete in your answers.

In this study we will ask you to think about (WOMEN or STEM PROFESSIONALS) and describe for us the way (WOMEN or STEM PROFESSIONALS) are generally viewed by our culture.

To begin, think about (WOMEN or STEM PROFESSIONALS) in the United States. Imagine that you have been asked by someone visiting from a foreign country what (WOMEN or STEM PROFESSIONALS) in the U.S. are like. What would you say? Write your description below. Please write 3-5 sentences. When you are done, please begin the next section.

Although there are exceptions, in general (WOMEN or STEM PROFESSIONALS) in the United States…

____

____

____

____

____

Now we would like you to consider a number of different traits or characteristics that could be used to describe people. For each trait, we want you to judge whether you think, in general, it describes or characterizes women/scientists. Do not spend too much time on any one adjective. There are dozens of traits you will rate.

Think about the typical or average woman/scientist in the United States today. Do you think that each of the following traits describes women/scientists?

(NOTE: all items in both columns were completed)

		Not at all 1	Not Really 2	Somewhat 3	Very Much 4
submissive	**good-natured**				
thrifty	**industrious**				
bossy	**harsh**				
weak	**adaptable**				
dependable	**poised**				
mortal	**impulsive**				
sexy	**shy**				
devoted	**dependent**				
talkative	**flirtatious**				
sentimental	**clear-thinking**				
charming	**aggressive**				
show-off	**breathing**				
sociable	**living**				
male	**emotional**				
selfish	**decisive**				
opinionated	**daring**				
stable	**coarse**				
imaginative	**mature**				
aloof	**pleasure-seeking**				
defensive	**fickle**				
preoccupied	**calm**				
creative	**boastful**				

cruel
capable
independent
careless
female
vindictive
ambitious
intelligent
shallow
courageous
self-confident
fair-minded
meek
pleasant
intuitive
bitter
human
adventurous
frivolous
alive
unemotional
whiny
assertive
egotistical
tense
person
reckless

List of Gender-STEM Traits by valence and gender-target (from Hodges & Park, 2013)

Woman Positive	Man Positive	Gender-Neutral Positive	Attention Check
pleasant	decisive	adaptable	alive
poised	adventurous	good-natured	breathing
sexy	ambitious	dependable	human
sentimental	independent	capable	Female/engineer
creative	assertive	stable	living
imaginative	self-confident	mature	Male/scientist
intuitive	courageous	thrifty	mortal
talkative	daring	calm	person
emotional	pleasure-seeking	fair-minded	
sociable	clear-thinking	intelligent	
charming	industrious	devoted	

Woman Negative	Man Negative	Neutral Negative
weak	aggressive	harsh
whiny	egotistical	defensive
shy	boastful	tense
submissive	opinionated	vindictive
fickle	show-off	shallow
dependent	unemotional	preoccupied
meek	reckless	bitter
flirtatious	cruel	aloof
frivolous	coarse	bossy
impulsive	selfish	careless

Study 1: Experience with Threat and Bias

Today you will be completing several surveys about what you remember about high-school.

Which grades were included at your high school? (If you went to more than one school, think about the last school you went to)

6^{th} __

7^{th}__

8^{th} __

9^{th} __

10^{th} __

11^{th} __

12^{th} __

How old were you when you entered 9^{th} grade? ________

Next, take a moment to think about what you were like in high school. Please write 3-5 sentences describing that time in your life. For example, you might write about which classes you took, the friends you spent time with, what you did after school, etc.

____

____

____

____

____

____

The Detection of Sex Bias and Discrimination Subscale of the Campus Environment Survey (Leonard & Ossana, 1987)

1. Teachers usually referred to all people as "he" even if some of the people were women.

1	2	3	4	5
Strongly Disagree				Strongly Agree

2. I did not hear my classmates use humor at the expense of women.*

1	2	3	4	5
Strongly Disagree				Strongly Agree

3. I was never discouraged by anyone from majoring in math or science.*

1	2	3	4	5
Strongly Disagree				Strongly Agree

4. I saw teachers ignore women in the classroom.

1	2	3	4	5
Strongly Disagree				Strongly Agree

5. Some teachers had poor reputations for their treatment of women students.

1	2	3	4	5
				Strongly

Strongly | Agree

Disagree

6. Some teachers there treated me in a manner stereotypical to my sex.

1	2	3	4	5
Strongly Disagree				Strongly Agree

7. Many classes had curriculum materials which reinforced traditional roles of women and men.

1	2	3	4	5
Strongly Disagree				Strongly Agree

8. I saw women become the focus of teachers' jokes in the classroom.

1	2	3	4	5
Strongly Disagree				Strongly Agree

Everyday Discrimination Scale: (Williams, Yu, Jackson, & Anderson, 1997).
Think about your math and science classes that you took in high school. Indicate how often you have experienced various forms of day-to-day mistreatment in your math and science classes.
In your day-to-day life, how often did any of the following things happen to you?

