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Impact of Role Model Gender and Communality on College Women's Math Performance and Interest in STEM

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Abstract

The current project examined the effect of science, technology, engineering, and math (STEM) role model gender and communality and communal goal endorsement on college women's math performance and their interest in, perceived belonging in, and perceived communal goal affordance of STEM. The first study was conducted online and did not include math performance, while the second study was conducted in the laboratory and added a math assessment. It was hypothesized that exposure to a female role model would result in greater math performance and interest and perceiving belonging in STEM, exposure to a communal role model would result in increased interest in, perceived belonging in, and perceived communal goal affordance of STEM fields, and gender and communality would interact such that gender would only make a difference for communal role models. In addition, it was hypothesized that the effects of role model communality would be greater for participants with higher communal goal endorsement. The hypotheses were not supported. There was no effect of role model communality, and effects of role model gender were not consistent across the two studies. Contrary to predictions, communal goal endorsement was positively related to interest and perceiving belonging in STEM in both studies.

Impact of Role Model Gender and Communality on College Women's Math Performance and Interest in STEM

Although women receive bachelor's degrees at a higher rate than men, men earn degrees at a greater rate in several areas of science, technology, engineering, and math (STEM) (National Science Foundation [NSF], 2013). Women have high participation in psychology, representing 70 to 79 percent of psychology degrees earned in 2010 (depending on the type of degree), and medium participation rate in biosciences and social sciences, representing between 47 and 56 percent of social science degrees and 52 to 58 percent of bioscience degrees. On the other hand, women have medium to low levels of participation in math and physical sciences and low participation in computer science and engineering, earning 33 to 41 percent of degrees in physical sciences, 30 to 43 percent of degrees in math, 18 to 23 percent of engineering degrees, and 18 to 28 percent of computer science degrees. Furthermore, the percent of bachelor's and master's degrees in computer science awarded to women has decreased from 2000 to 2010 from 28 percent to 18 percent of bachelor's degrees and from 33 percent to 28 percent of master's degrees. In terms of the makeup of the workforce, men made up 72 percent of the science and engineering workforce in 2010 (NSF, 2013).

A recent review examined several potential causes of women's underrepresentation in STEM fields (Ceci, Williams, & Barnett, 2009). The review indicated that there is little evidence that there are genetic or biological differences in ability, and, indeed, if representation in math-intensive careers was based solely on math ability, women's representation would double, demonstrating that ability cannot be the primary cause of women's underrepresentation in STEM. The review concluded that four main factors contribute to women's underrepresentation in math-intensive careers. First, more men than women score at the highest end on math or quantitative sections of gatekeeper tests such as SAT and GRE. This gender difference on the GRE-Q is particularly problematic because it leads to men being admitted to graduate programs in math-intensive fields at greater rates than women. Second, women with high math competence are disproportionately likely to also have high verbal competence, compared with men, which allows women with high math competence more career options in non-STEM careers. Third, math-proficient women are more likely than math-proficient men to prefer careers in non-math-intensive fields, and for the women who do enter math-intensive fields, they are more likely than men to leave those careers as they advance. Finally, in some math-intensive fields, women are penalized in promotion rates for having children (Ceci et al., 2009).

The Ceci et al. (2009) review and another review by Ceci and Williams (2011) both conclude that the main reason for women's underrepresentation in STEM is women's preferences for non-STEM careers. Ceci and Williams (2011) suggest that role models may increase girls' interest in STEM, and another review (Halpern, Aronson, Reimer, Simpkins, Star, & Wentzel, 2007) recommends specifically female role models as a technique for encouraging girls to explore STEM, though it notes that the evidence for this is minimal. The review calls for more research to determine if role models are effective at increasing girls' interest in STEM and thus women's representation in those fields, as well as what aspects of role models are key to boosting girls' and women's interest in STEM.

Research shows that role models must be relevant, and their success must be perceived as attainable in order for them to be motivational (Lockwood & Kunda, 1997). The stereotype inoculation model (Dasgupta, 2011) describes how both expert and peer role models can protect ingroup members' self-concept from belonging threats in domains in which there are negative stereotypes about the group. Essentially, the presence of ingroup members in an academic or professional context can improve sense of belonging, self-efficacy, attitudes, and identification, and can change the perception of a domain in which the ingroup is negatively stereotyped from that of a threat to that of a challenge. Those changes in turn can increase effort, performance, and active participation, and influence individuals' career decisions. The stereotype inoculation model also suggests that similarity and identification with role models are important moderators of these effects (Dasgupta, 2011). In addition, role model gender has been found to be important for inspiring females, but not males (Lockwood, 2006).

A number of studies have examined the effects of female role models for girls and women in math and other STEM domains (Cheryan, Drury, & Vichayapai, 2013; Cheryan, Siy, Vichayapai, Drury, & Kim, 2011; Marx & Roman, 2002; Stout, Dasgupta, Hunsinger, & McManus, 2011). One study examined the impact of the gender of a math role model on women and men's math performance and performance state self-esteem, and found that women and men had equivalent math performance and self-esteem with the female role model, but men performed better and had higher self-esteem with a male role model (Marx & Roman, 2002). Two follow-up studies used only female role models, but manipulated perceptions of competence, and tested the effects on math performance, performance state self-esteem, and math self-efficacy. Women performed better with a competent female role model, whereas men performed worse with a competent female role model. One of the studies found that the improvement in women's performance was due to increased accuracy, while the other found that it was due to both higher accuracy and attempting more problems. Math self-efficacy was higher for female participants in the competent female role model condition, compared to the non-competent female role model condition. The effect of female role model competency on women's state self-esteem varied between the two studies, with one study finding that women had lower performance state self-esteem in the competent female role model condition than in the non-competent female role model condition and the other finding the opposite pattern (Marx & Roman, 2002).

In contrast to Marx and Roman's (2002) finding that female role models lead to higher math performance for women, an experimental study and a quasi-experimental study both found no effect of role model gender on math performance (Stout et al., 2011). However the experimental study did find that women attempted to solve more problems in the female role model condition compared to the male role model condition, and the quasi-experimental study found that female students who were exposed to a female role model had higher self-efficacy compared to female students who were exposed to a male role model. Stout and colleagues (2011) also examined the effect of role model gender on women's attitudes toward and identification with STEM and found that women had more positive implicit attitudes toward and higher implicit identification with STEM if they were exposed to female role models than if they were exposed to male role models or no role models. However, the same effect was not found for explicit attitudes and identification. In addition, one of the three studies did not find an effect on implicit identification (Stout et al., 2011). For those in the female role model condition, identification with the female role model was found to predict intentions to pursue an engineering career, which was mediated by self-efficacy in engineering (Stout et al., 2011).

Studies that specifically investigated the effect of role models for women in computer science found no effect of role model gender on women's beliefs about potential for success in computer science (Cheryan et al., 2011), sense of belonging in computer science, or interest in computer science (Cheryan et al., 2013). These studies also examined the stereotypicality of the role models—how much they embodied stereotypes about computer science majors in their clothing, hobbies, and favorite movies, television shows, and magazines. The first set of studies found that women had lower success beliefs when exposed to a stereotypical role model and perceived the stereotypical role models as less similar to themselves. Moreover, perceived similarity to the role model mediated the effect of role model stereotypicality on success beliefs (Cheryan et al., 2011). A follow-up study found that stereotypical role models decreased women's interest and perceived belonging in computer science, and that perceived belonging mediated the effect of role model stereotypicality on interest in computer science (Cheryan et al., 2013).

Another study examined the stereotypicality of female role models in a different way by manipulating the femininity of the role models (Betz & Sekaquaptewa, 2012). This study was also unique in that it examined effects on adolescent girls. The study found that girls who were exposed to feminine (as opposed to gender-neutral) female STEM role models had lower math self-efficacy and interest in math, and that girls who were STEM-disidentified (did not list science or math as one of their favorite school subjects) and exposed to feminine female role models reported a lower likelihood of taking math classes in high school and college compared to STEM-disidentified girls who were exposed to gender-neutral female role models (Betz & Sekaquaptewa, 2012).

