

THESIS

DOES ENDORSEMENT OF GENDER STEREOTYPES PREDICT
WOMEN'S INTEREST IN, AND EXPRESSED LIKELIHOOD TO PURSUE
AN ACADEMIC CAREER IN SCIENCE OR ENGINEERING?

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ABSTRACT

DOES ENDORSEMENT OF GENDER STEREOTYPES PREDICT WOMEN'S INTEREST IN, AND EXPRESSED LIKELIHOOD TO PURSUE AN ACADEMIC CAREER IN SCIENCE OR ENGINEERING?

Background: In recent decades much attention has been given in the United States (U.S.) to women's underrepresentation in science and engineering (SE) fields. Early theories were that women are simply not good at math and/or science, and that women are uninterested in SE. Both theories are not supported by evidence. To start with, in the U.S. women's representation in SE varies greatly by field (e.g., high representation in biology and low in computer science). Women's representation in SE also varies by country. For example, in Lithuania women represent the majority of engineers. This variability indicates that women are capable and interested in science, with social-cultural context (e.g., culture and opportunities) playing a major role in women's participation in SE.

This study focused on the social-cultural context of women's participation in SE in the U.S. - specifically gender stereotypes and gender-ideology factors that are emerging as relevant to U.S. women's participation in SE fields mostly via studies of SE undergraduate students. The gender-ideology factors that are the focus of this study are: women's gender stereotypes of SE fields, gender stereotypes of SE individuals, SE women's goal orientation (e.g., self-versus other-growth focus), and SE women's family/work beliefs and expectations. This study examined whether these gender stereotypes and ideologies predict interest and expressed likelihood to pursue an academic career among graduate student women in SE.

Regarding gender stereotypes of SE fields, U.S. studies of computer science (CS) and engineering undergraduate students suggest that when female students view these fields as more "masculine" they express less interest in SE careers (see Cheryan et al., 2017 for a review). Regarding gender stereotypes of

SE individuals, U.S. studies of CS undergraduate students indicate that CS female students' interest and intention to pursue an academic career is lower when they view the field as masculine (e.g., Cheryan et al., 2011). Regarding goal orientation, U.S. studies conducted with undergraduate women in a variety of SE fields as well as psychology suggest that a focus on self-growth as an education goal is associated with greater interest in pursuing an SE career while a focus on others-growth is associated with less interest in pursuing an SE career (e.g., Diekmann et al., 2010). Finally, with regard to family/work beliefs and expectations, quantitative survey studies of female SE undergraduates (e.g., in CS, Haines & Wallace, 2003; Sax, 2001) as well as qualitative and quantitative studies of female graduate students in science (e.g., in atmospheric sciences, Canetto et al., 2017; in chemistry and biology, Ferreira, 2003) suggest that women's interest and intention to pursue a leadership career in these fields are less strong when these women view themselves as having to take primary responsibility for family caregiving.

A limitation of past U.S. studies of the social-cultural context of women in SE is that they mostly focused on undergraduate women or on professional women (e.g., Cech & Blair-Loy, 2019). An understudied SE educational stage is that of graduate school. Graduate school is when women make professional and personal decisions that support or interfere with their pursuit of a SE academic career. By the very fact of being in SE graduate school, SE graduate-student women have behaviorally challenged at least some SE stereotypes. The fact that they are investing in advanced SE education suggests SE-leadership ambition, including potentially, interest in a SE academic career.

Aim: The purpose of this study was to examine the association, among SE female graduate students, between their interest in, and their expressed likelihood to pursue a career in academia, with their views in four domains: 1. Their views of academia, science in general, and their SE field, as relatively feminine or masculine; 2. Their views of women or men who excel in academia, science, and specific SE field, as relatively feminine or masculine; 3. Their educational and career goals, as mostly self-growth or others-growth oriented; and 4. Their views of women's and men's family responsibilities.

Method: The sample consisted of 140 SE graduate student women at a large state university in the U.S. Participants were asked to respond to an online questionnaire that included questions regarding their

endorsement of various gender stereotypes and ideologies, and questions about their interest in, and expressed likelihood of pursuing a career in academia.

Results: Endorsement of gender stereotypes and of gender ideologies of work and family did not predict women's interest in, and stated likelihood to pursue an academic career. Endorsement of gender stereotypes and ideologies was low in this sample of female SE graduate students. The least endorsed were the family/work gender ideologies that competitiveness and nurturance vary by sex, and that mother should work for pay only if necessary. The relatively least rejected family/work gender ideology was the idea that a father's major responsibility is to provide financially for his children. The most endorsed gender stereotypes were the belief that men excel more than women in SE, and that academia, science, and their specific field are masculine. Women also endorsed others-growth goals more than self-growth goals. Endorsement of self-growth or others-growth oriented career goals varied by field. Also, interest and expressed likelihood to pursue an academic career were both relatively low. Women's interest in an academic career varied by field and years in the program. Women in Math, Microbiology, and Atmospheric Sciences expressed the most interest in an academic career while women in Chemistry, Engineering and Statistics reported the least interest. The more years the women had spent in their graduate program the less interest in an academic career they expressed.

Discussion: This study assessed the possible role of gender stereotypes of SE, gendered ideologies of career goals, and gendered ideologies of family and work, in women's interest and intention to pursue a SE academic career. A main finding is that SE female graduate students did not endorse these gender stereotypes and ideologies. The only stereotypes that they gave some credence to were the idea that men excel in SE more than women and the idea that academia, science, and their SE field are masculine. Interest and expressed likelihood to pursue an academic career were both relatively low. Not surprisingly then gender stereotypes of SE, gendered ideologies of career goals, and gendered ideologies of family and work did not predict interest and intention to pursue a SE academic career. In this study endorsement of gender stereotypes and ideologies varied by field. Specifically, women in Math, Microbiology, and Atmospheric Sciences expressed the most interest in an academic career while women in Chemistry,

Engineering and Statistics reported the least interest. The uneven sizes of participants by field did not allow examination of patterns by field.

A conclusion based on these findings is that the gender stereotypes of SE and of gendered ideologies of career goals and of family and work evaluated in this study do not matter to women's interest and expressed likelihood to pursue a SE academic career once women are in graduate school, though they have been found to be relevant to undergraduate women considering a SE higher education and leadership path (Cheryan et al., 2017). Other gender stereotypes and ideologies may be relevant to graduate school women's interest and intention to pursue a SE academic career. It is also conceivable that the self-report measures of gender stereotypes and of gendered ideologies used in this study were not sensitive-enough to capture the chosen constructs among women in SE graduate school. Interviews may be a more effective method to explore gender stereotypes and gender ideologies among women in SE graduate school. Given the variability in gender stereotypes and ideologies endorsement by field suggested by this study, future research should examine by SE discipline the relationship between endorsement of gender stereotypes and ideologies and SE career interest and expressed likelihood to pursue it. To evaluate what predicts women in SE graduate school's actual move into a SE academia career, future research should assess not only SE academic-career interest and stated likelihood to pursue an academic career but actual SE career behaviors, including SE academic career choice and progress in a SE academic career, via a longitudinal design.

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Introduction

Much attention has been given in the United States (U.S.) to women's underrepresentation in science and engineering (SE) fields. Women are particularly underrepresented in SE leadership roles, despite the proportion of women in SE undergraduate and graduate programs having increased in recent decades. Only 38% of SE academic faculty are women even though women earned about half of SE bachelor's degrees, 44% of master's degrees, and 41% of doctorate degrees in 2016 (NSF, 2019). In SE leadership, and in SE academia specifically there are fewer and fewer women at each higher status level—a phenomenon commonly referred to as the leaky pipeline (Barinaga, 1992). To understand and address the scarcity of women in SE leadership we need to understand why SE women who are in graduate school are not pursuing academic careers.

Many explanations have been proposed for women's underrepresentation in SE. One is that women are simply not good at math and/or science. Another is that women are uninterested in SE. Both theories have been challenged by evidence. Meta-analyses have challenged ability theories by demonstrating that women and men do not differ on math and science ability (Lindberg et al., 2010). Lack of interest is also not an explanation because women's representation in SE varies greatly by field. For example, in the U.S. women hold the highest proportion of degrees in psychology and biology, and the lowest in computer science (CS) and engineering (NSF, 2019). There is also variability within fields. For example, there is variability of women's representation in engineering fields with biomedical engineering having more women than mechanical engineering. Women's representation in SE also varies by country. For example, in 2010 women earned only 26% of math and CS doctorates in the U.S but in Lithuania and Saudi Arabia they earned 60% of doctorate degrees in those fields (Scientific American, 2014). This variability across field and culture indicates that social-cultural context (e.g., culture and opportunities) has a major role in women's interest, participation, and leadership in SE.

Theory and research have begun to move away from ability and interest theories as sex differences givens, and to focus instead on the social-cultural context of women's interest, participation,

persistence, and leadership in SE. Master and Meltzoff (2020) proposed that cultural stereotypes specific to SE fields contribute to women's lower SE participation by negatively affecting interest and academic outcomes. This theory places an emphasis on social factors such as SE stereotypes and feelings of belonging as explanations for women's underrepresentation in certain SE fields. Research conducted mostly with undergraduate students suggests that gender-ideology factors may be implicated in the variability of women's participation in different SE fields. In a review of the literature on disparities in women's participation by SE fields Cheryan and colleagues (2017) identified social and cultural factors that may explain women's under-participation in certain fields such as CS and engineering. These factors are (a) a discipline's "masculine" culture that signals a lower sense of belonging to women than men, (b) women's insufficient early experience with CS, engineering, and physics, and (c) women's lower SE self-efficacy.

