

## **An Evidence-Based Approach to Technology Workforce Expansion by Increasing Female Participation in STEM Entrepreneurship**

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**The Effect of Relatable Role Models on Increasing Female  
Participation in STEM Entrepreneurship**

## Introduction

Entrepreneurship among STEM students is an important phenomenon: Companies formed by students in STEM programs include large U.S. employers such as Microsoft, Facebook, and Google. Unfortunately, women are less likely than men to participate in potential upward mobility driven by entrepreneurship. For example, only 1 in 6 employees in Silicon Valley startup companies are women (Financial Times 2017). In this study, we develop a field experiment designed to increase entrepreneurial proclivity in undergraduate women studying STEM fields. Entrepreneurial proclivity is defined as the extent of an individual's (1) intentions to engage in entrepreneurship, (2) efforts to acquire knowledge about entrepreneurship, and (3) entrepreneurial actions.

There is a general agreement in the literature that women are less likely than men to be involved in entrepreneurship [1], [2]. In 2016, women were majority owners for 38% of firms, and this ownership was concentrated primarily in non-STEM retail and service industries [3], [4]. In STEM fields, women face professional barriers in pursuing careers [5]–[7]. When it comes to entrepreneurship in STEM, Roach et al. [8] estimate that male Ph.D. students in STEM fields are four times more likely than female students to have intentions to enter the workforce as company founders.

Low female participation rates in STEM-based entrepreneurship pose several problems: First, to the extent that individuals form companies that solve problems they face or that are based on their own experiences, the existing population of STEM-based firms is less likely to meet the needs of women [9], [10]. For example, in an analysis of patent data, Koning et al. [11] found female inventors were more likely to create inventions that address female diseases and conditions than male inventors. Second, in addition to this potential gendered innovation gap, a failure to fully integrate half of the workforce into STEM entrepreneurship likely leads to lower levels of innovation and entrepreneurship in general. These effects thereby negatively impact the national competitiveness of the United States [12]. Third, research indicates that entrepreneurship is a significant driver of wealth within the U.S. economy [13]. Thus, finding ways to encourage women to pursue STEM careers generally, and entrepreneurial careers specifically, can lead to wealth creation and upward mobility for women.

The literature offers some explanations for differences in the proclivity of men and women towards entrepreneurship. A number of researchers have focused on broad, general factors. For example, even though research finds the effectiveness of male and female leaders comparable [14], stereotypes about leaders and men overlap with authority, power, and risk-taking [15], [16]. In contrast, stereotypes about women include being relational, supportive, and collaborative [17]–[20]. Scholars note that women tend to be less richly rewarded than men in an economic system where success conforms to male but not female social expectations [21], [22]. Further, there appear to be greater challenges for women to become entrepreneurs due to the structure of the socio-economic entrepreneurial ecosystem [7], [23]–[26]. In a network of entrepreneurship clubs, Abraham [27] found that women were less likely to receive third-party referrals to help grow their businesses than men, particularly in male-dominated fields. Fortunately, there is evidence that college experiences can positively influence women to choose STEM careers [28], [29]. For example, though not causally linked in the study design, Carrell et

al. [30] found that female students in math and science courses taught by female professors performed better than those taught by men. Despite an emerging literature that connects college education and entrepreneurship [31], we have little knowledge of the drivers of entrepreneurship amongst female students in STEM and how one might attenuate the gender imbalance.

Most incoming students likely have had limited direct experience with entrepreneurship and, hence, might not understand what entrepreneurship entails nor view it as an exciting career option. In such circumstances, allowing students to vicariously experience what it means to be an entrepreneur may fuel their interest in entrepreneurship. Such vicarious experiences can be provided to female students by introducing them to role models who describe what STEM entrepreneurship is and why they enjoy it. Exposure to relatable role models may make female students feel that they, too, can engage in entrepreneurship. Thus, we expect that Female STEM students will demonstrate higher entrepreneurial proclivity when they are exposed to relatable role models in entrepreneurship than when they are exposed to unrelatable ones.

Aiming at achieving greater gender parity in entrepreneurial career choices for women studying STEM, we conducted a large-scale field experiment in which students are exposed to relatable role models sharing their experiences as entrepreneurs in short videos. The field experiment involved over 1,400 incoming first-year students at a large Carnegie R1 university from June to July 2022 who participated in student orientation. Male and female students were randomly assigned to one of two experimental conditions: the relatable role model condition or the unrelatable role model condition. In the relatable role model condition, role models in the videos were young, recent alumnae from the same university. They talked about their journey to entrepreneurship. In the unrelatable role model condition, students watched a video similar to the one described above, but the individuals who appeared in the video were older and dressed in formal or somewhat outdated clothing. After watching the assigned video, participants completed a survey. The research plan and analysis were preregistered and are available at the Center for Open Science registration platform ([osf.io](https://osf.io)). Preliminary analysis indicates that exposure to the relatable role model video increased the entrepreneurial intention of both female and male students, and the entrepreneurial identity aspiration was the underlying process driving the effect.