In the studies described above, one study (Marx & Roman, 2002) found that exposure to a female role model improved women's math performance, while another set of studies (Stout et al., 2011) found no effect of role model gender on women's math performance, but did find in one of the two studies that exposure to a female role model increased effort. The studies provided some evidence of a positive effect of female role models on women's state self-esteem (Marx & Roman, 2002), self-efficacy (Stout et al., 2011), and implicit attitudes about STEM and identification with STEM. However, the studies did not find evidence for an effect of role model gender on explicit attitudes about STEM, explicit identification with STEM (Stout et al., 2011), beliefs about STEM (Cheryan et al., 2011), belonging in STEM, or interest in STEM (Cheryan et al., 2013). The mixed findings on role model gender may be due to an issue with the assumption underlying the focus on role model gender, which is that women and girls will notice the role model's gender, and if she is female, view her as more similar, resulting in an increase in math performance and positive attitudes toward STEM. However, it's possible that women will instead compare themselves to the role model and feel worse about their own abilities, especially when a negative stereotype about gender is salient (Blanton, Christie, & Dye, 2002). In addition to effects of gender, two of the studies discussed above found an effect of role model stereotypicality, regardless of the role model's gender (Cheryan et al., 2011, Cheryan et al., 2013), and other studies found that the effects of female role models depended on their competence (Marx & Roman, 2002) and femininity (Betz & Sekaquaptewa). This suggests the importance of examining characteristics of role models other than gender.

Other research that examines methods for increasing women's interest in STEM focuses on communal goals. These goals include helping others, caring for others, serving humanity or the community, working with people, connecting with others, intimacy, and spiritual rewards (Diekman, Brown, Johnston, & Clark, 2010; Diekman, Clark, Johnston, Brown, & Steinberg, 2011). In accordance with stereotypes about gender roles, women tend to rate communal goals as more important than men do (Diekman et al., 2010; Diekman et al., 2011). Furthermore, STEM careers are perceived as affording communal goals less than both male-stereotypic non-STEM careers and female-stereotypic careers (Diekman et al., 2010; Diekman et al., 2011). As a result of STEM careers' lower perceived communal goal affordance, communal goal endorsement predicted lower interest in STEM careers, even when controlling for self-efficacy and experience in STEM in a correlational study (Diekman et al., 2010). Moreover, the study found that gender predicted communal goal endorsement and that communal goal endorsement mediated the effect of gender on interest in STEM careers (Diekman et al., 2010).

Building on this correlational study, two experimental studies were conducted to test the relationships between communal goal endorsement, goal affordance stereotypes, and interest in STEM (Diekman et al., 2011). In the first study, communal goals were primed in participants in the experimental condition, which resulted in lower interest in STEM compared to participants who were not primed with communal goals, and this effect did not differ between men and women. The second study manipulated goal affordance stereotypes by describing the activities of scientists as involving collaboration or independent work. Positivity toward the scientist career was higher among women in the collaborative framing condition, compared to women in the independent framing condition, but there were no differences in positivity between the conditions among men. In addition, perceived communal goal affordances of the scientist career mediated the effect of framing on positivity among women. Moreover, the relationship between perceived communal goal affordances and positivity was moderated by communal goal endorsement, and this was true for both women and men (Diekman et al., 2011).

Results from these studies suggest that communal goals and stereotypes about how much STEM careers afford communal goals are important influences on individuals' career decisions, particularly for women who tend to value communal goals more than men. Although the framing of the scientist career as communal through information about collaboration has been shown to increase positivity toward science among those high in communal goal endorsement (Diekman et al., 2011), the framing of STEM careers as communal has not been studied with aspects of communal goals that go beyond collaboration, nor has it been studied in terms of effects on actual interest in STEM fields. Furthermore, communality has not been studied with role models, who can be used to portray STEM fields or the individuals who work in STEM as communal. Such role models could not only change perceived communal goal affordances but also perceived belonging in STEM among women and individuals who are high in communal goal endorsement. Since the evidence on the impact of STEM role model gender is mixed, it is important to study how gender may interact with other key characteristics of role models to influence women's decisions to pursue STEM, their performance in math, and their career decisions.

Overview of Study 1

Study 1 was a preliminary examination of the effect of role model gender and communality on college women's interest in, perceived belonging in, and perceived communal goal affordance of STEM majors with communal goal endorsement as a moderating variable. The study was also used to pilot test the role model manipulation to ensure that participants perceive the role models as successful, believe that the success of the role models is attainable, and view the role models in the communal condition as being more communal than those in the non-communal condition. Study 1 was an online experimental study with a 2 (male v. female role model) by 2 (communal v. non-communal role model) between-subjects design. All participants were female.

It was predicted that there would be a main effect of role model gender and role model communality, such that participants exposed to a female role model would indicate greater interest in STEM compared to those exposed to a male role model, and participants exposed to a communal role model will indicate greater interest in STEM compared to those exposed to a non-communal role model. It is also expected that role model gender and communality will interact such that within the communal conditions, those exposed to a female role model will express greater interest compared to those exposed to a male role model, whereas gender will not make a difference within the non-communal role model condition.

It was predicted that the effect of role model communality on interest in STEM majors would be mediated by sense of belonging in and perceived communal goal affordances of STEM majors, while the effect of role model gender on interest in STEM majors would be mediated only by sense of belonging in STEM. Furthermore, it was predicted that communal goal endorsement would moderate the effect of role model communality on interest in STEM, such that the effect would be greater for those with high communal goal endorsement, compared to those with low communal goal endorsement.

Methods

Participants

Female students from the University of Connecticut undergraduate psychology participant pool were recruited for this study. Although gender was used as a restriction, five male participants completed the study and were given credit, but their data were dropped from all subsequent analyses. The subsequent sample consisted of 190 female participants. The sample was primarily White, with 133 participants (70.0%) self-identifying as White. Thirty-three (17.4%) self-identified as Asian/Pacific Islander, nineteen (10.0%) as Hispanic/Latino, ten (5.3%) as Black/African American, three (1.6%) as Native American, and fifteen (7.9%) as other. Since the participant pool uses students from introductory psychology classes, most participants were freshmen or sophomores. Eighty-four (44.2%) participants were freshmen, 62 (32.8%) were sophomores, 35 (18.4%) were juniors, 8 (4.2%) were seniors, and 1 (0.5%)

declined to answer. The majority of the sample, 141 (74.2%) participants, had already declared a major. The mean score on the math section of the SAT was 602.62 (SD = 85.53, N = 180), and the mean score on the verbal section of the SAT was 600.91 (SD = 84.10, N = 180).

Procedure

The description of the study on the study sign up website, as well as the information sheet at the beginning of the survey, indicated that the purpose of the study was to examine factors that affect students' choice of majors. Once participants signed up for the study, they were emailed the survey link via Qualtrics with instructions to complete the survey in one sitting within 24 hours. Qualtrics provided information on how long participants took to complete the survey after clicking on the link. The first task in the study was a purported reading comprehension assessment with the passage acting as the manipulation. Participants were randomly assigned to one of four conditions based on a two (gender) by two (communality) completely crossed factorial design: communal female role model, communal male role model, non-communal female role model, or non-communal male role model. The passage was a biographical sketch of an engineer (see Appendix). For participants in the male role model condition, the bio used a male name and male pronouns, whereas for participants in the female role model condition, the bio used a female name and female pronouns. For participants in the communal condition, the bio included several examples of how the engineer works with others, helps others, serves humanity and the community, and connects with others through engineering and his/her job and outside of work. For participants in the non-communal condition, these sentences were be replaced by details regarding working independently and aspects of being an engineer and his/her life outside of work that do not involve connecting with others, serving the community or humanity, or helping others.