This study focused on the social-cultural context of women's participation in SE in the U.S., specifically on the gender stereotypes and gender-ideology factors that in research with undergraduate participants are emerging as relevant to women's participation in SE fields. The gender-ideology factors that were the focus of this study were: SE women's gender stereotypes of SE fields, gender stereotypes of SE individuals, goal orientation (e.g., self-versus other-growth focus), and family/work beliefs and expectations, building on past research on these four dimensions. This study focused on women in SE graduate school and examined whether these gender ideologies predict interest and expressed likelihood to pursue an academic career among graduate student women in SE.

Empirical Research on Gender Ideologies and Women's Participation in Academia, Science and in Science/Engineering Fields

This section reviews U.S. research on socio cultural gender factors in women's interest and persistence in SE, specifically, studies of SE women's gender stereotypes of SE fields, studies of SE women's gender stereotypes of SE individuals, studies of SE women's career goal orientation (e.g., self-versus other-growth goals), and studies of SE women's gender ideologies, beliefs, and expectations of family/work.

Women's Perceptions of Academia, Science in General, and Their SE Field, as More Masculine or More Feminine

U.S. studies of CS and engineering undergraduate students found that female students' perceptions of these fields as more "masculine" was associated with their being less interested in these fields. One study examined undergraduate students' perceptions of computer scientists by having the students provide descriptions of computer scientists (Cheryan et al., 2013). Researchers found that women viewed computer scientists as lacking social skills and being singularly focused on computers. These views conflicted with their expectations of themselves as socially competent and service oriented. In another study undergraduate students were presented two newspaper articles about computer scientists. One article portrayed computer scientists as "nerdy," technology oriented, focused, or intense, and lacking interpersonal skills while the other did not. Women who read the article presenting computer scientists in a stereotypical way reported less interest in CS than women who read the other article. Yet another study of undergraduate engineering students asked participants to rate how strongly they agreed or disagreed with the view that engineering is "created for men, by men, and built on male attitudes and traditions." Eighty-one percent of first-year female students either strongly disagreed or disagreed with this statement. However, only 49% of women in their fourth year disagreed with this view. First-year male students also disagreed with this statement more (61%) than fourth-year male students (50%). This study suggests that as female and male students progress through their program their awareness of these stereotypes becomes even stronger, potentially through learning about history and systems of oppression or through personal experiences (Haines & Wallace, 2003).

Another line of research of stereotypes of SE engineering has focused on implicit bias. Researchers have used the Implicit Association Test (IAT), a response-latency categorization task that assesses the strength of associations between concepts, to measure gender-science stereotypes (Greenwald et al., 1998). One study using the IAT found that female science-majors with strong male-science associations identified less with science and had weaker science career aspirations than female science majors with weaker male-science associations (Cundiff et al., 2013). Research with undergraduate

students has also supported a relationship between viewing science as associated with males and low SE career interest among female students (Lane et al., 2012). Research on stereotypes of gender and SE has not been conducted with graduate students.

Women's Perceptions of Women or Men as Excelling in Academia, Science, and Specific SE Field

Research has examined whether women's perceptions of the stereotypical person who excels in a SE field influences their willingness to pursue a career in that field. U.S. studies with CS undergraduates indicate that female students' interest and intention to pursue an academic career is lower when they view CS as masculine. Undergraduate women who had brief interactions with a female or male CS major who embodied current CS stereotypes (e.g., a male or female student wearing a shirt stating "I code therefore I am") anticipated being less successful in the field and were less interested in pursuing CS than women who interacted with someone who did not embody these stereotypes (Cheryan et al., 2011). This study additionally showed that female CS majors who were exposed to classrooms containing CS stereotypical objects (e.g., Star Trek posters, video games) felt less belonging in CS and believed they would be less successful in CS than women who were exposed to classrooms containing non-CS stereotypical objects (e.g., art posters, water bottles). This study suggests the influence of stereotypes or beliefs about the field on perceptions of fit. When women are exposed to stereotypes about people in certain SE fields, they are more likely to report being uninterested in pursuing careers in these fields. However, this study only focused on environmental cues of the stereotypes and did not directly measure participant's perceptions of SE fields.

Other research on this topic has examined what these perceptions are towards CS and engineering and how similarity to them impacts women's educational and career interest in SE. Research has identified that similarity to a prototypical person in a field is a predictor of interest in pursuing a career in a certain field (Cheryan & Plaut, 2010). For CS and engineering, women tend to report not viewing themselves as similar to the prototypical computer scientist or engineer. In a study conducted with undergraduate students, participants were asked to describe a prototypical computer scientist or engineer through open-ended responses and ratings of traits. Women were more likely to provide stereotypical

descriptions (e.g., intelligent, logical, clumsy, geeky) of computer scientists and engineers than men and also perceived themselves as less similar to the description of the prototypical computer scientist than men. This difference in the perceptions of a prototypical computer scientist or engineer given by women and men mediated lower interest in CS and engineering careers among women (Ehrlinger et al., 2018). This study suggests that women do not perceive themselves as being similar to the typical computer scientist or engineer. It also suggests that women's gender stereotypical views of CS are associated with their lesser willingness to pursue a career in the field. Research has not been conducted on SE women's gender stereotypes of SE individuals among graduate student women.

Self-Growth Versus Others-Growth Educational and Career Goals

Past research has examined two different types of educational/career goals: self-growth and others-growth goals. *Self-growth goals* are referred to as agentic goals and can be defined as goals relating to agency, discovery, and power. *Others-growth goals* are referred to as communal goals and are goals relating to community, helping others, and working with others. A study of SE and psychology undergraduate students examined views of self-growth and other growth careers (Diekmann et al., 2010). SE careers (e.g., mechanical engineer, computer scientists) were rated as affording others-growth goals less than lawyer or architect careers. The latter were viewed as affording others-growth goals less than teacher or nurse careers, Women endorsed others-growth goals more than men, and this endorsement was associated with lower interest in SE careers. Research has not been conducted on others-growth or self-growth career goals among women in graduate school.

Views About Women's and Men's Family and Work Responsibilities

Research has examined whether women's views about whether an academic career in SE is compatible with having a family likely impacts their interest in pursuing a career in SE academia. A study of undergraduate students in biology, engineering, physical sciences, and math/CS explored persistence of undergraduates into graduate school (Sax, 2001). This study found that women's desires to raise a family was a significant predictor of their decision not to continue with SE at the graduate level. Similarly, a study of female undergraduate students in CS using survey methods found that as women progressed in

their program, they became more pessimistic about having a career in their field that could be combined with family life (Haines & Wallace, 2003). These studies suggest that when undergraduate women perceive SE as incompatible with having a family, which may involve childbearing and doing a large majority of the family caregiving and household work themselves (Sax, 2001; Canetto et al., 2017), they are less interested in continuing their education or pursuing a career in SE.

Research conducted with women in SE graduate school level suggests that SE women's interest and intention to pursue a SE leadership career are less strong when these women express an intention to have a family and expect to take primary responsibility for family caregiving. A mixed method study of female graduate students in biology and chemistry using questionnaires and interviews found that females were less likely than their male counterparts to report that a career in STEM would be compatible with having a family (Ferreira, 2003). Similarly, in a qualitative study with female graduate students in atmospheric sciences, an academic career in SE was perceived by these students as incompatible with having a family (Canetto et al., 2017). A dominant and recurring theme in these interviews was the frustration women experienced about the lack of options to pursue their dream of being a scientist while having a family. Having beliefs that women are responsible for family direct caregiving, and that a husband's career has priority over a wife's career, may be the strongest factor in heterosexual women's avoidance of SE leadership careers based on interview data with graduate students.

Empirical Research on Women's Interest and Expressed Likelihood of an Academic Career

Interest and expressed likelihood of an academic career are constructs of interest in this study. These two constructs were measured separately because previous research suggests that women may be interested in an academic career and still not likely to pursue it, due to various disincentives and obstacles (MacPhee & Canetto, 2015). In this study likelihood of an academic career is described as expressed likelihood because what is asked is graduate students' plans for an academic career.

Interest in an Academic Career

In the U.S., universities play a major role in the SE enterprise by educating and training students as well as producing a large share of research. Faculty hold a great deal of influence over the training and

values of their students; and also over their field, through their research and publications. Academia has long been dominated by white men. Though in recent decades white male dominance has started to diminish, women continue to be unrepresented in academia leadership. In SE fields, the proportion of women in tenure track and tenured faculty positions remains low. Only 38% of SE tenure track and tenured academic faculty are women (NSF, 2019). Consistent with the leaky pipeline metaphor, the higher the rank the fewer the women (NSF, 2019). In the U.S., women represent 51% of assistant professors, 44% of associate professors, and 29% of full professors according to a 2014 study done that included 1,159 institutions of higher learning (AAUP, 2014). It has been argued that women are simply less interested in an academic career than men. However, evidence is growing that women are interested in academic careers, but view these careers as being incompatible with raising a family (e.g., Canetto et al., 2017). In Canetto and colleagues' study an academic career was described by women in atmospheric-sciences (ATS) graduate school as the best route to pursue their scientific interests, fulfill the promise of their training, and become a leader in science. These ATS female students however also said that an academic career would require them to sacrifice family life. The ATS female students expressed a desire to "have it all" and be able to have a family and an academic career but believe their desire to be unachievable. Beyond the cited studies, research on the family/work beliefs and expectations of a broad range of SE female graduate students is limited.