1. You were treated with less courtesy than other people were.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

2. You were treated with less respect than other people were.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

3. You received poorer assistance than other people.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

4. People acted as if they think you were not smart.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

5. People acted as if they were afraid of you.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

6. People acted as if they think you were dishonest.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

7. People acted as if they were better than you were.

Never	Less than	A few times	A few times	At least	Almost

	once a year	a year	a month	once a week	everyday

8. You were called names or insulted.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

9. You were threatened or harassed.

Never	Less than once a year	A few times a year	A few times a month	At least once a week	Almost everyday

Stereotype Awareness: Math (adapted from Leder and Forgasz, 2002

Instructions: For each statement, circle the number that best reflects **<u>what other people think.</u>**

People thought that when they leave school, girls would have more use for mathematics than boys would*

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that men are mathematically more intelligent than women

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that boys have more use for mathematics than do girls when they'd leave school

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that career choices make the study of mathematics more important for boys than for girls

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that girls have more natural mathematical ability than do boys*

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that boys understand mathematics better than girls do

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that the weakest mathematics students are more often boys than girls*

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that girls are more suited than boys to a career in a mathematically-related area*

1	2	3	4	5	6	7
Strongly						Strongly

Disagree						Agree

People thought that explaining answers in mathematics is harder for boys than for girls*

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that mathematics is easier for men than it is for women

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

Stereotype Awareness: Science (adapted from Leder and Forgasz, 2002

Instructions: For each statement, circle the number that best reflects **<u>what other people think.</u>**

People thought that when they leave school, girls would have more use for science than boys would

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that men are scientifically more intelligent than women

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that boys have more use for science than do girls when they'd leave school

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that career choices make the study of science more important for boys than for girls

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that girls have more natural scientific reasoning ability than do boys

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that boys were better at science than girls

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that the weakest science students are more often boys than girls

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that girls are more suited than boys to a career in a science-related area

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that explaining answers in science is harder for boys than for girls

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

People thought that science is easier for men than it is for women

1	2	3	4	5	6	7
Strongly Disagree						Strongly Agree

Study 1: Adult STEM support

Support from Adult Figures
Think back to the time you were in high school. Using the scale provided below, please indicate how supportive the following people in your life were about you possibly pursuing a career in a science, technology, engineering, or math field.

1 Very Unsupportive	**2**	**3**	**4**	**5**	**6**	**7** Very Supportive	N/A Not Applicable

1. ______ Mother

2. ______ Father

3. ______ Other Adults in Your Family

4. ______ Your Teachers

FSMA Attitude Scales: Parent Subscales (Mulhern & Rae, 1998)

The next few items will ask about how your parents thought about your math and science classes in high school. Please rate how much you agree or disagree with each item using the following scale:

Strongly Disagree				Strongly Agree
1	2	3	4	5

1. _____ My father thought that mathematics was one of the most important subjects I studied.
2. _____ As long as I passed, my father didn't care how I did in math.*
3. _____ My father has strongly encouraged me to do well in mathematics.
4. _____ My father thought I needed to know just a minimum amount of math.*
5. _____ My father has always been interested in my progress in mathematics.
6. _____ My father has shown no interest in whether I took more math courses.*
7. _____ My father thought that science was one of the most important subjects I studied.
8. _____ As long as I passed, my father didn't care how I did in science.*
9. _____ My father has strongly encouraged me to do well in science.
10. _____ My father thought I needed to know just a minimum amount of science.*
11. _____ My father has always been interested in my progress in science.
12. _____ My father has shown no interest in whether I took more science courses.*

1. _____ My mother thought that mathematics was one of the most important subjects I studied.
2. _____ As long as I passed, my mother didn't care how I did in math.*
3. _____ My mother has strongly encouraged me to do well in mathematics.
4. _____ My mother thought I needed to know just a minimum amount of math.*
5. _____ My mother has always been interested in my progress in mathematics.
6. _____ My mother has shown no interest in whether I took more math courses.*
7. _____ My mother thought that science was one of the most important subjects I studied.