Measures

Interest in STEM majors was assessed using an adapted version of the measure used by Cheryan and colleagues (2013) to assess interest in computer science in their study of role models. Instead of asking specifically about computer science, the adapted version asked about a list of thirty majors available at the University of Connecticut, evenly split between STEM and non-STEM fields. The measure asks participants how likely they are to major in each field on a 7-point Likert scale from “not at all likely” to “very likely” and how much they have considered majoring in each field on a 7-point Likert scale from “not at all” to “very much.” Example STEM majors included are chemistry, electrical engineering, and mathematics. Example-non-STEM majors included are anthropology, education, and political science. Nursing was included as a non-STEM major, however, the items had low correlations with the scale (“How likely are you to major in this field?” r = -.02, “How much have you considered majoring in this field?” r = -.05), and thus the nursing items were dropped, leaving a revised 28-item non-STEM interest scale (α = .87). Similarly, accounting was included as a STEM major, however the items had low correlations with the scale (“How likely are you to major in this field?” r = -.10, “How much have you considered majoring in this field?” r = -.001), and thus the accounting items were dropped, leaving a revised 28-item STEM interest scale (α = .92).

Similarly, sense of belonging in STEM was assessed using an adapted version of the measure used in the same study (Cheryan et al., 2013) to assess sense of belonging in computer science, with the adapted version using the same list of STEM majors as the measure of interest in STEM. For each major, participants were asked “How much do you feel that you fit in with this major?” on a 7-point Likert scale from “not at all” to “very much.” Once again, nursing had a low correlation with the non-STEM scale (r = -.02) and was dropped from the scale, leaving a

14-item scale ($\alpha = .75$). Similarly, accounting had a low correlation with the STEM scale ($r = .05$) and was dropped from the scale, leaving a 14-item scale ($\alpha = .87$).

Perceived communal goal affordance was assessed using an adapted version of the measure used by Diekman and colleagues (2010) in which participants were asked “How much do you think this major is likely to fulfill goals such as intimacy, affiliation, and altruism?” for the same thirty STEM and non-STEM on a 7-point Likert scale from “not at all” to “very much.” Communal goal endorsement was assessed using the measure created by Diekman and colleagues (2010), which includes both communal and agentic goal endorsement. The measure asks participants to rate how important each goal is to them personally on a 7-point Likert scale from “not at all important” to “extremely important.” The measure includes eight communal goals, such as caring for others and serving humanity ($\alpha = .89$), and fourteen agentic goals, such as power and success ($\alpha = .90$).

Role model ratings were used to check whether participants perceived the role models as successful and whether the role models in the communal condition were perceived as more communal and likable. This measure was adapted from the one used by Lockwood (2006) to assess whether participants felt role models were successful, with additional adjectives added related to likability and communality. Participants were asked “How much do the following characteristics describe the person in the passage?” on a 7-point Likert scale from “not at all” to “very much.” The list of adjectives included 16 traits related to success and competence, such as unskilled (reverse coded) and successful ($\alpha = .90$), however, influential had a low correlation with the scale ($r = .32$) and was dropped from the scale for analyses, leaving a 15-item scale ($\alpha = .91$). The list of adjectives included 15 traits related to communality and likability, such as warm and caring ($\alpha = .89$), however the reverse-coded items had low correlations with the scale (uncaring *r* = .29, selfish *r* = .14, competitive *r* = -.23) and were dropped from the scale for analyses, leaving a 12-item scale (α = .94).

A measure adapted from Lockwood (2006) was used to assess whether participants' perceived the role models' level of success as attainable (α = .88). Participants were asked how much they agreed with three statements regarding the person in the passage: "His/her achievements are out of my reach," "I will never attain success like that of him/her," and "He/she accomplished more in his/her life than I can hope to." Responses were on a 7-point Likert scale from "very strongly disagree" to "very strongly agree."

Reading comprehension questions about the passage were used as an attention check. Seven items were included, but only five were purely fact-based, so only those items were used to determine whether participants were paying sufficient attention to the passage. In addition, participants were asked to recall the gender and field of the person in the passage as a manipulation check.

Results

Preliminary Analysis

Twelve participants failed the manipulation check by incorrectly recalling either the role model's gender or field and were dropped from all subsequent analyses. Sixteen additional participants were dropped from all analyses because they completed the study in less than five minutes or more than one hour, and fourteen participants were dropped from analyses because they incorrectly answered more than two of the five fact-based reading comprehension items, indicating that they were not paying sufficient attention to the passage. This left a final analyzed sample of 148 participants. Means and standard deviations for all variables are in Table 1.

There were no differences by gender or condition for SAT math score (gender $F(1,135) = 1.26$, $p = .26$; communality condition $F(1,135) = 0.43$, $p = .51$), SAT verbal score (gender $F(1,135) = 0.17$, $p = .68$; communality condition $F(1,135) = 0.31$, $p = .58$), communal goal endorsement (gender $F(1,144) = 1.18$, $p = .28$; communality $F(1,144) = 1.56$, $p = .21$), or agentic goal endorsement (gender $F(1,144) = 0.17$, $p = .68$; communality $F(1,144) = 0.21$, $p = .64$). The manipulations did not affect the perceived success and competence of the role models (gender $F(1,138) = 0.28$, $p = .60$; communality $F(1,138) = 1.66$, $p = .20$), and the role models were perceived as being quite successful, with ratings ranging from 4.47 to 7.00 on a 1 to 7 scale ($M = 6.36$, $SD = 0.57$, $N = 142$). The manipulations also did not affect the perceived attainability of the role models' success (gender $F(1,142) = 0.001$, $p = .98$; communality $F(1,142) = 0.12$, $p = .73$). Consistent with expectations, ratings of role models' communality and likability were not affected by the gender of the role model, $F(1,144) = 0.05$, $p = .83$, but they were affected by the communality manipulation, $F(1,144) = 13.19$, $p <.001$, in the expected direction, with a mean in the communal role model condition of 5.24 (SD=.96) and 4.59 (SD=1.20) in the non-communal condition.

Data were analyzed using hierarchical linear regression. The control variables of SAT math score and perceived attainability of role model success were entered in the first step. In the second step the independent variables of role model gender (dummy coded; 0 for male, 1 for female), role model communality (dummy coded; 0 for non-communal, 1 for communal), and communal goal endorsement (mean centered) were added. Two-way interactions between the independent variables were added in the third step, and the three-way interaction term was added in the fourth step.

Interest in STEM and Non-STEM fields.

As can be seen in Table 2, there was no effect of role model gender, β = -.04, t(132) = -.50, p = .62, or role model communality, β = -.09, t(132) = -1.06, p = .29, on interest in STEM fields. There was a marginally significant effect of communal goal endorsement on interest in STEM fields, β = .15, t(132) = 1.70, p = .09,, with higher communal goal endorsement related to greater interest in STEM. The two-way interactions between gender and communality, β = .12, t(129) = .74, p = .46, gender and communal goal endorsement, β = .04, t(129) = .32, p = .75, and communality and communal goal endorsement, β = -.08, t(129) = -.56, p = .57, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, β = .03, t(128) = .16, p = .88.

The results for interest in non-STEM fields are presented in Table 3. There was no effect of role model communality, β = .05, t(132) = .62, p = .53, or communal goal endorsement, β = .03, t(132) = .31, p = .76, on interest in non-STEM fields. There was a marginally significant effect of role model gender on interest in non-STEM fields, β = .16, t(132) = 1.85, p = .07, with exposure to a female role model leading to greater interest in non-STEM fields. There was a significant interaction between gender and communal goal endorsement, β = -.25, t(129) = -2.01, p = .05, (see Figure 1) such that the effect of a female role model leading to greater non-STEM interest is only true for those with low communal goal endorsement. The two-way interactions between gender and communality, β = .13, t(129) = .89, p = .38, and communality and communal goal endorsement, β = .13, t(129) = .99, p = .33, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, β = .14, t(128) = .74, p = .46.

Perceived Belonging in STEM and non-STEM fields

As shown in Table 4, there was a significant effect of communal goal endorsement on perceived belonging in STEM fields, $\beta = .21$, $t(132) = 2.51$, $p = .01$, such that higher communal goal endorsement was related to greater belonging in STEM. However, there was no effect of role model gender, $\beta = -.04$, $t(132) = -.60$, $p = .55$, or role model communality, $\beta = -.09$, $t(132) = -1.06$, $p = .29$. The two-way interactions between gender and communality, $\beta = .17$, $t(129) = 1.11$, $p = .27$, gender and communal goal endorsement, $\beta = .07$, $t(129) = .53$, $p = .60$, and communality and communal goal endorsement, $\beta = -.14$, $t(129) = -1.03$, $p = .30$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .02$, $t(128) = .11$, $p = .92$.