Expressed Likelihood of an Academic Career

Women's expressed likelihood or intent to pursue an academic career in SE may not match their interest in such a career. A study of students and faculty in 34 ATS departments found that female graduate students were significantly less likely than male graduate students to take a position in academia (MacPhee & Canetto, 2015). This study's findings align with research in other SE fields, such as chemistry (Newsome, 2008). Female graduate students' perception of an incompatibility between family life and an academic career may be a factor in them not pursuing a career in SE leadership (Canetto et al., 2017). However, research on whether women are likely to pursue a career in academia due to these factors is limited among graduate student women.

The Current Study

This study examined the association between graduate student women's interest in, and expressed likelihood to pursue a career in academia, and their potentially gendered views in four domains: 1. Their views of academia, science in general, and their SE field, as relatively feminine or masculine; 2. Their views of women or men who excel in academia, science, and specific SE field, as relatively feminine or masculine; 3. Their educational and career goals, as mostly self-growth or mostly others-growth oriented; and 4. Their views of women's and men's family and work responsibilities.

This study focused on women in SE graduate school for several reasons. First, a doctorate degree is the passport for an academic position in SE. Being in graduate school puts an individual on a path of developing the skills, gaining the experience, and making the connections that are most conducive to a career in SE academia (Acker & Haque, 2015). Research has shown that ATS doctoral students report that a career in academia would most likely be the best use of the skills that they are acquiring in graduate school (Canetto et al., 2017). However, women continue to be underrepresented in SE academia, especially in its leadership. Second, women in SE doctoral programs have, to some degree, dealt with various threshold barriers to a career in SE academia leadership, for example, self-doubts in SE competence (Cowie et al., 2018). Understanding factors that uniquely impact women in graduate school will likely shed light onto the reasons for women not pursuing a SE academic career at the same rate as men. Lastly, SE graduate students are an understudied population. Past SE interest, retention and success research has focused on SE undergraduate students, likely because they are a larger group, and they are easier to reach. There is also research on women who are in SE academic careers (e.g., Cech & Blair-Joy, 2019). There are many unanswered questions about women in SE graduate school. Studying women in doctoral SE programs and what socio-cultural factors, specifically what gender stereotypes and gender-ideology factor may be associated with interest and expressed likelihood to pursue academic careers would contribute to expanding our view of what contributes to the women's underrepresentation in SE academic careers, and potentially making a change in this underrepresentation.

Building on past research findings, it was hypothesized that SE graduate-student women who view academia, science, and their field as more masculine; who view men as more likely than women to excel in academia, science, and their field; who tend to endorse others-growth goals; and who tend to endorse the belief that family caregiving is women's primary responsibility, will indicate less interest (Hypothesis 1) and a lower expressed likelihood (Hypothesis 2) to pursue a career in science academia. It was also expected that endorsing the view that family caregiving is women's primary responsibility would be the best predictor of a lower expressed likelihood to pursue a career in SE academia (Hypothesis 3). Specifically, the following hypotheses were tested.

1. Hypothesis 1_a: Beliefs about academia, science, and the respondent's specific field as feminine or masculine will predict women's interest in an academic career, such that women who endorse the belief that academia, science, and their own SE field are masculine will report less interest in an academic career.
2. Hypothesis 1_b: Beliefs about women/men as excelling in academia, science, and the respondent's specific field will predict women's interest in an academic career such that women who endorse the belief that men excel in academia, science, and in their own SE field more than women will report less interest in an academic career.
3. Hypothesis 1_c: Self-Growth versus Others-Growth educational/career goals will predict women's interest in an academic career, such that women who endorse others-growth educational/career goals will report less interest in an academic career.
4. Hypothesis 1_d: Beliefs about women's and men's family and work responsibilities will predict women's interest in an academic career, such that women who endorse the belief that women's primary responsibility is family caregiving will report less interest in an academic career.
5. Hypothesis 2_a: Beliefs about academia, science, and the respondent's specific field as feminine or masculine will predict women's expressed likelihood of pursuing an academic career, such that women who endorse the belief that that academia, science, and their own SE field are masculine will indicate a lower likelihood to pursue a career in SE academia.

6. Hypothesis 2_b: Beliefs about women/men as excelling in academia, science, and the respondent's specific field will predict women's expressed likelihood of pursuing an academic career such that women who endorse the belief that men excel in academia, science, and their own SE fields more than women will indicate a lower likelihood to pursue a career in SE academia.
7. Hypothesis 2_c: Self-Growth versus Others-Growth educational/career goals will predict women's expressed likelihood of pursuing an academic career, such that women who endorse others-growth educational/career goals will indicate a lower likelihood to pursue a career in SE academia.
8. Hypothesis 2_d: Beliefs about women's and men's family and work responsibilities will predict women's expressed likelihood of pursuing an academic career such that women who endorse the belief that women's primary responsibility is family caregiving will indicate a lower likelihood to pursue a career in SE academia.
9. Hypothesis 3: Endorsing the view that family caregiving is women's primary responsibility will be the best predictor of a lower expressed likelihood to pursue a career in SE academia.

The study sought to examine among graduate student women, the association of interest and expressed likelihood to pursue an academic career in a SE field with four predictors: 1. Academia, science, and different SE fields being rated as more feminine or more masculine, 2. Who (women or men) is seen as successful in different SE fields, academia, and science, 3. Having self-growth versus others-growth goals, and 4. The perceived family and work responsibilities of women and men.

Methods

Participants

The sample consisted of 140 women (Age $M = 26.82$, $SD = 4.64$; Years in program $M = 2.39$, $SD = 1.70$; 72% in a committed relationship, 92% did not have children; 65% European descent, 10% Multiple descent, 5% Asian descent, 2% African descent, 1% Latinx descent, 1% Indigenous descent) who were enrolled in a SE graduate program at a large state university in the U.S. The SE graduate programs ($N = 12$) in this study were Engineering, Biology, Chemistry, Atmospheric Sciences, Microbiology, Math, Animal Sciences, Statistics, Geosciences, Physics, Sociology, and Biochemistry. Most women were in Engineering (29%), Biology (19%) Chemistry (14%) or Atmospheric Sciences (8%). The overall response rate of this study was 9% of the total population of women in these departments over the course of three years from 2020 to 2023 ($N = 1563$) (See Table 1).

Procedure

Potential participants were contacted by email using individual invitations from SE list serves associated with various SE fields. Graduate program advisors and leaders of groups related to SE were asked to send an invitation to participate in the study to all of their graduate students, typically via their field's graduate student list serv. The invitation informed participants about the purpose of the study and what participation entailed. Participants could click on a link that brought them to an online questionnaire, administered using Qualtrics software. Participants were asked to read an informed consent form and clicked "next" at the bottom of the page to provide their consent. The items used in this study represent a portion of the data collected. The overall survey took approximately 30 minutes to complete. After participants completed the survey, they had the option to be entered into a drawing to win 1 of 5 \$50 Amazon gift cards. These procedures were approved by the Institutional Review Board at Colorado State University (Protocol ID: 19-8994H).

Measures

Beliefs About Academia, Science, and SE Fields as Feminine or Masculine

Participants were asked to respond to six questions about academia, science and about their field of study (e.g., “Academia is a profession that is...”) using a 5-point scale from “not at all feminine” (1) to “very feminine” (5); and from “not at all masculine” (1) to “very masculine” (5). Prior to this question we asked them to “list the first three words that come to mind when you think of ‘feminine’” and a separate question about “masculine” to first prime them to consider what these words mean. Average ratings of the femininity (3 questions) and masculinity (3 questions) of academia, science, and their field of study were calculated. Low scores indicate view of their discipline as low in femininity and low in masculinity, while high scores indicate views of their discipline as high in femininity and masculinity. The femininity and masculinity items were adapted from measures of gender stereotypes about Math and English (Stout et al., 2011). In the original version of the measure, participants were asked to complete four phrases about their views of who excels in these fields on an 11-point scale from “mostly men” to “mostly women” (e.g., “When I think of people who are very good at math [English] I think of...”). Math and English items produced alphas of .74 and .80, respectively (Stout et al. (2011). In this study the six items had an $\alpha = .73$ for femininity and $\alpha = .84$ for masculinity.

Beliefs About Women/Men as Excelling in Academia, Science, and Specific SE Field

Participants were asked to respond to 3 questions about their views of who excels in academia, science, and their field of study (e.g., “When I think of people who excel in my field of study, I think of...”) on a 5-point scale from “mostly of women” (1) to “mostly of men.” (5). An average score across the three questions was created. High scores indicate a belief that men excel in academia, science, and SE field. This measure was adapted from a measure used by Stout et al. (2011). Stout et al.’s items focused on views about who excels in Math and English and produced alphas of .74 and .80, respectively. In this study the three items had an $\alpha=.53$.