8. _____ As long as I passed, my mother didn't care how I did in science.*
9. _____ My mother has strongly encouraged me to do well in science.
10. _____ My mother thought I needed to know just a minimum amount of science.*
11. _____ My mother has always been interested in my progress in science.
12. _____ My mother has shown no interest in whether I took more science courses.*

FSMA Attitude Scales: Teacher Subscale Short Form - Math

The next few items will ask about how your teachers thought about your **math classes** in high school. Please rate how much you agree or disagree with each item using the following scale:

Strongly Disagree				Strongly Agree
1	2	3	4	5

1. _____ My teachers thought I was the kind of person who could do well in mathematics
2. _____ I found it hard to win the respect of math teachers*
3. _____ My math teachers made me feel I had the ability to go on in mathematics
4. _____ Getting a math teacher to take me seriously has been a problem*
5. _____ My math teachers were interested in my progress in mathematics
6. _____ I had a hard time getting teachers to talk seriously with me about mathematics*

FSMA Attitude Scales: Teacher Subscale Short Form - Science

The next few items will ask about how your parents thought about your **science classes** in high school. Please rate how much you agree or disagree with each item using the following scale:

Strongly Disagree				Strongly Agree
1	2	3	4	5

1. _____ My teachers thought I was the kind of person who could do well in science
2. _____ I found it hard to win the respect of science teachers*
3. _____ My science teachers made me feel I had the ability to go on in science
4. _____ Getting a science teacher to take me seriously has been a problem*
5. _____ My science teachers were interested in my progress in science
6. _____ I had a hard time getting teachers to talk seriously with me about science*

Parents' Careers

Just to remind you, STEM is an acronym for Science, Technology, Engineering, or Mathematics. STEM fields include the "hard sciences."

STEM Fields include

- Science fields like
  - Biology, Chemistry
  - Physics,
  - Astronomy
- Technology fields like
  - Computer Science, Robotics
- Engineering fields like
  - Electrical Engineering, Biomechanics
  - Mechanical Engineering, Industrial Engineering
- Mathematics fields like
  - Applied Mathematics, Statistics

Think about your parent/guardian. Is this your

__Mother __Father Other (please explain)

____

Does this parent have a job in a STEM field? (If your parent is retired, please think about the career they used to have).

__Yes, they work in a STEM field __No, they don't work in a STEM field

What do they do?

____

Think about your other parent/guardian. Is this your

__Mother __Father Other (please explain)

____

Does this parent have a job in a STEM field? (If your parent is retired, please think about the career they used to have).

__Yes, they work in a STEM field __No, they don't work in a STEM field

What do they do?

____

Study 1: Peer STEM models

Institutional Belonging Scale – peer items (modified from Tyler and Degoey 1995)
Please read each statement. Select the number that best represents how much you agree or disagree with each statement using the scale below.

1	2	3	4	5	6	7
STRONGLY DISAGREE	DISAGREE	DISAGREE SOMEWHAT	NEUTRAL	AGREE SOMEWHAT	AGREE	STRONGLY AGREE

_____ There were many people in my math classes who I thought of as good friends.

_____ I was proud to tell my friends about my math classes.

_____ Many of the people in my math classes had similar values to mine.

_____ There were many people in my science classes who I thought of as good friends.

_____ I was proud to tell my friends about my science classes.

_____ Many of the people in my science classes had similar values to mine.

Friends' attitudes toward STEM scale Please read each statement. Select the number that best represents how true each statement is from not at all true to very true.

My best friend liked science.
Not at all true 1 2 3 4 5 6 7 Very true
My best friend liked technology (e.g. computer coding).
Not at all true 1 2 3 4 5 6 7 Very true
My best friend liked engineering.
Not at all true 1 2 3 4 5 6 7 Very true
My best friend liked math.
Not at all true 1 2 3 4 5 6 7 Very true
My other friends liked science.
Not at all true 1 2 3 4 5 6 7 Very true
My other friends liked technology (e.g. computer coding).
Not at all true 1 2 3 4 5 6 7 Very true
My other friends liked engineering.
Not at all true 1 2 3 4 5 6 7 Very true
My other friends liked math.
Not at all true 1 2 3 4 5 6 7 Very true
Most of my friends did well in science and math.
Not at all true 1 2 3 4 5 6 7 Very true

Social Coping Questionnaire Peer Acceptance subscale:

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree

_____ Being good at math would have hurt my popularity.*

_____ Other students would have liked me less if I was good at math.*

_____ I wouldn't have fit in well at school if I had been better at math.*

_____ Being good at science hurt my popularity.*

_____ Other students liked me less because I was good at science.*

_____ I wouldn't have fit in well at school if I had been better at science.*

Descriptive information on close friends.
Think about your closest friends from high school.

What proportion of your close friends were girls?
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

What proportion of your close friends were boys?
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

What proportion of your close friends had a strong interest in science, technology, engineering, or math?
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Think about your friend(s) with a strong interest in science, technology, engineering, or math. How often did you see them?

Never	Almost never	About once a year	A few times a year	Every 2 or 3 months	About Once a Month	Several times a month	Several times a week	Almost every day	every day

General Academic Self-efficacy *Academic Self-efficacy (Midgley et al., 2000; Sub-scale of University of Michigan Patterns of Adaptive Leaning Scales)*

Here are some questions about you as a high school student in general. Please read each statement below and click on the number that best represents how true each statement is of you and what you think.