For perceived belonging in non-STEM fields, there were no significant effects. There was no effect of role model gender, $\beta = .11$, $t(132) = 1.33$, $p = .19$, role model communality, $\beta = -.002$, $t(132) = -.03$, $p = .98$, or communal goal endorsement, $\beta = .12$, $t(132) = 1.43$, $p = .16$, on perceived belonging in non-STEM fields. The two-way interactions between gender and communality, $\beta = .16$, $t(129) = 1.08$, $p = .28$, gender and communal goal endorsement, $\beta = -.20$, $t(129) = -1.56$, $p = .12$, and communality and communal goal endorsement, $\beta = .21$, $t(129) = 1.57$, $p = .12$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .07$, $t(128) = .33$, $p = .74$.

Perceived Communal Goal Affordance in STEM and non-STEM fields.

As shown in Table 5, there was no effect of role model gender, $\beta = .08$, $t(131) = .94$, $p = .35$, role model communality, $\beta = -.003$, $t(131) = -.03$, $p = .98$, or communal goal endorsement, $\beta = .11$, $t(131) = 1.26$, $p = .21$, on perceived communal goal affordance of STEM fields. The two-way interactions between gender and communality, $\beta = .11$, $t(128) = .68$, $p = .50$, gender and communal goal endorsement, $\beta = -.09$, $t(128) = -.62$, $p = .53$, and communality and communal goal endorsement, $\beta = .17$, $t(128) = 1.19$, $p = .24$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = -.34$, $t(128) = -1.62$, $p = .11$.

For perceived communal goal affordance in non-STEM fields, there was no effect of role model gender, $\beta = .08$, $t(131) = .91$, $p = .37$, or role model communality, $\beta = .02$, $t(131) = .17$, $p = .86$, on perceived communal goal affordance of non-STEM fields. There was a significant effect of communal goal endorsement, $\beta = .21$, $t(131) = 2.48$, $p = .01$, on perceived communal goal affordance of non-STEM fields, such that higher communal goal endorsement was related to a greater perception of non-STEM fields as fulfilling communal goals. The two-way interactions between gender and communality, $\beta = .06$, $t(128) = .36$, $p = .72$, gender and communal goal endorsement, $\beta = .06$, $t(128) = .27$, $p = .79$, and communality and communal goal endorsement, $\beta = .20$, $t(128) = 1.38$, $p = .17$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = -.01$, $t(127) = -.06$, $p = .95$.

Summary of Results

Although the communal role models were perceived as being more communal and likable, there was no effect of role model communality on any of the outcomes variables, including perceptions of STEM as fulfilling communal goals. Participants who were exposed to a female role model had marginally greater interest in non-STEM fields. However, role model gender interacted with communal goal endorsement such that the effect of gender only occurred for those with low communal goal endorsement. There were no other effects of role model gender. Finally, participants with higher communal goal endorsement had marginally greater interest in STEM fields, significantly greater perceived belonging in STEM, and rated non-STEM fields as being significantly more communal.

One important limitation of this study is that it was conducted online. Participants were given instructions to complete the survey in one sitting and without multitasking. However, it is possible that they did not follow these instructions or did not pay much attention to the passage, which could have limited the effect of the manipulation. A better test of the hypotheses would be to bring participants into the laboratory where there are no distractions and where participants might be more motivated to take the study seriously due to the presence of the experimenter.

Overview of Study 2

Study 2 was a replication of Study 1, but with the added outcome variable of math performance and effort. In addition, Study 2 was conducted in the laboratory. Hypotheses were the same as in Study 1. In addition, it was predicted that participants in the female role model condition would perform better on the math exam and attempt to answer more questions compared to those in the male role model condition. There was not expected to be a main effect of role model communality on math performance or effort and no interaction between gender and communality on math performance or effort. Female role models were expected to counteract the stereotype that women are bad at math, and thus female role models should boost women's math performance. However, since communality is not relevant to the stereotype that women are bad at math, it should not counteract the stereotype or moderate the effect of role model gender.

Methods

Participants

Female freshmen and sophomores from the University of Connecticut undergraduate psychology participant pool who had completed prescreening were recruited for this study, and

101 participated. The sample was primarily White, with 71 participants (70.3%) self-identifying as White. Twenty-two (21.8%) self-identified as Asian/Pacific Islander, twelve (11.9%) as Hispanic/Latino, eight (7.9%) as Black/African American, one (1.0%) as Native American, and seven (6.9%) as other. Seventy-two (71.3%) participants were freshmen, and 29 (28.7%) were sophomores. The majority of the sample, 79 (78.2%) participants, had already declared a major. The mean score on the math section of the SAT was 605.59 ($SD = 84.42$, $N = 93$), and the mean score on the verbal section of the SAT was 611.15 ($SD = 81.87$, $N = 91$).

Procedure

The description of the study on the study sign up website, as well as the consent form, indicated that the purpose of the study was to examine factors that affect students' choice of majors. When participants came to the lab, they were checked in and consented by a white female experimenter in groups of up to five participants. The experimenter then showed each participant to a cubicle where the participant completed the experiment in private on the computer using Qualtrics. Scrap paper, a calculator, and pencils were provided for the math assessment. The math section was timed, and participants had up to 20 minutes to complete the math section. When participants reached the end of the study, they notified the experimenter and were debriefed. Randomization was the same as in Study 1. The only difference in the passage from Study 1 is that the school that the role model attended was changed to the University of Connecticut to make the role model's success seem more attainable to participants.

Measures

Math performance and effort were assessed using ten questions from the math section of an Educational Testing Service GRE preparation book. These particular questions were either taken from the medium or difficult level practice question sections, or they were questions from practice tests in the book that fewer than 50 percent of individuals correctly answer. Performance was determined by the number of questions answered correctly, while effort was determined by the number of questions attempted.

Interest in STEM (α = .94) and non-STEM fields (α = .89), belonging in STEM (α = .87) and non-STEM fields (α = .83), and perceived communal goal affordance of STEM (α = .94) and non-STEM fields (α = .87) were measured the same as in Study 1, but without the items for nursing and accounting. Communal (α = .91) and agentic goal endorsement (α = .86) were measured during prescreening with a version of the same measure used in Study 1 that only included the seven communal items and seven agentic items with the highest correlations to their respective scales in Study 1. The same role model ratings from Study 1 were used, but without the influential item and with added items of feminine and masculine to ensure that the communality manipulation did not affect how masculine and feminine the role models were perceived. There were fifteen traits related to success and competence (α = .95) and fifteen traits related to communality and likability (α = .91). The same measure of perceived attainability of the role model's success from Study 1 was used (α = .85). The same reading comprehension questions as in Study 1 were used as an attention check. Once again, participants were asked to recall the gender and field of the person in the passage as a manipulation check. Participants completed the goal endorsement measure during prescreening at the beginning of the semester. When participant came in the lab they started by reading the passage about the role model and responding to the reading comprehension question, then they completed the measures of interest, belonging, and perceived communal goal affordance, followed by the math assessment, and finally they answered the questions about the role model, including the manipulation check

Results

Preliminary Analysis

Five participants failed the manipulation check by incorrectly recalling either the role model's gender or field and were dropped from all subsequent analyses. In addition, data from four participants were dropped because they received a math test with an error that made one question impossible to solve, and one other participant was dropped because she completed the math section in under two minutes. This left a final analyzed sample of 91 participants. Means and standard deviations for all measures are in Table 6.