Self-Growth (“Agentic/Discovery/Power”) Versus Others-Growth (“Communal/Social/Service”) Educational/Career Goals.

Participants were asked to respond to twenty-four questions about the importance to them of various educational/career goals, on a 5-point scale ranging from “Not at all” (1) to “Extremely”

important (5). The goals, which were presented in random order, cluster into two categories: self-growth goals (e.g., power, recognition, achievement) and others-growth goals (e.g., helping others, serving community, working with people). Total educational/career goals scores were calculated by taking the average of each subscale. This study's scale was adapted from the Career Goal Endorsement Scale developed by Diekmann et al. (2010). The original scale asks participants to report relative importance of educational or career goals and assesses goals across two domains: agentic (e.g., power) ($\alpha=.87$) and communal (e.g., serving community) ($\alpha=.84$). In this study these categories were named self-growth instead of agentic and others-growth instead of communal because these categories seem to better reflect a difference in how women and men are socialized to prioritize self vs. others, rather than men being more "agentic" than women. In this study the internal consistency reliability of the self-growth subscale was $\alpha=.88$ and the internal consistency reliability of the others-growth subscale was $\alpha=.83$.

Beliefs About Women's and Men's Family and Work Responsibilities

Participants were asked to respond to the Gender Transcendent subscale of Baber and Tucker's (2006) Social Roles Questionnaire. This four-items subscale addresses beliefs about women's and men's rights and responsibilities in terms of family and paid employment (i.e., "Mothers should work for pay only if necessary" and "A father's major responsibility is to provide financially for his children"), division of household tasks ("Tasks around the household should not be assigned by sex") and trait attribution by sex ("People can be competitive and nurturing regardless of sex"), on a 5-point scale, ranging from "strongly disagree" (1) to "strongly agree" (5). Total scores are the average score, after reverse scoring two items. Higher scores indicate more gender stereotyped work/family beliefs. In the original study, the Gender Transcendent subscale was reported to have convergent and discriminant validity as well as an internal consistency reliability ($\alpha = .71$) and test-retest reliability ($r = .81$) (Baber & Tucker, 2006). In this study the Gender Transcendent subscale had internal consistency reliability of $\alpha = .43$. Based on item analysis (see Table 3), item 3 ("Tasks around the household should not be assigned by sex") did not behave like other items. Without item 3, alpha increased to $\alpha = .63$.

Interest in an Academic Career

To assess interest in pursuing an academic career, participants were asked to respond to the question, “How interested are you in pursuing an academic career?” on a 5-point scale from “Not at all interested” (1) to “Absolutely interested.” (5). Low scores indicate low interest, and high score denote high interest in an academic career.

Expressed Likelihood of an Academic Career

To assess stated likelihood to pursue an academic career, participants were asked to respond to the question, “How likely are you to pursue an academic career?” on a 5-point scale from “Definitely not” (1) to “Definitely will” (5). Low scores indicate low likelihood, and high scores denote high likelihood.

Data Analyses

Total scores for all variables were calculated. After that, descriptive statistics and correlations (see Table 2) as well as the reliability coefficients of each scale were calculated. Next, regression analyses were conducted to evaluate the possible association of predictor and outcome variables, testing each of the hypotheses. Last, exploratory analyses were conducted.

Missing Data

Approximately 4% of the data were missing at random (MAR). Instead of replacing missing values with the mean, median, or mode, Multivariate Imputation by Chained Equations (MICE) uses the distribution of the data to estimate plausible values for the missing data. Via MICE multiple data sets are created, analyzed individually, and combined to obtain a set of parameter estimates. Previous literature on the use of MICE has suggested that this technique should be used with MAR data, and when no more than 30-50% of data is missing (White et al., 2011). As these standards were met, MICE was utilized to account for missing data.

Results

Descriptive Statistics

Endorsement of gender stereotypes and ideologies was low in this sample of SE graduate-student women (see Table 2). They were also not highly correlated with one another, meaning that multicollinearity was not present. The least endorsed were the family/work gender ideologies ($M = 1.38$, $SD = 0.47$), specifically the idea that competitiveness and nurturance vary by sex ($M = 1.08$, $SD = 0.30$), and the idea that mothers should work for pay only if necessary ($M = 1.26$, $SD = 0.64$). The most endorsed family/work gender ideology was “A father’s major responsibility is to provide financially for his children.” ($M = 1.79$, $SD = 1.08$) (See Table 3). The most endorsed gender and SE stereotypes were the idea that men excel more than women in SE ($M = 3.47$, $SD = 0.64$), and the idea that academia, science, and their specific field are masculine ($M = 3.46$, $SD = 0.64$). Others growth career goals ($M = 3.63$, $SD = 0.61$) were more endorsed than self-growth career goals ($M = 3.29$, $SD = 0.63$). Interest in an academic career ($M = 2.58$, $SD = 1.48$) and likelihood to pursue an academic career ($M = 2.71$, $SD = 1.21$) were both relatively low. Means and standard deviations of predictor and outcome variables by field are reported in Tables 4a and 4b. Women in Math, Microbiology, and Atmospheric Sciences respectively expressed the most interest in an academic career while women in Chemistry, Engineering and Statistics respectively reported the least interest. Analyses of variance by field could not be conducted due to unequal N of respondents in different fields (See Tables 4a and 4b). For example, Engineering had $N = 41$ respondents while Physics had $N = 4$. There was not enough power or variance to detect meaningful differences between groups.

Gender Ideologies Predicting Interest in an Academic Career (Hypothesis 1)

Multiple Linear Regression (Model 1)

A multiple linear regression was used to test if gender stereotypes of SE and gender ideologies of family and work predicted interest in an academic career. This model did not control for any other variables and only included the predictor variables and interest. The overall regression was not

statistically significant ($R^2 = .05$, $F(6,133) = 1.18$, $p = .32$). The results of this analysis are presented in Table 5.

Demographic and Educational Profile

A simple linear regression tested if the students' demographic (i.e., age, ethnicity, field, relationship status, years in program, parental status) and educational profile (i.e., field of study; masters or doctoral level) was associated with interest in an academic career. Field of study was a predictor of interest in an academic career ($R^2 = .17$, $F(12,127) = 2.16$, $p < .05$). Women in Math, Microbiology, and Atmospheric Sciences expressed significantly higher interest in an academic career, relative to women in other fields. Women in Chemistry, Engineering and Statistics reported the least interest in an academic career (see Table 5 and Figures 1a and 1b).

Simple linear regressions were used to examine whether endorsement of gender stereotypes and ideologies varied by field (see Table 6). Field of study predicted endorsement of others-growth goals ($R^2 = .16$, $F(12,127) = 2.03$, $p = .02$) and also the extent to which women rated academia, science, and their field of study as feminine ($R^2 = .16$, $F(12,127) = 2.03$, $p = .03$). Women in Engineering, Biology, Atmospheric Sciences, and Physics endorsed others' growth goals more than women in other fields. Women in Engineering, Microbiology, and Biology expressed the belief that academia, science, and their specific field are feminine more than women in other fields.

Years in Program

Students had been in their SE graduate program for an average of 2.49 years ($SD = 1.79$, range = < 1 year – 8 years). Years in graduate school significantly predicted interest in an academic career ($R^2 = .03$, $F(1,138) = 4.05$, $p < .05$) (see Figure 2). Years in program was negatively correlated with interest in an academic career (see Table 2). Women who had been in their graduate program for longer expressed less interest in an academic career than women who had been in their graduate program for less time.

Multiple Linear Regression with Control Variables (Model 1a)

Multiple linear regression was used to examine whether Model 1 improved when adding control variables (i.e., field of studies and years in program). The model with these control variables was

significant ($R^2 = .23$, $F(19,120) = 1.87$, $p < .05$) (see Table 6). However, none of the gender stereotypes or gender ideology variables significantly predicted interest when controlling for other variables (i.e., age, ethnicity, field, relationship status, program years, parental status, and whether they were in a masters or doctoral program). A one-way ANOVA was conducted to examine if Model 1a was significantly better than Model 1. The results of the ANOVA indicated Model 1a better predicted interest than the Model 1 ($F(13, 120) = 2.13$, $p < .05$).

Gender Ideologies Predicting Expressed Likelihood of Pursuing an Academic Career (Hypothesis 2)

Multiple Linear Regression (Model 2)

Multiple linear regression was used to test if gender ideologies of family and work significantly predicted expressed likelihood to pursue an academic career. The overall regression was not statistically significant ($R^2 = .03$, $F(6,133) = .78$, $p = .59$) (see Table 7 and Figure 3). A simple linear regression was used to examine if any of the control variables impacted expressed likelihood to pursue an academic career. However, the results of these regression analyses were nonsignificant.