I felt certain I could master the skills taught in my classes.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I was certain I could figure out how to do the most difficult class work.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I knew I could do almost all the work in class if I didn’t give up.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

Even if the work was hard, I could learn it.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I could do even the hardest work in classes if I tried.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

Demographics:

Are you currently enrolled in college or graduate school?
No, Yes – college, Yes – Graduate school

What year are you in college? Freshman, Sophomore, Junior, Senior, Graduate School: Master's degree, Graduate School: Doctoral/Professional degree

Do you go to a public or private college? Public, Private

Are you enrolled full-time or part time? Full time (4+ classes per semester), Part time (3 or fewer classes per semester)

Do you attend an online college or traditional college? Online college, traditional college

What is your major/degree?

What is the highest degree you think you will complete?
Some college but no completed degree
Associates degree
Bachelor's (BA, BS)
Master's
Doctorate (PhD)
Professional Degree (MD, JD, DDS)

What is your overall college GPA (out of 100 points)?
What is your GPA in your major(s) (out of 100 points)? Major 1: Major 2:

(Think about the last one you went to if you went to more than one)
What type of high school did you attend?
All boys, all girls, co-ed
Public, private, charter school, other

Did you attend a specialized high school e.g., a performing arts high school, science school, etc? Yes, no, please indicate which type
On average, how many people were in each class with you?
What was the size of your graduating class (about how many students graduated with you)?
On a 100 point scale, what was your overall (unweighted) high school grade point average (GPA)?
Many students take the SAT several times. Please report your scores for the SAT each time you took the exam.
First SAT scores: Math, reading, writing
Second SAT scores: Math, reading, writing
How many years did you attend high school?

How many REQUIRED classes did you take in each of the following areas during high school?

Math classes, science classes, technology classes (e.g., computer programming), engineering classes, English classes

How many OPTIONAL classes did you take in each of the following areas during high school?

Math classes, science classes, technology classes (e.g., computer programming), engineering classes, English classes

Did you take any Advanced Placement (AP courses) in High School? If yes, please provide information below.

Name of Course, Grade in Class (from 0-100), and AP test score (from 1-5)

Course 1- Course 10

Basic demographics:

Age, gender, race/ethnicity

What is your domestic status? US Citizen, Greencard holder, immigrant

Is English a second language for you? Yes/No

Think about your parent/guardian. Is this your

__Mother __Father Other (please explain)

____

What was the highest level of education they completed?

Completed some lower/middle school

Completed some high school, but didn’t graduate

Graduated from high school

Completed some college, but didn’t finish a degree

Completed Associates degree (2 years of college)

Completed Bachelor’s degree (4 years of college)

Completed some graduate or professional school, but didn’t finish a degree

Completed master’s degree (MA, MS, EdM)

Completed Doctorate (PhD) or Professional Degree (MD, JD, DDS)

Think about your other parent/guardian. Is this your

__Mother   __Father   Other (please explain)

____

What was the highest level of education they completed?

Completed some lower/middle school

Completed some high school, but didn’t graduate

Graduated from high school

Completed some college, but didn’t finish a degree

Completed Associates degree (2 years of college)

Completed Bachelor’s degree (4 years of college)

Completed some graduate or professional school, but didn’t finish a degree

Completed master’s degree (MA, MS, EdM)

Completed Doctorate (PhD) or Professional Degree (MD, JD, DDS)

To the best of your knowledge, what was your family's income this past year?

Less than 10,000

10,000 – 50,000

50,000 – 100,000

100,000-200,000

More than 200,000

Study 2: Manipulation of Perceived Identity Compatibility

Entry-Level Scientist Career Description: Communal Goals Version
8:15 am: I come in and check my e-mail then plan the day. I usually have to communicate closely with the Operations Group (they run the high-throughput screens) to check on the status of ongoing experiments so we can go from primary to secondary characterizations.

9:15 am: I go to the lab after about an hour to check on samples left overnight (for example, to see if a drug crystallized), characterize samples from the previous afternoon to integrate the data collected the previous day, and characterize new samples that have come in that day. I meet some of my lab group in the lab and consult with them about the procedures.

12:00 pm: I join co-workers from other labs at lunch. The company runs presentations during lunch, where we learn what else is going on both within the company and with the Big Pharma companies who supply us with compounds. Speakers might be a group member from a different group giving an update, a patent lawyer briefing us on legal issues in patent protection, and a member of the Products Group describing ongoing product development work. Lunch is a good chance to catch up on the progress that other labs are making, and to share our ideas and feedback.

1:00 pm: Mentor new members of my statistics group in doing data analysis (e.g., powder X-ray diffraction, differential scanning calorimetry, thermal gravimetric analysis).