Participants exposed to a male role model had a significantly higher SAT math score than those exposed to a female role model, $F(1,79) = 6.38$, $p = .01$, but there was no difference in SAT math score between those exposed to a communal role model and those exposed to a non-communal role model, $F(1,79) = .03$, $p = .87$. Participants exposed to a male role model reported marginally lower communal goal endorsement than those exposed to a female role model, $F(1,87) = 2.89$, $p = .09$, but there was no difference in communal goal endorsement between those exposed to a communal role model and those exposed to a non-communal role model, $F(1,87) = 1.05$, $p = .31$. There were no differences by condition for SAT verbal score (gender $F(1,77) = 0.10$, $p = .76$; communality $F(1,77) = 0.83$, $p = .37$) or agentic goal endorsement (gender $F(1,87) = 0.05$, $p = .83$; communality $F(1,87) = 0.19$, $p = .67$). The manipulations did not affect the perceived success and competence of the role models (gender $F(1,87) = 0.82$, $p = .37$; communality $F(1,87) = 0.20$, $p = .66$), and the role models were perceived as being quite successful, with ratings ranging from 3.67 to 7.00 on a 1 to 7 scale ($M = 6.33$, $SD = 0.66$, $N = 91$). The manipulations also did not affect the perceived attainability of the role models' success (gender $F(1,87) = 0.05$, $p = .83$; communality $F(1,87) = 0.10$, $p = .75$). Consistent with expectations, ratings of role models' communality and likability were not affected by the gender of the role model, *F(1,87)* = 0.08, *p* = .77, but they were affected by the communality manipulation, *F(1,87)* = 19.57, *p* <.001, in the expected direction, with a mean of 5.35 (SD=.87) in the communal role model condition and 4.52 (SD=.90) in the non-communal condition.

Data were analyzed using hierarchical linear regression. The control variables of SAT math score and perceived attainability of role model success were entered in the first step. In the second step the independent variables of role model gender (dummy coded; 0 for male, 1 for female), role model communality (dummy coded; 0 for non-communal, 1 for communal), and communal goal endorsement (mean centered) were added. Two-way interactions between the independent variables were added in the third step, and the three-way interaction term was added in the fourth step.

Math Assessment

As shown in Table 7, there was no effect of role model gender, β = .01, *t*(77) = .07, *p* = .94, role model communality, β = .07, *t*(77) = .81, *p* = .42, or communal goal endorsement, β = -.06, *t*(77) = -.59, *p* = .56, on math performance. The two-way interactions between gender and communality, β = .02, *t*(74) = .13, *p* = .90, gender and communal goal endorsement, β = .10, *t*(74) = .90, *p* = .37, and communality and communal goal endorsement, β = -.17, *t*(74) = -1.40, *p* = .17, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, β = .04, *t*(73) = .23, *p* = .82. The only predictor of math performance was math SAT score.

As shown in Table 8, there was a marginally significant effect of role model communality on the amount of time participants took to complete the math assessment, β = .18, *t*(77) = 1.68, *p* = .10, with participants exposed to a communal role model taking more time to complete the assessment. There was no effect of role model gender, β = .06, *t*(77) = .52, *p* = .60, or communal goal endorsement, $\beta = .16$, $t(77) = 1.37$, $p = .17$, on time to complete the math assessment. The two-way interactions between gender and communality, $\beta = .25$, $t(74) = 1.26$, $p = .21$, gender and communal goal endorsement, $\beta = -.08$, $t(74) = -.56$, $p = .58$, and communality and communal goal endorsement, $\beta = -.07$, $t(74) = -.47$, $p = .64$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .20$, $t(73) = 1.08$, $p = .29$.

For effort on the math test, there was no effect of role model gender, $\beta = -.18$, $t(77) = 1.57$, $p = .12$, role model communality, $\beta = -.09$, $t(77) = -.82$, $p = .41$, or communal goal endorsement, $\beta = -.06$, $t(77) = -.51$, $p = .61$, on effort. The two-way interactions between gender and communality, $\beta = .02$, $t(74) = .11$, $p = .92$, gender and communal goal endorsement, $\beta = -.05$, $t(74) = -.37$, $p = .72$, and communality and communal goal endorsement, $\beta = .15$, $t(74) = .96$, $p = .34$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was marginally significant, $\beta = .33$, $t(73) = 1.76$, $p = .08$ (see Figure 2). Among those with low communal goal endorsement, participants who were exposed to a female communal role model attempted fewer items on the math assessment. In contrast, among those with high communal goal endorsement, participants who were exposed to a female non-communal role model attempted fewer items.

Interest in STEM and non-STEM fields

As shown in Table 9, there was a marginally significant effect of role model gender on interest in STEM fields, $\beta = -.21$, $t(77) = -1.89$, $p = .06$, with male role models leading to greater interest. There was also a marginally significant effect of communal goal endorsement on interest in STEM fields, $\beta = .21$, $t(77) = 1.95$, $p = .06$, with communal role models leading to greater interest. There was no effect of role model communality, $\beta = .07$, $t(77) = .62$, $p = .54$, on interest in STEM. The two-way interactions between gender and communality, $\beta = -.03$, $t(74) = -.17$, $p = .87$, gender and communal goal endorsement, $\beta = -.08$, $t(74) = -.63$, $p = .53$, and communality and communal goal endorsement, $\beta = -.12$, $t(74) = -.82$, $p = .42$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .05$, $t(73) = .26$, $p = .80$. For interest in STEM, there was also a significant effect of the perceived attainability of the role model's success: The more attainable the participants perceived the role model to be, the more interested they were in STEM fields, $\beta = .24$, $t(80) = 2.21$, $p = .03$.

The pattern for interest in non-STEM fields was similar, with no effect of role model gender, $\beta = -.06$, $t(77) = -.50$, $p = .62$, role model communality, $\beta = .02$, $t(77) = .14$, $p = .89$, or communal goal endorsement, $\beta = .05$, $t(77) = .43$, $p = .67$. The two-way interactions between gender and communality, $\beta = -.17$, $t(74) = -.82$, $p = .41$, gender and communal goal endorsement, $\beta = -.06$, $t(74) = -.45$, $p = .65$, and communality and communal goal endorsement, $\beta = -.06$, $t(74) = -.42$, $p = .68$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = -.09$, $t(73) = -.45$, $p = .65$. Again, however, perceived attainability of the role model success was a significant predictor, $\beta = -.29$, $t(80) = -2.72$, $p < .01$: The more attainable the role model was perceived to be, the less interested participants were in non-STEM fields.

Perceived Belonging in STEM and non-STEM fields

As shown in Table 10, there was a significant effect of role model gender on perceived belonging in STEM fields, $\beta = -.26$, $t(77) = -2.34$, $p = .02$, and a marginally significant effect of communal goal endorsement on perceived belonging in STEM fields, $\beta = .19$, $t(77) = 1.78$, $p = .08$. Both of these effects were in the same direction as the effects on interest; male role models and higher communal goal endorsement both led to greater perceived belonging in STEM. There was no effect of role model communality, $\beta = .07$, $t(77) = .66$, $p = .51$, on belonging in STEM. The two-way interactions between gender and communality, $\beta = .004$, $t(74) = .02$, $p = .99$, gender and communal goal endorsement, $\beta = -.09$, $t(74) = -.69$, $p = .50$, and communality and communal goal endorsement, $\beta = -.21$, $t(74) = -1.45$, $p = .15$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .03$, $t(73) = .17$, $p = .87$. Here again, the greater perceived attainability of the role model's success, the greater perceived belonging in STEM fields, $\beta = .28$, $t(80) = 2.62$, $p = .01$.

For perceived belonging in non-STEM fields, there was no effect of role model gender, $\beta = .03$, $t(77) = .26$, $p = .79$, role model communality, $\beta = .05$, $t(77) = .50$, $p = .62$, or communal goal endorsement, $\beta = .04$, $t(77) = .32$, $p = .75$. The two-way interactions between gender and communality, $\beta = -.13$, $t(74) = -.65$, $p = .52$, gender and communal goal endorsement, $\beta = -.04$, $t(74) = -.27$, $p = .79$, and communality and communal goal endorsement, $\beta = -.07$, $t(74) = -.47$, $p = .64$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .01$, $t(73) = .06$, $p = .96$. Greater perceived attainability of role model success predicted lower perceived belonging in non-STEM fields, $\beta = -.24$, $t(80) = -2.19$, $p = .03$.