Gender Ideologies About Women's and Men's Family and Work Responsibilities Predicting Likelihood of Pursuing an Academic Career (Hypothesis 3)

A simple linear regression was used to test the hypothesis that gender ideologies about women's and men's family and work responsibilities (Gender F/W Beliefs) would be the strongest predictor of expressed likelihood to pursue an academic career. This hypothesis was also examined in Model 2 by entering Gender F/W Beliefs into the model first, however, it was not a significant predictor of likelihood. This hypothesis was not supported by the simple linear regression ($R^2 = .00$, $F(1,138) = .08$, $p = .78$) or in Model 2. The simple linear regression was also conducted without item 3 due to issues with reliability, and the results were also non-significant ($R^2 = .00$, $F(1,138) = .08$, $p = .78$) (see Table 3 for item statistics). Model 2 was also run without item 3 and also remained non-significant ($R^2 = .04$, $F(6,108) = .66$, $p = .68$).

Discussion

This study assessed the possible role of gender stereotypes of SE, and of gendered ideologies of career goals, and gendered ideologies of family and work in women's interest and expressed likelihood to pursue a SE academic career, building on similar research with undergraduate students. This study advances research on gender stereotypes and gender-ideology factors associated with women's variability in participation in different SE fields by focusing on graduate students. This study's findings have the potential to make contributions to theory and research about women in SE fields.

In this study SE female graduate students had low rates of endorsement of the gender stereotypes and ideologies measured in this study. The only stereotypes that they gave some credence to were the idea that men excel in SE more than women and the idea that academia, science, and that their SE field are masculine. The least endorsed were the family/work gendered idea that competitiveness and nurturance vary by sex, and the gendered idea that mothers should work for pay only if necessary. Others growth career goals were more endorsed than self-growth career goals. Interest and expressed likelihood to pursue an academic career were both relatively low. Not surprisingly then gender stereotypes of SE and gender ideologies of career goals and gendered ideologies of family and work did not predict interest and expressed likelihood to pursue a SE academic career.

A conclusion based on these findings is that this study's gender stereotypes of SE and gendered ideologies of career goals and of family and work do not matter to graduate school women's interest and intention to pursue a SE academic career. Another possibility is that the self-report measures of gender stereotypes and of gendered ideologies used in this study were not sensitive-enough to assess these chosen constructs among women who are in SE graduate school. In studies with SE undergraduate students, gender stereotypes and ideologies measures like the ones used in this study predicted interest in a SE career (see Cheryan et al., 2017 for a review). In this study certain measures (i.e., the family/work gender beliefs measure and measure of stereotypes of whether women/men excel in certain fields) not only had very low endorsement but also did not reach good levels of reliability. For example, the

family/work item of the gender beliefs scale “Mothers should work for pay only if necessary” received low endorsement. In some ways it is not surprising that women in graduate SE studies would not endorse this item. Female SE graduate students, by virtue of being in a graduate program, have already invested in the possibility of paid work, and a career. Another reason that the item “Mothers should work for pay only if necessary” received low endorsement likely is that most women in this study were not mothers. As a result, they did not have personal experience with parenting/career tensions. These items also only assess what participants think people broadly should do, and this may be different from what one feels oneself should do. Another explanation is that there were issues with range restriction in measures of gender ideologies and stereotypes that could have led to low power, reliability, or validity in the analyses, which in turn led to lower correlations and associations than expected. This group is a self-selected, volunteer sample and there may not be much variance in these constructs among women who are already in graduate school. The findings of this study may also reflect method effects. The questions about interest in, and likelihood to pursue an academic career were presented one after the other. It may be that the participants did not perceive the two questions as distinct and could have led to the high correlation between them. Additionally, this study measured SE career views and intentions rather than SE career behavior or choice. There is research that supports the predictive validity of interest measures on career choice (Hanna & Rounds, 2020). However, levels of predictive validity may not be similar in this study to past research because this study used a single-item scale, while other scales are more robust. Therefore, this study’s participants may have indicated that there was a low likelihood that they would pursue a SE academic career, but they eventually went into SE academia; or vice versa.

Other gender stereotypes and ideologies may be relevant to graduate school women’s interest and intention to pursue a SE academic career. For example, a longitudinal, qualitative study of graduate student women in SE found that the students perceived that they did not belong in their program and felt academic and social isolation (Fabert et al., 2011). These perceptions led them to questioning their competence and overall fit within their department. It is possible that measures assessing who belongs in a field, women or men, (rather than who excels) might better capture this experience. Stereotypes about

who belongs in a field can also be related to others-growth goals. When considering SE careers, many people think of the “lone scientist” and do not perceive that SE fields support others-growth goals. SE careers can involve community, helping others, and working with others. The dominant perception of SE as not affording others-growth goals may contribute to deterring women from pursuing SE careers. In this study, women especially endorsed others-growth goals. Endorsement in others growth goals varied by field, though it did not predict interest in SE academic careers by SE graduate student women. Future research could examine a broader range of gender ideologies and stereotypes that may be particularly relevant during the graduate school stage in general, and that may be important within specific field.

The finding of this study that graduate students do not endorse these specific stereotypes contribute a necessary update of theory of interest in SE academia. For undergraduate students, endorsing gender stereotypes about SE such as viewing the field as masculine seem to impact their career plans. For graduate students, endorsement of these stereotypes and gender ideologies measured in this study may be less relevant because these students overcame some of the basic stereotypes of SE like the idea that men excel in SE more than women. Despite this, women are still underrepresented in academic SE careers. It is possible that graduate students may face different kinds of stereotypes and gendered ideologies associated with their advanced progress. At the same time, basic gender stereotypes and ideologies are present in the culture and may unconsciously affect them even if they do not explicitly endorse them. Some studies have shown that awareness of gender stereotypes of SE can impact SE interest even when there is no explicit endorsement of these gender stereotypes and ideologies (Master & Meltzoff, 2020). Awareness of gender stereotypes may impact graduate student women’s interest in SE academia. Further research is needed to understand more about graduate students’ interest in SE academia and whether the presence or awareness of these stereotypes within a culture or field impacts their behaviors. Qualitative research that only focuses on whether these stereotypes are explicitly endorsed is therefore limited when studying graduate student populations.

Interviews may be a more effective method to explore the impact of gender ideologies such as those related to family and work. Interview studies with women in Atmospheric Sciences graduate school

found that gender ideologies of family and work impacted these women's interest in an academic career (e.g., Canetto et al., 2017). Research by Hochschild and Machung (1989) illuminated the importance of using interviews to assess people's beliefs about family and work. Their research found that when asked directly about family/work responsibilities, women affirmed egalitarian beliefs; however, when they describe the family/paid work responsibilities in their lives the same women reported a non-egalitarian division of family/paid work responsibilities. Hochschild and Machung concluded that people hold contradictory "on top ideologies" and "underneath ideologies" about family/paid work responsibilities and argued that only interviews often capture underneath ideologies, that is, actual beliefs. Structured measures may be too limited and as a result only access on top ideologies, while missing what is underneath. Interviews with graduate student women may better capture actual beliefs on family/work gender ideologies.

In this study, interest in a SE academic career varied by field. Specifically, women in Math, Microbiology, and Atmospheric Sciences expressed the most interest in an academic career while women in Chemistry, Engineering and Statistics reported the least interest. The uneven number of participants by field did not allow examination of patterns by field. One reason why interest in an academic career varies by field is that women may be less attracted to male dominated fields. In the past few decades, women have achieved equal representation in SE academic careers such as in biology, psychology, mathematics, and statistics, but continue to be underrepresented in fields such as computer science, engineering, and physics (NSF, 2019). Previous research on this topic has compared women in male-dominated SE fields (e.g., computer science) and women in female dominated fields outside of SE (e.g., English). This research has demonstrated that women in these fields differ in their stereotypes about science as masculine, such that women within SE fields viewed science as less masculine (Dunlap & Barth, 2018). Other research in this area has examined by field undergraduate women's sense of similarity with others in their field and SE sense of belonging as a factor in SE interest (Cheryan & Plout, 2010). This study found that women in female dominated fields (such as Math and Biology) demonstrated more interest in an academic career than women in male dominated fields (such as Chemistry and Engineering). Future

research with SE graduate student women should also examine gender stereotypes and ideologies by SE discipline.

It is also notable that in this study the longer women had been in SE graduate school the less likely they were to express an interest in an academic career. This finding raises questions about how interest in pursuing an academic-career changes over the course graduate school. There is limited longitudinal research on SE graduate students. Research with undergraduate engineering students found that women in their fourth year agreed more than women in their first year in college with the idea that “engineering is created for men and by men,” and that engineering is “built on male attitudes and traditions” (Haines & Wallace, 2003, p. 378-379). This suggests that women feel less SE belonging as they move through their educational path. This finding affirms the value of longitudinal research.

Future research should assess career interest, intention, as well as behaviors via a longitudinal design. While longitudinal research is necessary to evaluate actual behavior over time, this study’s findings provide some indication that women choose to leave academia in the later stages of their graduate program. Longitudinal research should seek to confirm this finding by examining students’ interest in an academic career yearly as they progress through their program, potentially even starting at the undergraduate level and following them into the early stages of their career. This will provide further understanding about how gender stereotypes within SE may impact women’s interest in an academic career over time and help to determine causality and directionality.