3:00 pm: Collaborate with my group (which has 6 members) to prepare for a meeting with our supervisor. Go to meeting to update our supervisor on the status of our projects, which are typically larger projects that have several team members. Our supervisor will ask questions and give advice on running further experiments or collecting additional data points. Our supervisor also gives us a heads-up on what compounds are coming in during the next few weeks. This gives us an idea of the workload of the group.

4:00 pm: Update lab notebook with either data collected that day or experiments started. Get started on experiments that can be set up and run overnight.

5:00 pm: Prepare for the monthly presentation my lab group gives at local schools to inform interested students about our research. Typically, I make a PowerPoint presentation using tables and charts of data, a summary, and discussion points.

5:30 pm: Commute home.

Summary: I like that so much of my work involves working closely with other people and helping them solve problems. The interactions we have are really fun, and I get the sense that I am contributing a great deal to their projects. I like having a variety of tasks, gathering data through multiple methods, and trying to interpret data from both high-throughput experiments and bench-top experiments. I like the sense of contributing to understanding drug candidates that are likely to get into clinical trials. I like being exposed to industry and to the various issues in the pharmaceutical industry, both within my field and outside—largely from presentations—from the senior scientists and other experts.

Entry-Level Scientist Career Description: Non-communal Goals Version
8:15 am: I come in and check my e-mail then plan the day. I usually have to check a database maintained by the Operations Group (they run the high-throughput screens) to learn the status of ongoing experiments so I can go from primary to secondary characterizations.

9:15 am: I go to the lab after about an hour to check on samples left overnight (for example, to see if a drug crystallized), characterize samples from the previous afternoon to integrate the data collected the previous day, and characterize new samples that have come in that day. I look up relevant past research to consult about the procedures.

12:00 pm: The company runs presentations during lunch, where we learn what else is going on both within the company and with the Big Pharma companies who supply us with compounds. I watch video feed of these presentations at my desk while I eat. Speakers might be a researcher from a different lab giving an update, a patent lawyer briefing us on legal issues in patent protection, and a member of the Products Group describing ongoing product development work.

1:00 pm: Do data analysis (e.g., powder X-ray diffraction, differential scanning calorimetry, thermal gravimetric analysis) and troubleshoot any problems that come up by myself.

3:00 pm: Go to meeting to update my supervisor on the status of my projects, which are typically independent. My supervisor will tell me what further experiments to run or additional data points to collect. My supervisor also gives me a heads-up on what compounds are coming in during the next few weeks. This gives me an idea of what my own workload will be like.

4:00 pm: Update lab notebook with either data collected that day or experiments started. Get started on experiments that can be set up and run overnight.

5:00 pm: Prepare for weekly meetings with the entire Solid State Chemistry Group (15 members). Typically, I make a PowerPoint presentation using tables and charts of data, a summary, and discussion points.

5:30 pm: Commute home.

Summary: I like that so much of my work involves working by myself and solving problems. The solitary nature of my work really lets me advance at a quick pace, and I get the sense that I am achieving a great deal through my projects. I like having a variety of tasks, gathering data through multiple methods, and trying to interpret data from both high-throughput experiments and bench-top experiments. I like the sense of contributing to understanding drug candidates that are likely to get into clinical trials. I like being exposed to industry and to the various issues in the pharmaceutical industry, both within my field and outside—largely from presentations—from the senior scientists and other expert

Study 2: Measures of STEM engagement

Sense of Belonging Measure

Imagine that you were considering taking a position in this lab. We know you have been given very little information, but we are interested in how appealing this position is given the little information that can be gleaned from a job listing. Given the little you know about a typical day in this lab, how would you feel about the environment? Using the scale from 1-10, please choose a number that best describes how you feel about the following questions.

How would you feel about a position in this lab?

Thrilled to be there OK Miserable to be there

1 2 3 4 5 6 7 8 9 10

How would you feel about a position in this lab?

Definitely fit in Sort of fit in Would NOT fit in

1 2 3 4 5 6 7 8 9 10

How would you feel about a position in this lab?

Very welcome Sort of welcome NOT welcome

1 2 3 4 5 6 7 8 9 10

How would you feel about a position in this lab?

Very comfortable So-so Very uncomfortable

1 2 3 4 5 6 7 8 9 10

How would you feel about your coworkers in this lab?

Like them Sort of like them Do NOT like them

1 2 3 4 5 6 7 8 9 10

How would you feel about your coworkers in this lab?

Feel very comfortable with them Sort of comfortable with them Do NOT feel comfortable with them

1 2 3 4 5 6 7 8 9 10

How would you feel about the lead researcher for whom you'd work?

Would like them Would sort of like them Would NOT like them

1 2 3 4 5 6 7 8 9 10

How would you feel about the lead researcher for whom you'd work?