Communal Goal Affordance

Table 11 shows the results for perceived communal goal affordance in STEM fields. There was no effect of role model gender, $\beta = -.13$, $t(77) = -1.09$, $p = .28$, role model communality, $\beta = .00$, $t(77) = .00$, $p = 1.00$, or communal goal endorsement, $\beta = .16$, $t(77) = 1.43$, $p = .16$. The two-way interactions between gender and communality, $\beta = .14$, $t(74) = .68$, $p = .50$, gender and communal goal endorsement, $\beta = -.02$, $t(74) = -.15$, $p = .89$, and communality and communal goal endorsement, $\beta = -.21$, $t(74) = -1.37$, $p = .18$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .12$, $t(73) = .62$, $p = .54$.

Likewise, there were no effects on perceived communal goal affordance in non-STEM fields: There was no effect of role model gender, $\beta = -.04$, $t(77) = -.30$, $p = .76$, role model communality, $\beta = .03$, $t(77) = .30$, $p = .76$, or communal goal endorsement, $\beta = .17$, $t(77) = 1.46$, $p = .15$, on perceived communal goal affordance of non-STEM fields. The two-way interactions between gender and communality, $\beta = -.08$, $t(74) = -.38$, $p = .71$, gender and communal goal endorsement, $\beta = .14$, $t(74) = 1.04$, $p = .30$, and communality and communal goal endorsement, $\beta = -.25$, $t(74) = -1.65$, $p = .10$, were not significant. The three-way interaction between gender, communality, and communal goal endorsement was not significant, $\beta = .08$, $t(73) = .43$, $p = .67$.

Summary of Results

Once again, participants viewed the communal role model as more communal and likable. However, the only effect of role model communality was on the amount of time participants took to complete the math assessment, with participants exposed to a communal role model taking marginally more time to complete it. For effort on the math assessment, there was also a marginal three-way interaction between role model gender, role model communality, and communal goal endorsement. Among participants with low communal goal endorsement, exposure to a female communal role model resulted in participants attempting fewer items on the math assessment. However, among participants with high communal goal endorsement, exposure to a female non-communal role model resulted in participants attempting fewer items. Contrary to hypotheses, participants exposed to a male role model reported marginally greater interest in STEM fields and significantly greater perceived belonging in STEM. In addition, communal goal endorsement was marginally positively related to both interest and perceived belonging in STEM. Finally, there was a consistent effect of the perceived attainability of the role model's success on participants' interest and belonging. The more attainable the role model's success, the greater their interest and belonging in STEM and the less their interest and belonging in non-STEM fields.

Discussion

The current project examined the effect of STEM role model gender and communality and communal goal endorsement on college women's math performance and their interest in, perceived belonging in, and perceived communal goal affordance of STEM. The first study was conducted online and did not include math performance as an outcome. The second study was conducted in the laboratory and added the math assessment.

It was hypothesized that women would attempt more questions and have higher math performance when exposed to a female role model, as opposed to a male role model, but there would be no effect of role model communality and no interaction. It was hypothesized that women would express greater interest and perceived belonging in STEM when exposed to a female role model and when exposed to a communal role model, and that gender and communality would interact such that gender would only make a difference for communal role models. It was hypothesized that women would perceive STEM as more fulfilling of communal goals when exposed to a communal role model, but there would be no effect of role model gender and no interaction. Finally, it was hypothesized that the effects of role model communality would be moderated by communal goal endorsement, such that the effects would be larger for those with greater communal goal endorsement. None of the hypotheses were supported.

In both studies, communal role models were perceived as being more communal and likable as compared to non-communal role models, but there was no effect on communal goal affordance. Since the details related to communality pertained to both the role model as a person, as well as his/her job, it's possible that participants attributed the communality just to the role model and perhaps thought that the role model chose his/her job because it was more communal than other engineering jobs, and thus did not generalize the communal aspects of the job as described in the passage to STEM in general. In addition, there were no main effects of role model communality on any other outcome variable, except time on the math assessment in Study 2. Participants spent more time on the math assessment when exposed to a communal role model, perhaps because reading about someone who enjoys helping others may have primed the participants to help the researcher by taking the experiment seriously and spending more time on the math assessment. It is also possible that communality is not an important characteristic of role models.

For effects of role model gender, in Study 1, participants reported marginally greater interest in non-STEM fields when exposed to a female role model. However, this was qualified by an interaction with communal goal endorsement, which showed that the effect of gender only occurred for those with low communal goal endorsement. This same effect did not replicate in Study 2. However, in Study 2, there was a main effect of gender on interest and belonging in STEM, but in the opposite direction to what was hypothesized, with participants indicating marginally lower interest and significantly lower belonging when exposed to a female role model. It is possible that because a male engineer is prototypical, exposure to a male role model does not remind participants of their gender, whereas a female engineer makes gender relevant because she is counterstereotypical and serves as a reminder that it is unusual for women to go into STEM careers.

In Study 2 there was also a marginal three-way interaction between role model gender, communality, and participants' communal goal endorsement in the effect on effort. Plotting the interaction showed that among participants with low communal goal endorsement, exposure to a female communal role model resulted in participants attempting fewer items on the math assessment. However, among participants with high communal goal endorsement, exposure to a female non-communal role model resulted in participants attempting fewer items. In other words, participants attempted fewer items when they were exposed to a female role model who was dissimilar to themselves in terms of communality.

There were also main effects of communal goal endorsement in both studies. In Study 1, participants with higher communal goal endorsement had marginally greater interest in STEM fields, significantly greater perceived belonging in STEM, and perceived non-STEM fields as being significantly more communal. The first two findings replicated in Study 2, with participants with higher communal goal endorsement having marginally greater interest and perceived belonging in STEM. This finding was contrary to what was expected, since previous research has shown that STEM is considered to be less communal than non-STEM careers and therefore less appealing to individuals with high communal goal endorsement (Diekman et al., 2010). However, it's possible that both the communal and non-communal passages portrayed STEM as relatively communal due to the fact that both passages describe the mission of the department that the role model works for as "to preserve resources, protect the environment, and put the United States in a better economic position through introducing and implementing new technology."

Finally, there was a significant effect of the perceived attainability of the role model's success on participants' interest and belonging in both STEM and non-STEM fields, but this occurred only in Study 2. For Study 2, the more attainable the role model's success, the greater their interest and belonging in STEM and the less their interest and belonging in non-STEM fields. In Study 1, the role model was a graduate of Cornell, but in Study 2 it was changed to UConn. It's possible that the effect of role model attainability on interest and belonging only occurs when participants can identify with the role model, such as when they attended the same school.

The present studies had several limitations. Study1 was conducted online, which introduces the possibility that participants were not paying sufficient attention to the passage and may not have absorbed the information. This is less likely to have occurred in Study 2 since it was done in the laboratory, but both studies did involve participants reading about a role model, rather than watching a video or actually interacting with a role model, which would likely be more engaging.

In addition, both studies used students from the psychology participant pool, who are all enrolled in introductory psychology classes. The majority of both samples had already declared a major, and the vast majority were not STEM majors, and if so were mostly areas of STEM in which women are fairly well represented, such as biology. Therefore it may have been more difficult with this sample to impact their interest and perceived belonging in various majors because their minds are already made up.

Another limitation is that the communality manipulation portrayed both the role models themselves and their career as communal. As mentioned earlier, it's possible that portraying the role model as communal may have resulted in participants attributing any communality in the role model's job to their own preference. In other words, they may have thought that the role model chose that particular job because it was communal, and not that all STEM jobs are similarly communal.

Finally, the present studies did not have a no role model control condition to compare to. It's possible that all versions of the role model passage increased participants' interest and belonging in STEM, and may have even increased their perception of STEM as fulfilling communal goals, regardless of condition, but that cannot be determined because there is no group of participants who were not exposed to any role model to compare to.