To conclude, in this study gender stereotypes and gender ideologies did not predict interest in a SE academic career among graduate student women. To address some of the questions raised by this study, future research with female SE graduate students could use qualitative or mixed methods designs. Qualitative data could clarify how women think about their choice not to pursue a career in academia after graduate school and what influences their decision. To evaluate how socio-cultural factors predict SE doctoral students’ actual engagement with a SE academia career, future research should assess not only SE academic career interest and stated likelihood but actual SE career behaviors, including SE academic career choice and progress, and via a longitudinal design. Future research should also examine

gender stereotypes and ideologies by SE discipline. In conclusion, this study generated findings that are important for the design of future research on the potential role of gender stereotypes and ideologies in women's interest and intention to pursue an academic career.

Tables and Figures

Table 1

Total Response Rate and Percentage by Field

	<i>Enrollment</i>	<i>Response Rate</i>	<i>Response</i> %
Engineering	209	41	19.62%
Biology	46	26	56.52%
Chemistry	268	21	7.84%
Atmospheric Sciences	106	12	11.32%
Microbiology	256	9	3.52%
Math	67	5	7.46%
Animal Sciences	126	4	3.17%
Statistics	195	4	2.05%
Geosciences	86	4	4.65%
Physics	39	4	10.26%
Sociology	98	3	3.06%
Biochemistry	67	3	4.48%
Did not indicate	--	4	--
Total	1563	140	8.96%

Note. Enrollment is totaled across all 3 years of recruitment (2020 – 2023).

Table 2*Descriptive Statistics and Correlations for the Six Predictor and the Two Outcome Variables*

	<i>M (SD)</i>	Correlations						
		1	2	3	4	5	6	7
1. AcScFieldFem	2.63 (0.47)	--						
2. AcScFieldMasc	3.46 (0.64)	-.32	--					
3.. MenExcel	3.47 (0.64)	-.33	.49	--				
4. SelfGrowth	3.29 (0.63)	-.02	.01	-.04	--			
5. OthersGrowth	3.63 (0.61)	-.04	-.13	.15	.40	--		
6. Gender F/W Beliefs	1.38 (0.47)	-.01	-.03	-.08	-.10	-.02	--	
7. Interest	2.58 (1.48)	.01	.15	.05	.08	.12	-.16	--
8. Likelihood	2.71 (1.21)	-.04	.15	.06	.06	.15	-.17	.87

Note. AcScFieldFem = Beliefs about academia, science, and SE fields as feminine; AcScFieldMasc = Beliefs about academia, science, and SE fields as masculine; MenExcel = Beliefs about women/men as excelling in academia, science, and specific SE field; SelfGrowth = Self-Growth (“Agentic/Discovery/Power”) educational/career goals; OthersGrowth = Others-Growth (“Communal/Social/Service”) educational/career goals; Gender F/W Beliefs = Beliefs about women’s and men’s family and work responsibilities; Interest = Interest in an academic career; Likelihood – Expressed interest in an academic career.

Table 3

Means/Item Difficulty, SDs, Item Discrimination, and Interitem Correlations of Items in the Gender Family-Work Beliefs Subscale (Baber & Tucker, 2006)

	<i>M/Item Difficulty (SD)</i>	Item Discrimination	Inter-item Correlations			
			1	2	3	4
1. Mothers should work for pay only if necessary.	1.26 (0.64)	.62	--			
2. A father's major responsibility is to provide financially for his children.	1.79 (1.08)	.67	.35	--		
3. Tasks around the household should not be assigned by sex.	1.40 (1.10)	.60	.10	-.06	--	
4. People can be competitive and nurturing regardless of sex.	1.08 (0.30)	.30	.08	.08	.12	--

Note. Participants responded on a 5-point Likert scale (from 1 *strongly disagree* to 5 *strongly agree*). Items 3 and 4 were reverse scored. Item statistics are presented after reverse scoring.

Table 4a*Means and SD of Gender Stereotypes and Gender Ideology Predictors by Field*

	<i>N</i>	<i>AcScField</i> <i>Fem</i>	<i>AcScField</i> <i>Masc</i>	<i>Men</i> <i>Excel</i>	<i>Self</i> <i>Growth</i>	<i>Others</i> <i>Growth</i>	<i>Gender</i> <i>F/W Beliefs</i>
Engineering	41	2.52 (0.52)	3.51 (0.66)	3.64 (0.59)	3.54 (0.62)	3.79 (0.57)	1.37 (0.45)
Biology	26	2.76 (0.45)	3.24 (0.48)	3.40 (0.59)	3.08 (0.65)	3.46 (0.66)	1.35 (0.45)
Chemistry	21	2.37 (0.37)	3.49 (0.76)	3.59 (0.86)	3.22 (0.74)	3.51 (0.61)	1.62 (0.68)
At Sciences	12	2.58 (0.49)	3.61 (0.58)	3.25 (0.47)	3.04 (0.58)	3.26 (0.64)	1.35 (0.36)
Microbio	9	2.98 (0.27)	3.44 (0.31)	3.26 (0.46)	3.24 (0.54)	3.81 (0.46)	1.25 (0.33)
Math	5	2.70 (0.34)	3.37 (0.32)	3.00 (0.41)	3.06 (0.27)	3.72 (0.66)	1.10 (0.22)
An Sciences	4	2.67 (0.91)	3.67 (0.53)	3.33 (0.86)	3.77 (0.26)	4.35 (0.25)	1.31 (0.24)
Statistics	4	2.96 (0.08)	3.25 (0.29)	3.42 (0.50)	3.05 (0.52)	3.63 (0.30)	1.75 (0.35)
Geosciences	4	2.96 (0.39)	3.54 (0.25)	3.08 (0.32)	3.77 (0.45)	3.75 (0.31)	1.38 (0.48)
N/A	4	2.88 (0.16)	3.25 (0.62)	3.08 (0.17)	3.34 (0.49)	3.60 (0.22)	1.13 (0.25)
Physics	4	2.33 (0.14)	3.71 (0.88)	3.67 (1.05)	3.11 (0.39)	3.08 (0.86)	1.38 (0.43)
Sociology	3	2.61 (0.42)	4.17 (0.01)	3.56 (0.69)	2.79 (0.50)	3.90 (0.26)	1.08 (0.14)
Biochem	3	2.72 (0.54)	3.39 (0.19)	4.00 (0.88)	3.29 (0.40)	4.07 (0.32)	1.33 (0.58)

Note. At Sciences = Atmospheric Sciences; Microbio = Microbiology; An Sciences = Animal Sciences; N/A = Did not indicate; Biochem = Biochemistry; N = N by field; AcScFieldFem = Beliefs about academia, science, and SE fields as feminine; AcScFieldMasc - Beliefs about academia, science, and SE fields as masculine; MenExcel = Beliefs about women/men as excelling in academia, science, and specific SE field; SelfGrowth = Self-Growth (“Agentic/Discovery/Power”) educational/career goals; OthersGrowth = Others-Growth (“Communal/Social/Service”) educational/career goals; Gender F/W Beliefs = Beliefs about women’s and men’s family and work responsibilities.

Table 4b*Means and SDs of Interest and Expressed Likelihood to Pursue an Academic Career by Field*

	<i>N by Fields</i>	<i>Interest Means (SD)</i>	<i>Likelihood Means (SD)</i>
Engineering (Intercept)	41	2.20 (1.27)	2.59 (1.18)
Biology	26	2.69 (1.62)	2.62 (1.42)
Chemistry	21	1.71 (1.19)	2.10 (1.18)
Atmospheric Sciences	12	3.33 (1.23)	3.33 (0.98)
Microbiology	9	3.44 (1.67)	3.00 (1.12)
Math	5	4.20 (0.84)	3.80 (1.10)
Animal Sciences	4	3.00 (1.83)	2.75 (0.96)
Statistics	4	2.25 (1.26)	2.50 (0.58)
Geosciences	4	3.00 (1.83)	2.75 (0.96)
Did not indicate	4	2.75 (2.06)	3.50 (1.73)
Physics	4	2.75 (1.71)	2.75 (0.96)
Sociology	3	3.00 (1.00)	3.00 (1.00)
Biochemistry	3	3.00 (1.73)	3.00 (1.00)

Note. Interest = Interest in an academic career; Likelihood = Expressed likelihood of pursuing an academic career.

Table 5*Multiple Linear Regression Results for Gender Stereotypes and Ideologies of SE on Interest – Model 1*

	<i>Estimate</i>	<i>Std. Error</i>	<i>t-value</i>	<i>Pr(> t)</i>
(Intercept)	0.98	1.74	0.57	0.57
Gender F/W Beliefs	-0.39	0.28	-1.39	0.17
AcScFieldFem	0.13	0.29	0.44	0.66
AcScFieldMasc	0.38	0.26	1.43	0.16
MenExcel	-0.07	0.23	-0.32	0.75
SelfGrowth	0.04	0.22	0.17	0.86
OthersGrowth	0.18	0.23	0.76	0.45

Note. The overall regression was not statistically significant ($R^2 = .05$, $F(6,133) = 1.18$, $p = .32$).

Gender F/W Beliefs = Beliefs about women’s and men’s family and work responsibilities; AcScFieldFem = Beliefs about academia, science, and SE fields as feminine; AcScFieldMasc = Beliefs about academia, science, and SE fields as masculine; MenExcel = Beliefs about women/men as excelling in academia, science, and specific SE field; SelfGrowth = Self-Growth (“Agentic/Discovery/Power”) educational/career goals; OthersGrowth = Others-Growth (“Communal/Social/Service”) educational/career goals.