Feel very comfortable with them Sort of comfortable with them Do NOT feel comfortable with them

1 2 3 4 5 6 7 8 9 10

Self-Confidence in Science from Martin, Mullis, & Chrostowski, 2004

Please answer using the following scale

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

______ I usually do well in science.

______ Science is more difficult for me than for many of my classmates.

______ Science is not one of my strengths.

______ I learn things quickly in science.

Evaluation of Position from Diekman et al., 2011

1) "What is your impression of the career of an entry-level scientist?"	Not at all positive						Extremely positive
	1	2	3	4	5	6	7
2) "How enjoyable do you believe you would find a career as an entry-level scientist?"	Not at all enjoyable						Extremely enjoyable
	1	2	3	4	5	6	7

Enjoyment of Science from Taylor et al., 1982

Please answer using the following scale

1	2	3	4
Strongly Disagree	Disagree	Agree	Strongly Agree

_______ I like to study science in school.

_______ I feel the study of science in school is important.

_______ Science is dull.

_______ I do not enjoy science.

_______ I would like to study more science.

_______ Science classes are boring.

_______ Science is a valuable subject.

Value of Science and Technology from the international Relevance of Science Education (ROSE) project

1	2	3	4
Disagree			Agree

_____ Science and technology are important for society.

_____ Science and technology will find cures to diseases such as HIV/AIDS, cancer, etc.

_____ Thanks to science and technology, there will be greater opportunities for future generations.

_____ Science and technology make our lives healthier, easier and more comfortable.

_____ New technologies will make work more interesting.;

_____ The benefits of science are greater than the harmful effects it could have.

Study 2: Job Candidate Credentials

DEMOGRAPHIC
Participants ID #:149
Name: Jennifer ********
Gender: Female
Ethnic Background: Caucasian
Age: 22
Degree: Bachelors of Science, obtained May 2011 from ****** University

BACKGROUND
GPA: 3.2
GRE score: 650 verbal, 780 quantitative
Awards/honors: President's Service Award, Rotary Club College Scholarship
Previous research experience: 2 years as a research assistant working with 2 different faculty mentors
Academic standing: appears from Jennifer's transcript that she was in good standing upon graduation, but withdrew from 1 class prior to final
Letters of recommendation: Three (2 from former faculty research supervisors, 1 from an intro science course professor), all supportive
Future plans: apply to doctoral programs
Extracurricular activities: student government, college learning center tutor
Position sought: Lab Manager
Position duration: 2 years, with possibility of renewal pending satisfactory performance

STATEMENTS/LETTERS
Excerpt from student statement: "I am a motivated student and would like the most of the opportunity to serve as your lab manger. After spending a semester working in Dr. *****'s lab and another year doing research with Dr. *****, I have gained valuable technical skills, co-authored a journal article, and am now committed to an academic research career…as someone focused on improving my standing and enhancing my research experience, this lab manager position would provide the perfect opportunity to hone the necessary skills to make me competitive for graduate school applications…additionally, the fascinating research taking place in your lab is directly in line with my interests and experiences…in short, I am focused, motivated, organized and dedicated to improving my research skills. I am enthusiastic about the opportunity to fill the lab manger position and collaborate with you on future research."

Excerpt from faculty recommendation letter: "…although Jennifer admittedly took a bit longer than some students to get serious about her studies early in college, she has impressed me by improving over the last two years of her science coursework and has made every effort to make up for lost ground…she has been a strong research assistant in my lab, and I know she is capable of serving as a dedicated lab manger."

Study 2: Job Candidate Evaluations

Candidate Competence from Moss-Racusin et al., 2012
Please choose a number that best describes how you feel about what is being asked in each question.

Did the applicant strike you as competent?

Not at all	1	2	3	4	5	6	7	Very much

How likely is it that the applicant has the necessary skills for this job?

Not at all	1	2	3	4	5	6	7	Very much

How qualified do you think the applicant is?

Not at all	1	2	3	4	5	6	7	Very much

Candidate Hireability from Moss-Racusin et al., 2012
Using the scale of 1(- Not all all) to 7(-Very much), please choose a number that best describes how you feel about what is being asked in each question.

How likely would you be to invite the applicant to interview for the laboratory manager job?
Not at all 1 2 3 4 5 6 7 Very much

How likely would you be to hire the applicant for the laboratory manager job?
Not at all 1 2 3 4 5 6 7 Very much

How likely do you think it is that the applicant was actually hired for the laboratory manager job he/she applied for?
Not at all 1 2 3 4 5 6 7 Very much

STEM Background:
Using the scale below, indicate how much you agree or disagree with each statement in regards to S.T.E.M. (Science, Technology, Engineering, or Math) scored from 1 (Strongly disagree) to 5 (Strongly Agree).