Further research is needed to address the limitations of the current studies. Future research should use a more engaging role model, such as a video or in-person role model, and the communality manipulation should be stronger and focus solely on the career. It would also be useful to explore the effects of the altruism and collaboration aspects of communality separately, since the view of STEM as not fulfilling communal goals may be driven more by one aspect than the other. It might also be helpful to include information about the gender make-up of the workplace of the role model in addition to information about the gender of the role model and to explore the effect of role model characteristics other than gender and communality. Additional studies should also include a no role model control condition and use students who have not yet declared a major and might be more open to changing their opinions about STEM or even target younger girls. Alternatively, future research could use participants who are already involved in STEM to look at the effects of role models on retention. Whether or not future research uses students who have already declared a major, it may be helpful to examine outcomes that may be easier to change than choice of major, such as plans to take math or science courses.

The evidence for the efficacy of role models for increasing women's interest in STEM is limited, especially without a comparison to similar information presented without a role model. In addition, it can often be difficult to find role models for such interventions, especially if they have to be female and in-person. Therefore it is important to explore other options for increasing women's interest in STEM besides role models.

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Table 1. Descriptives for Study 1.

Measure	Mean (SD)	N
Role Model Success Rating	6.36 (.57)	142
Role Model Communality & Likability	4.93 (1.13)	148
Role Model Attainability	5.18 (1.47)	146
SAT-M	601.88 (84.83)	139
Communal Goal Endorsement	5.88 (.92)	148
STEM Interest	1.87 (.89)	148
Non-STEM Interest	2.33 (.84)	148
STEM Belonging	1.75 (.87)	148
Non-STEM Belonging	2.40 (.87)	148
STEM Communal Goal Affordance	2.46 (1.29)	147
Non-STEM Communal Goal Affordance	3.36 (1.19)	147

Table 2. Hierarchical linear regression predicting interest in STEM fields in Study 1.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**B**	**B**
Math SAT score	**.098**	**.109**	**.116**	**.114**
Perceived attainability of role model success	**.101**	**.095**	**.085**	**.084**
Role model gender	**-**	**-.043**	**-.124**	**-.117**
Role model communality	**-**	**-.091**	**-.126**	**-.119**
Communal goal endorsement	**-**	**.146^{+}**	**.167**	**.179**
Gender x Communality	**-**	**-**	**.115**	**.098**
Gender x Communal Goal Endorsement	**-**	**-**	**.042**	**.023**
Communality x Communal Goal Endorsement	**-**	**-**	**-.077**	**-.095**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**.031**
Model R^2	**.022**	**.050**	**.057**	**.057**

$^{+}$ p<.10
*** p <.05**
**** p<.01**

Table 3. Hierarchical linear regression predicting interest in non-STEM fields in Study 1.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**-.222****	**-.208***	**-.196***	**-.205***
Perceived attainability of role model success	**.058**	**.059**	**.089**	**.086**
Role model gender	**-**	**.156^{+}**	**.189**	**.220**
Role model communality	**-**	**.053**	**-.074**	**-.042**
Communal goal endorsement	**-**	**.026**	**.094**	**.146**
Gender x Communality	**-**	**-**	**.133**	**.058**
Gender x Communal Goal Endorsement	**-**	**-**	**-.253***	**-.339^{+}**
Communality x Communal Goal Endorsement	**-**	**-**	**.130**	**.045**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**.144**
Model R^2	**.050***	**.080^{+}**	**.119***	**.122***

$^{+}$ p<.10
*** p <.05**
**** p<.01**

Table 4. Hierarchical linear regression predicting perceived belonging in STEM fields in Study 1.

Predictor	Step 1	Step 2	Step 3	Step 4
	β	β	β	β
Math SAT score	.153^{+}	.169*	.180*	.179*
Perceived attainability of role model success	.126	.117	.098	.098
Role model gender	-	-.050	-.171	-.167
Role model communality	-	-.089	-.129	-.125
Communal goal endorsement	-	.210*	.253^{+}	.261
Gender x Communality	-	-	.167	.156
Gender x Communal Goal Endorsement	-	-	.068	.055
Communality x Communal Goal Endorsement	-	-	-.136	-.149
Gender x Communality x Communal Goal Endorsement	-	-	-	.022
Model R^2	.043^{+}	.093*	.111^{+}	.111^{+}

$^{+}$ p<.10
* p <.05
** p<.01

Table 5. Hierarchical linear regression predicting perceived communal goal affordance of STEM fields in Study 1.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**.037**	**.055**	**.061**	**.078**
Perceived attainability of role model success	**.002**	**.001**	**.029**	**.039**
Role model gender	**-**	**.081**	**.055**	**-.031**
Role model communality	**-**	**-.003**	**-.136**	**-.224**
Communal goal endorsement	**-**	**.110**	**.051**	**-.102**
Gender x Communality	**-**	**-**	**.107**	**.287**
Gender x Communal Goal Endorsement	**-**	**-**	**-.086**	**.135**
Communality x Communal Goal Endorsement	**-**	**-**	**.172**	**.393^{+}**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**-.338**
Model R^2	**.001**	**.021**	**.040**	**.059**

$^{+}$ $p<.10$
*** $p<.05$**
**** $p<.01$**

Table 6. Descriptives for Study 2.

Measure	**Mean (SD)**	**N**
Role Model Masculinity	3.84 (1.76)	91
Role Model Femininity	2.99 (1.69)	91
Role Model Success Rating	6.33 (.66)	91
Role Model Communality & Likability	4.95 (.98)	91
Role Model Attainability	5.49 (1.37)	91
SAT-M	607.47 (87.08)	83
Communal Goal Endorsement	5.93 (.89)	91
STEM Interest	2.13 (.95)	91
Non-STEM Interest	2.53 (.88)	91
STEM Belonging	2.13 (1.02)	91
Non-STEM Belonging	2.71 (1.06)	91
STEM Communal Goal Affordance	3.47 (1.41)	91
Non-STEM Communal Goal Affordance	3.86 (1.07)	91
Time on Math Assessment	14.95 (3.61)	91
Number of Math Items Attempted	9.64 (.86)	91
Math Score	4.20 (2.06)	91

Table 7. Hierarchical linear regression predicting math performance in Study 2.

Predictor	Step 1	Step 2	Step 3	Step 4
	β	β	β	β
Math SAT score	**.608*** **	**.612*** **	**.609*** **	**.610*** **
Perceived attainability of role model success	**.057**	**.061**	**.065**	**.067**
Role model gender	-	**.007**	**-.010**	**-.010**
Role model communality	-	**.073**	**.062**	**.059**
Communal goal endorsement	-	**-.055**	**.002**	**.016**
Gender x Communality	-	-	**.021**	**.018**
Gender x Communal Goal Endorsement	-	-	**.100**	**.077**
Communality x Communal Goal Endorsement	-	-	**-.172**	**-.192**
Gender x Communality x Communal Goal Endorsement	-	-	-	**.035**
Model R^2	**.379*** **	**.387*** **	**.409*** **	**.409*** **

$^+$ p<.10
* p <.05
** p<.01
*** p<.001

Table 8. Hierarchical linear regression predicting time spent on the math assessment in Study 2.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**.096**	**.101**	**.107**	**.110**
Perceived attainability of role model success	**-.091**	**-.116**	**-.093**	**-.082**
Role model gender	**-**	**.061**	**-.076**	**-.076**
Role model communality	**-**	**$.184^{+}$**	**.037**	**.020**
Communal goal endorsement	**-**	**.155**	**.246**	**$.322^{+}$**
Gender x Communality	**-**	**-**	**.252**	**.238**
Gender x Communal Goal Endorsement	**-**	**-**	**-.077**	**-.211**
Communality x Communal Goal Endorsement	**-**	**-**	**-.072**	**-.188**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**.204**
Model R^2	**.016**	**.084**	**.107**	**.121**

$^{+}$ p<.10
*** p <.05**
**** p<.01**

Table 9. Hierarchical linear regression predicting STEM interest in Study 2.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**.163**	**.091**	**.088**	**.089**
Perceived attainability of role model success	**.237***	**.215***	**.221***	**.224***
Role model gender	**-**	**-.210^{+}**	**-.186**	**-.186**
Role model communality	**-**	**.065**	**.087**	**.083**
Communal goal endorsement	**-**	**.210^{+}**	**.337***	**.355^{+}**
Gender x Communality	**-**	**-**	**-.032**	**-.036**
Gender x Communal Goal Endorsement	**-**	**-**	**-.082**	**-.114**
Communality x Communal Goal Endorsement	**-**	**-**	**-.119**	**-.146**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**.047**
Model R^2	**.090***	**.161***	**.175^{+}**	**.175^{+}**

$^{+}$ p<.10
*** p <.05**
**** p<.01**

10. Hierarchical linear regression predicting STEM belonging in Study 2.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**.152**	**.068**	**.065**	**.066**
Perceived attainability of role model success	**.278***	**.260***	**.272***	**.274***
Role model gender	**-**	**-.256***	**-.251**	**-.251**
Role model communality	**-**	**.068**	**.069**	**.067**
Communal goal endorsement	**-**	**.189^{+}**	**.377***	**.388***
Gender x Communality	**-**	**-**	**.004**	**.001**
Gender x Communal Goal Endorsement	**-**	**-**	**-.088**	**-.108**
Communality x Communal Goal Endorsement	**-**	**-**	**-.206**	**-.223**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**-.030**
Model R^2	**.108***	**.190****	**.218***	**.218***

$^{+}$ p<.10
*** p <.05**
**** p<.01**

Table 11. Hierarchical linear regression predicting perceived communal goal affordance of STEM in Study 2.