Table 6

Multiple Linear Regression Results for Gender Family/Work Stereotypes and Ideologies and Control Variables (Field and Years in Program) on Interest – Model 1a

	<i>Estimate</i>	<i>Std. Error</i>	<i>t-value</i>	<i>Pr(> t)</i>
Engineering (Intercept)	0.20	1.83	0.11	0.91
Sociology	0.85	0.88	0.97	0.33
Microbiology	1.56	0.55	2.85	0.01*
Biology	0.77	0.38	2.04	0.04*
Chemistry	-0.31	0.40	-0.77	0.44
Biochemistry	0.77	0.86	0.89	0.37
Atmospheric Sciences	1.27	0.50	2.53	0.01*
Physics	0.76	0.76	1.00	0.32
Math	2.26	0.70	3.24	0.00**
Animal Sciences	0.65	0.76	0.85	0.40
Statistics	0.31	0.77	0.41	0.68
Geosciences	0.80	0.77	1.04	0.30
Did not indicate	0.76	0.76	1.00	0.32
Years in Program	-0.08	0.08	-1.00	0.32
GenderBeliefs	-0.08	0.28	-0.29	0.78
AcScFieldFem	-0.17	0.29	-0.59	0.56
AcScFieldMasc	0.27	0.26	1.03	0.30
MenExcel	0.17	0.24	0.70	0.49
SelfGrowth	0.24	0.23	1.04	0.30
OthersGrowth	0.08	0.24	0.35	0.73

Note. * Indicates $p < .05$, ** indicates $p < .01$. The regression model was significant ($R^2 = .23$, $F(19,120) = 1.87$, $p < .05$).

Table 7*Regressions Predicting Study Outcomes by Field*

	<i>f</i> -statistic	<i>p</i> -value
AcScFieldFem	2.04	0.03*
AcScFieldMasc	0.97	0.47
MenExcel	1.24	0.26
SelfGrowth	1.76	0.06
OthersGrowth	2.04	0.02*
Gender F/W Beliefs	1.11	0.36

Note. * Indicates $p < .05$, ** indicates $p < .01$. Field of study predicted endorsement of others-growth goals ($R^2 = .16$, $F(12,127) = 2.03$, $p = .02$) and also the extent to which women rated academia, science, and their field of study as feminine ($R^2 = .16$, $F(12,127) = 2.03$, $p = .03$). AcScFieldFem = Beliefs about academia, science, and SE fields as feminine; AcScFieldMasc = Beliefs about academia, science, and SE fields as masculine; MenExcel = Beliefs about women/men as excelling in academia, science, and specific SE field, SelfGrowth = Self-Growth (“Agentic/Discovery/Power”) educational/career goals; OthersGrowth = Others-Growth (“Communal/Social/Service”) educational/career goals; Gender F/W Beliefs = Beliefs about women’s and men’s family and work responsibilities.

Table 8*Multiple Linear Regression for Gender Stereotypes and Ideologies on Likelihood – Model 2*

	<i>Estimate</i>	<i>Std. Error</i>	<i>t-value</i>	<i>Pr(> t)</i>
(Intercept)	1.33	1.43	0.93	0.36
Gender F/W Beliefs	-0.04	0.23	-0.16	0.88
AcScFieldFem	-0.02	0.24	-0.10	0.92
AcScFieldMasc	0.09	0.22	0.40	0.69
MenExcel	0.01	0.19	0.07	0.95
SelfGrowth	-0.04	0.18	-0.21	0.84
OthersGrowth	0.35	0.19	1.82	0.07

Note. The overall regression was not statistically significant ($R^2 = .03$, $F(6,133) = .78$, $p = .59$). Gender F/W Beliefs = Beliefs about women’s and men’s family and work responsibilities; AcScFieldFem = Beliefs about academia, science, and SE fields as feminine; AcScFieldMasc = Beliefs about academia, science, and SE fields as masculine; MenExcel = Beliefs about women/men as excelling in academia, science, and specific SE field; SelfGrowth = Self-Growth (“Agentic/Discovery/Power”) educational/career goals; OthersGrowth = Others-Growth (“Communal/Social/Service”) educational/career goals.

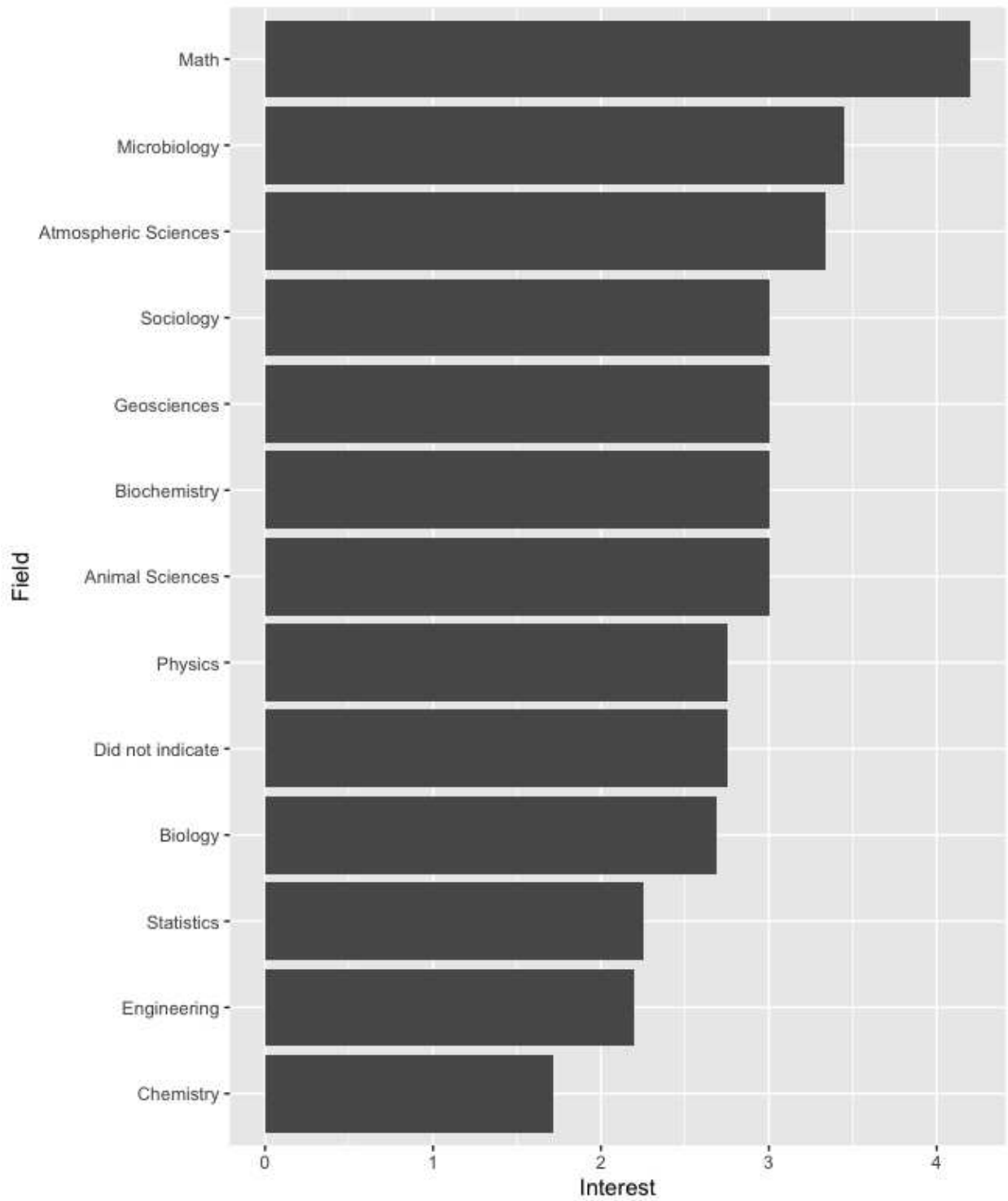


Figure 1

Note. Interest in Academic Career by Field.