There are elements of science, technology, engineering, or math (STEM) in my current job/major.
Strongly Disagree 1 2 3 4 5 Strongly Agree

I work/study in a STEM field.
Strongly Disagree 1 2 3 4 5 Strongly Agree

I am interested in science or technology.
Strongly Disagree 1 2 3 4 5 Strongly Agree

I enjoy learning about science or technology.
Strongly Disagree 1 2 3 4 5 Strongly Agree

I used to work/study in a STEM field but I no longer do.
Strongly Disagree 1 2 3 4 5 Strongly Agree

I considered working/studying in a STEM field but went into a different field.
Strongly Disagree 1 2 3 4 5 Strongly Agree

STEM Self-efficacy *(Modified from General Academic Self-efficacy by Midgley et al., 2000; Sub-scale of University of Michigan Patterns of Adaptive Leaning Scales)*

Here are some questions about your general abilities in math, science, technology, and engineering. Please read each statement below and click on the number that best represents how true each statement is of you and what you think.

I'm certain I could master the skills taught in science, technology, engineering, and math (STEM) classes.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I'm certain I could figure out how to do the most difficult STEM class work.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I could do almost all the work in a STEM class if I didn't give up.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

Even if the work in a STEM class is hard, I could learn it.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

I could do even the hardest work in STEM classes if I tried.

1	2	3	4	5
NOT AT ALL TRUE		SOMEWHAT TRUE		VERY TRUE

Communal Goal Endorsement *(Deikman et al., 2011)*

How important is each of the following goals to you personally?

Serving community

Not at all important 1 2 3 4 5 6 7 Extremely important

Working with people

Not at all important 1 2 3 4 5 6 7 Extremely important

Helping others

Not at all important 1 2 3 4 5 6 7 Extremely important

Connecting with others

Not at all important 1 2 3 4 5 6 7 Extremely important

Attending to others

Not at all important 1 2 3 4 5 6 7 Extremely important

Caring for others

Not at all important 1 2 3 4 5 6 7 Extremely important

The Rosenberg Self-esteem Scale *(Rosenberg, 1989)*

On the whole I am satisfied with myself.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

At times I think that I am no good at all.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I feel that I have a number of good qualities.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I am able to do things as well as most other people.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I feel I do not have much to be proud of.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I certainly feel useless at times.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I feel that I am person of worth, at least the equal of others.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I wish I could have more respect for myself.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

All in all, I am inclined to feel that I am a failure.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

I take a positive attitude toward myself.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

Study 3: Background Measures

Background
What program at Stony Brook are you beginning this Fall (include both department/program name and degree program such as Master's or PhD)?

____

Department: (e.g., Chemistry, Engineering, English): ___________
Specific Program: (e.g., Art History, Biochemistry, Electrical Engineering): ___________
Degree Program: (e.g., Master's, PhD): ___________

What FIELD of study are you thinking about pursuing? FIELD is the career, discipline,

or subject area that you are studying, e.g., science, mathematics, history, art.

____

What is your gender?

Female Male

Perceived Identity Compatibility Scale

Using the scale provided below, please indicate how much you agree or disagree with the following statements.

	1- Strongly Disagree	2	3	4	5	6	7- Strongly Agree
I don't think that my gender will affect how others view me in my field of study.							
I don't think that my gender will affect how well I do in my field of study.							
I think my gender and my field of study are very compatible.							
I think I may experience difficulties in my field of study because of my gender.							
I think my gender will be an important factor in the type of career I decide to pursue.							
I don't think I would pursue certain fields because of my gender.							

Sense of belonging in field and department: *(NOTE: All items reversed)*

Select the number that best describes your feelings toward your **department**.

1- Thrilled to be there 2 3 4 5- OK 6 7 8 9 10- Miserable to be there

Select the number that best describes your feelings toward your **department**.

1- Definitely fit in 2 3 4 5- Sort of fit in 6 7 8 9 10- Do NOT fit in

Select the number that best describes your feelings toward your **department**.

1- Very welcome 2 3 4 5- Sort of welcome 6 7 8 9 10- NOT welcome

Select the number that best describes your feelings toward your **department**.

1- Very comfortable 2 3 4 5- So-so 6 7 8 9 10- Very uncomfortable

Select the number that best describes your feelings toward your **PEERS AND CLASSMATES** in your **department**.

1- Like them 2 3 4 5- Sort of like them 6 7 8 9 10- do NOT like them

Select the number that best describes your feelings toward your **PEERS AND CLASSMATES** in your **department**.

1- Feel very comfortable with them	2 3 4	5- Sort of comfortable with them	6 7 8 9	10- Do NOT feel comfortable with them

Select the number that best describes your feelings toward your **PROFESSORS** in your **department**.

1- Like them 2 3 4 5- Sort of like them 6 7 8 9 10- Do NOT like them

Select the number that best describes your feelings toward your **PROFESSORS** in your **department**.