Predictor	**Step 1**	**Step 2**	**Step 3**	**Step 4**
	β	**β**	**β**	**β**
Math SAT score	**.178**	**.133**	**.133**	**.135**
Perceived attainability of role model success	**.161**	**.145**	**.163**	**.170**
Role model gender	**-**	**-.126**	**-.200**	**-.200**
Role model communality	**-**	**.000**	**-.077**	**-.087**
Communal goal endorsement	**-**	**.160**	**.307^{+}**	**.352^{+}**
Gender x Communality	**-**	**-**	**.136**	**.127**
Gender x Communal Goal Endorsement	**-**	**-**	**-.020**	**-.097**
Communality x Communal Goal Endorsement	**-**	**-**	**-.205**	**-.272**
Gender x Communality x Communal Goal Endorsement	**-**	**-**	**-**	**.117**
Model R^2	**.063^{+}**	**.095**	**.119**	**.124**

$^{+}$ $p<.10$
*** $p<.05$**
**** $p<.01$**

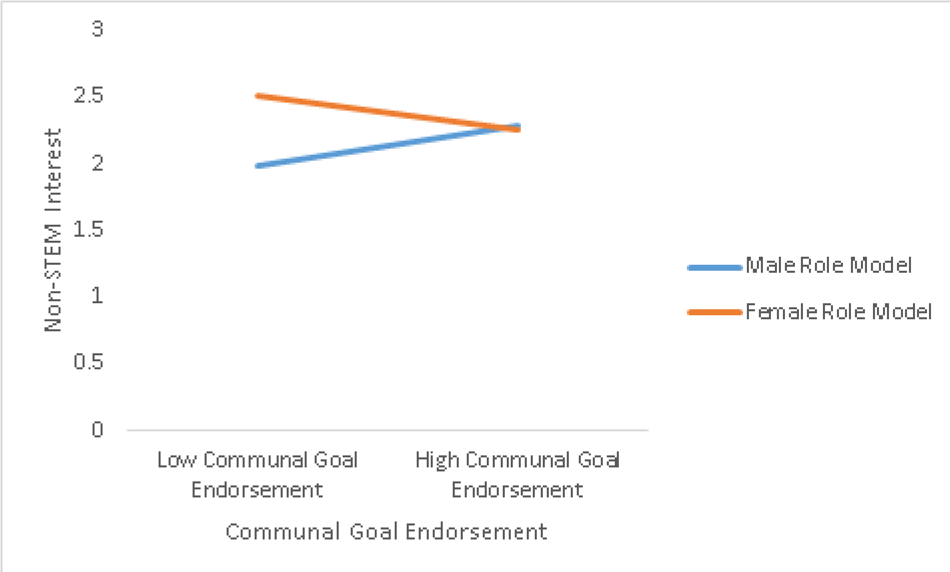

Figure 1. Non-STEM interest regressed onto communal goal endorsement and role model gender, controlling for math SAT score, perceived attainability of role model success, role model communality, the interaction between role model gender and communality, and the interaction between role model communality and communal goal endorsement in Study 1. Low communal goal endorsement is on standard deviation below the mean, and high communal goal endorsement is one standard deviation above the mean.

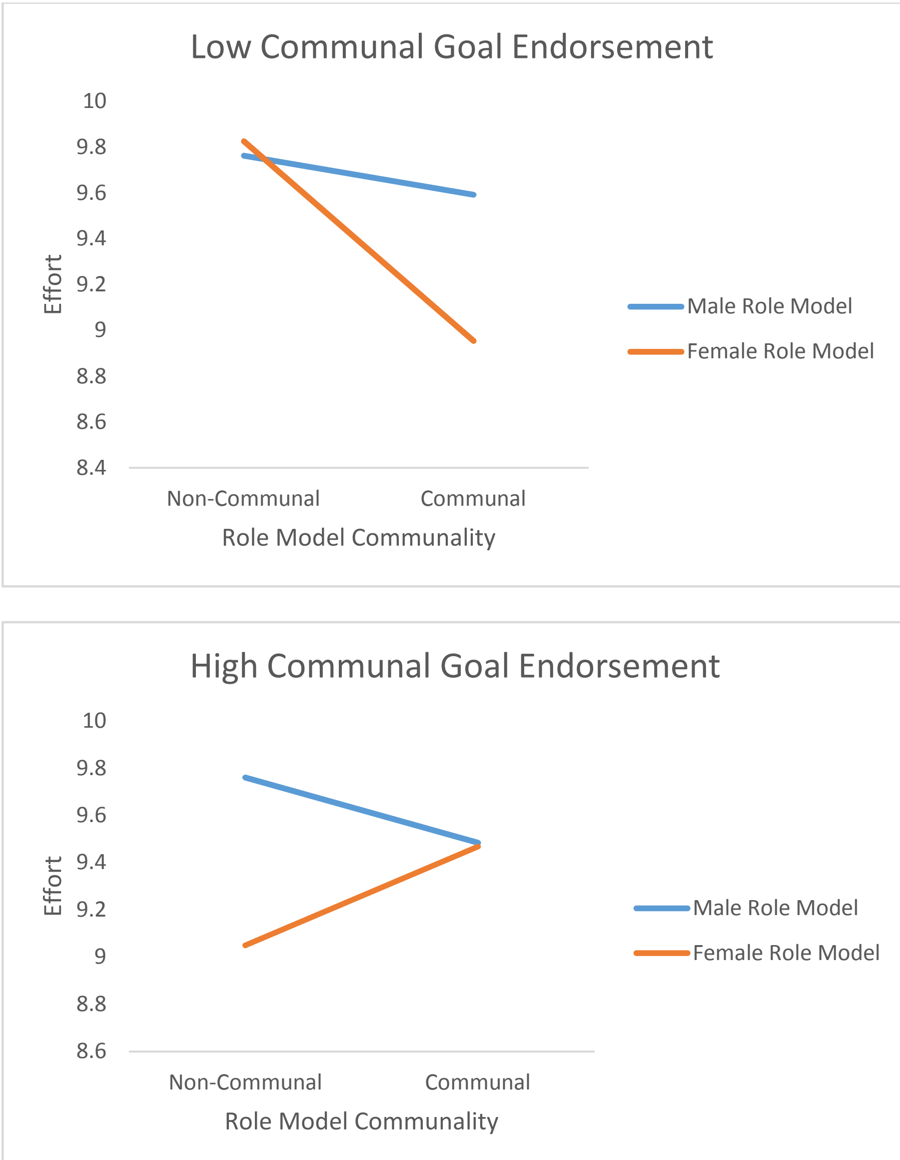

Figure 2. Effort regressed onto communal goal endorsement and role model gender, controlling for math SAT score, perceived attainability of role model success, role model communality, the interaction between role model gender and communality, and the interaction between role model communality and communal goal endorsement in Study 2. Low communal goal endorsement is on standard deviation below the mean, and high communal goal endorsement is one standard deviation above the mean.