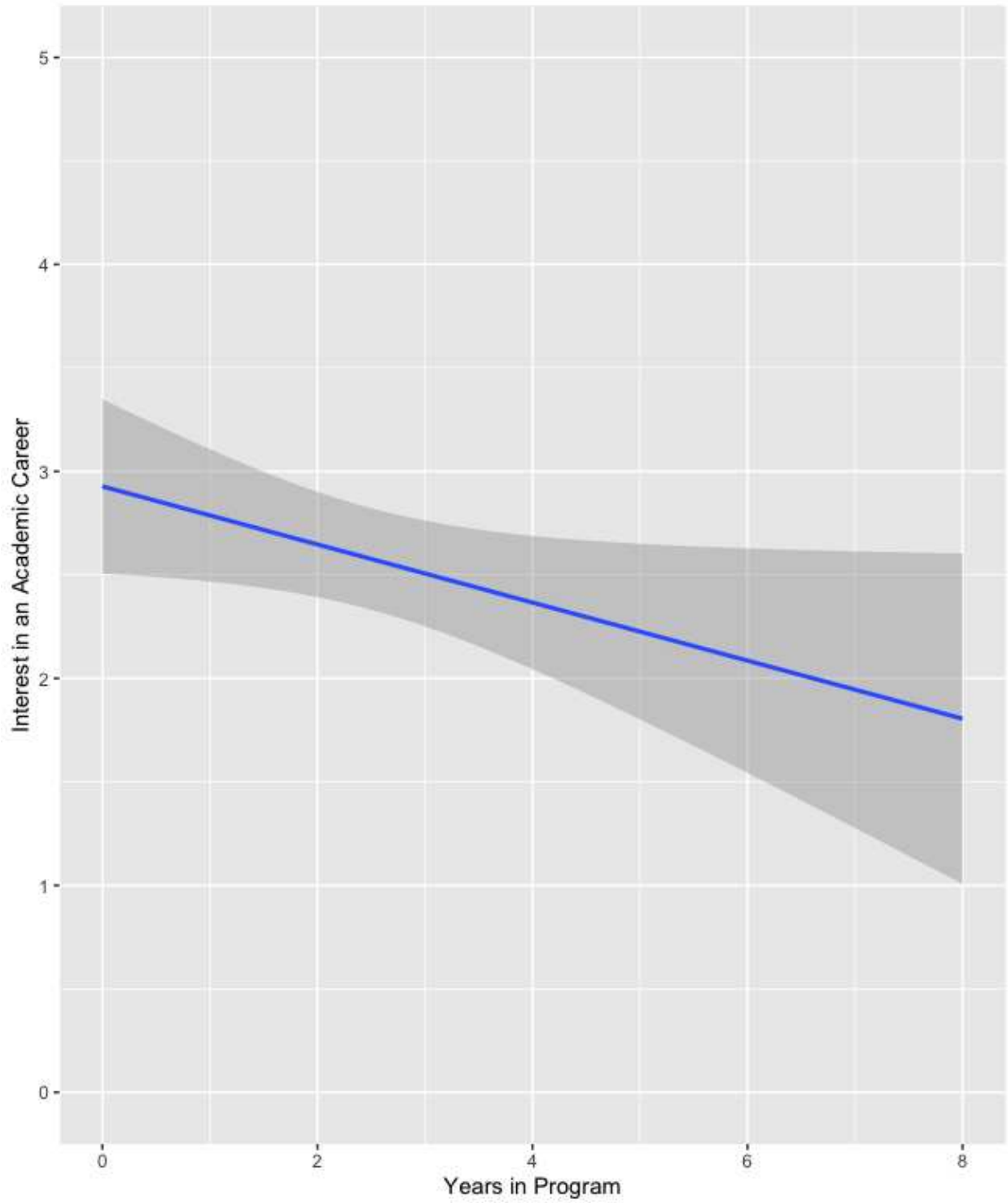


Figure 2

Note. Association Between Interest in an Academic Career and Years in Program.

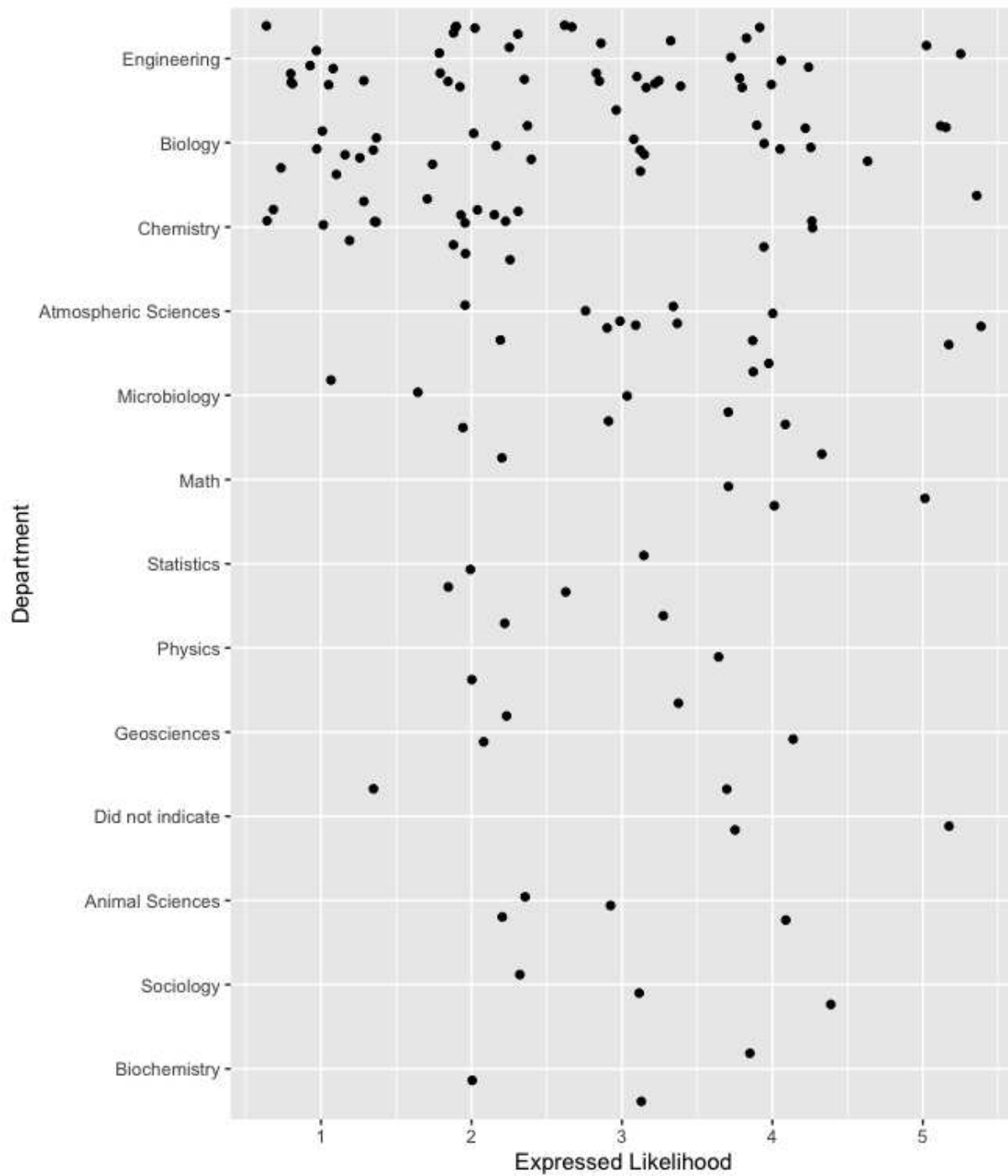


Figure 3

Note. Women's Expressed Likelihood of Pursuing an Academic Career, by Field

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Appendix

Appendix A

Beliefs about Academia, Science, and SE fields as Feminine or Masculine:

Please answer the following questions on a scale from 1-5.

1 = Not at all feminine

2

3

4

5 = Very feminine

1. Academia is a profession that is:
2. Science is a field that is
3. The field that I am currently in (e.g., biology, psychology) is:
4. Scientists are:
5. Professionals in my field (e.g., computer scientists, sociologists) are:

1 = Not at all masculine

2

3

4

5 = Very masculine

1. Academia is a profession that is:
2. Science is a field that is
3. The field that I am currently in (e.g., biology, psychology) is:
4. Scientists are:
5. Professionals in my field (e.g., computer scientists, sociologists) are:

Appendix B

Beliefs About Women/Men as Excelling in Academia, Science, and Specific SE Field:

Please answer the following questions on a scale from 1-5.

1 = Mostly of women

2

3 = Both

4

5 = Mostly of men

1. When I think of people who excel in academia, I think...
2. When I think of people who excel in science, I think...
3. When I think of people who excel in my current field of study, I think...

Appendix C

Self-Growth Versus Others-Growth Educational/Career Goals:

Please rate the relative importance of the following goals in terms of your educational/career choice.

1 = Not at all

2

3

4

5 = Extremely

1. Power
2. Demonstrating skill
3. Achievement
4. Altruism
5. Recognition
6. Serving the community
7. Status
8. Working with people
9. Focus on self
10. Helping others
11. Success
12. Connecting with others
13. Financial reward
14. Serving humanity
15. Self-direction
16. Attending to others
17. Mastery
18. Caring for others
19. Self-promotion
20. Spirituality
21. Independence
22. Intimacy
23. Individualism
24. Competition

Appendix D

Beliefs About Women's and Men's Family and Work Responsibilities:

Please rate to what extent you agree or disagree with the following statements:

- 1 = Strongly disagree
- 2 = Somewhat disagree
- 3 = Neither agree nor disagree
- 4 = Somewhat agree
- 5 = Strongly agree

1. Mothers should work for pay only if necessary.
2. A father's major responsibility is to provide financially for his children.
3. Tasks around the household should not be assigned by sex. (R)
4. People can be competitive and nurturing regardless of sex (R)

Note: (R) indicates items that were reverse scored.

Appendix E

Interest in an Academic Career and Expressed Likelihood in an Academic Career:

Please answer the following question on a scale from 1-5.

How interested are you in pursuing an academic career?

1. Not at all interested
2. A little interested
3. Ambivalent
4. Somewhat interested
5. Absolutely interested

How likely are you to pursue an academic career?

1. Definitely not
2. Probably not
3. Not sure
4. Probably yes
5. Definitely will