1- Feel very comfortable with them	2 3 4	5- Sort of comfortable with them	6 7 8 9	10- Do NOT feel comfortable with them

Select the number that best describes your feelings toward your **field of study**.

1- Thrilled to be there 2 3 4 5- OK 6 7 8 9 10- Miserable to be there

Select the number that best describes your feelings toward your **field of study**.

1- Definitely fit in 2 3 4 5- Sort of fit in 6 7 8 9 10- Do NOT fit in

Select the number that best describes your feelings toward your **field of study**.

1- Very welcome 2 3 4 5- Sort of welcome 6 7 8 9 10- NOT welcome

Select the number that best describes your feelings toward your **field of study**.

1- Feel very comfortable 2 3 4 5- So-so 6 7 8 9 10- Very uncomfortable

Desire to leave program

I may consider dropping out of my graduate program before graduating.

Strongly Disagree | **Strongly Agree**

1 2 3 4 5 6 7

I may consider changing to a different field of study before graduating.

Strongly Disagree | **Strongly Agree**

1 2 3 4 5 6 7

Study 3: Biweekly Measures

Overall, how are you feeling RIGHT NOW?

Terrific   Very Good   Good   So-So   Bad   Very Bad   Terrible

Field Evaluation:

Think about the FIELD of study that you are pursuing right now. Rate each statement below to indicate **how you feel about your FIELD of study RIGHT NOW**:

	1- Not at all	2	3	4	5	6	7- Completely
It is important to me.							
I feel confident.							
I feel interested.							
I feel motivated.							
I feel excited.							
I feel satisfied.							
I feel insecure.							

NOW rate each statement below to indicate how you feel RIGHT NOW about **your FUTURE IN YOUR FIELD** of study:

	1- Not at all	2	3	4	5	6	7- Completely
I feel happy.							

I feel optimistic.

I feel excited.

I feel confident.

Field connectedness:
Rate each statement below:

	1- Strongly Disagree	2	3	4- Neutral	5	6	7- Strongly Agree
I feel a strong sense of belonging to others in my field of study.							
I feel a strong sense of belonging to others in my program.							
I feel a strong sense of belonging to others in my lab.							
I feel a strong sense of belonging to others in my university.							

Field Centrality:
Rate each statement below:

	1- Strongly Disagree	2	3	4- Neutral	5	6	7- Strongly Agree
Being in my field of study is an important part of who I am.							
Being in my program is an important part of who I am.							
Being in my lab is an important part of who I am.							
Being at my university is an important part of who I am.							

Perceived identity compatibility scale (short):
Using the scale provided below, please indicate how much you agree or disagree with the following statements RIGHT NOW.

	1- Strongly Disagree	2	3	4	5	6	7- Strongly Agree
I don't think that my gender will affect how others view me in my field of study.							
I think my gender and my field of study are very compatible.							
I think my gender will be an important factor in the type of career I decide to pursue.							

Sense of belonging in field/department (short);*(NOTE: All items reversed)*

Select the number that best describes your feelings toward your **department**.

1- Thrilled to be there 2 3 4 5- OK 6 7 8 9 10- Miserable to be there

Select the number that best describes your feelings toward your **department**.

1- Definitely fit in 2 3 4 5- Sort of fit in 6 7 8 9 10- Do NOT fit in

Select the number that best describes your feelings toward your **department**.

1- Very welcome 2 3 4 5- Sort of welcome 6 7 8 9 10- NOT welcome

Select the number that best describes your feelings toward your **department**.

1- Very comfortable 2 3 4 5- So-so 6 7 8 9 10- Very uncomfortable

Select the number that best describes your feelings toward your **field of study**.

1- Thrilled to be there 2 3 4 5- OK 6 7 8 9 10- Miserable to be there

Select the number that best describes your feelings toward your **field of study**.

1- Definitely fit in 2 3 4 5- Sort of fit in 6 7 8 9 10- Do NOT fit in

Select the number that best describes your feelings toward your **field of study**.

1- Very welcome 2 3 4 5- Sort of welcome 6 7 8 9 10- NOT welcome

Select the number that best describes your feelings toward your **field of study**.

1- Feel very comfortable 2 3 4 5- So-so 6 7 8 9 10- Very uncomfortable

Perceived Sexist Climate:

Please indicate your level of agreement RIGHT NOW with each of the following statements concerning the atmosphere in your department/program:

	1- Strongly Disagree	2	3	4	5- Strongly Agree
Sexist remarks are heard in my department/program.					
There is equal access for both men and women to departmental/program opportunities.					
Men are more likely than women to receive helpful advice from faculty in the department/program.					
In my department/program, people pay just as much attention when women speak as when men do.					

Perceived success:

Rate each statement below to indicate **how you feel about your FIELD of study RIGHT NOW**:

	1- Not at all	2	3	4	5	6	7- Completely
I am doing/performing well.							