This research makes several important contributions. First, we develop and test a theory that advances our understanding of factors that influence the gender gap in STEM entrepreneurship. Second, this work will also advance our scientific understanding of student entrepreneurship, an important yet under-researched topic. Third, the interventions developed in this study also have practical implications, as they appear to provide a cost-efficient means to increase interest in STEM entrepreneurship within undergraduate populations in at least one major University in the United States.

## **Hypothesis development**

Prior work in psychology posits that the way both traits and psychological states affect action depends on context, and, importantly, that psychological states are malleable [33]. This view is reflected in entrepreneurship research as well in the study of factors that influence individuals' interest in pursuing entrepreneurship [34], [35].

We focus on entrepreneurial self-concept as an umbrella term that encompasses three closely related, malleable psychological states that can increase entrepreneurial proclivity: (a) Intrinsic entrepreneurial motivation, (b) Entrepreneurial self-efficacy, and (c) Entrepreneurial identity aspiration. Intrinsic entrepreneurial motivation refers to the degree to which individuals see themselves enjoying being an entrepreneur e.g., [36], [37]. Individuals with higher intrinsic entrepreneurial motivation feel excited not merely by the external economic benefits of being an entrepreneur, but also by the possibility that they will derive personal satisfaction from entrepreneurship [38]. Entrepreneurial self-efficacy refers to the confidence and self-assurance of an individual in being an entrepreneur [39], [40]. Those with high entrepreneurial self-efficacy feel personally capable of performing the roles and tasks of an entrepreneur e.g., [41]. Entrepreneurial identity aspiration represents a person's desire for a "possible but unrealized future entrepreneur self" [42, p. 246]. When entrepreneurial identity aspiration is higher, individuals begin to personally define themselves using terms that characterize an entrepreneur (e.g., innovator, idea person) and seek to be referred to as entrepreneurs [43].

These three psychological states together represent the entrepreneurial self-concept. Entrepreneurial self-concept should motivate individuals to engage in goal-directed behaviors that put them on a path to being entrepreneurs; hence, entrepreneurial self-concept should lead to entrepreneurial proclivity, including entrepreneurial intentions, entrepreneurial knowledge acquisition, and entrepreneurial action. Importantly, these psychological states are malleable [38], e.g. [41], [44] and therefore likely to be impacted by carefully designed interventions.

### *Relatable role models*

We propose that exposure to appropriate role models can help instill entrepreneurial self-concept in female students. Most students likely have had limited direct experience with entrepreneurial activity and, hence, might not understand what it entails or view it as an exciting career option. In such circumstances, to fuel their interest in entrepreneurship (i.e., enhance entrepreneurial self-concept), it is likely important to allow students to vicariously experience what it means to be an entrepreneur [45]. Such vicarious experiences can be provided to female students by introducing them to role models who describe the what and how of STEM entrepreneurship, as well as why they enjoy it. This exposure can make female students feel that they, too, can engage in entrepreneurial behaviors, especially when the role models seem relevant and relatable to them [41]. A relatable role model is one that is similar in many dimensions to the target audience. Dimensions of relatability include gender [46], [47], age [48]–[50], shared experiences (e.g., enrollment at the same university), and values.

In that context, it is important for female students to see successful female STEM entrepreneurs for both symbolic as well as functional reasons [46], [51]. Symbolically, exposure to female STEM entrepreneurs can signal to female students that STEM entrepreneurship is not only for men and that women can be successful in entrepreneurship. Functionally, female students are likely to pay greater attention to female STEM entrepreneurs and take an interest in hearing about the challenges they have faced and how they have integrated the seemingly conflicting social roles of being an entrepreneur and a woman. Consequently, we propose that female students who are part of an intervention where they observe female STEM entrepreneurs

would develop a greater entrepreneurial self-concept and thereby demonstrate greater entrepreneurial proclivity.

Additionally, it is important for female students to observe role models who are closer to their age and peer group. Research suggests that junior women often do not identify with or assimilate the behaviors of female role models who are much more senior to them as they are seen to be distant from themselves instead of being inspirational [48]. Further, there is evidence that senior role models can demoralize rather than inspire junior women as agency demonstrated by such senior women role models is seen as unattainable [49], [50], [52]–[54]. Hence, an intervention in which female students are exposed to role models who are STEM entrepreneurs who are close to the peer group of the female students is likely more effective in comparison to a group involving entrepreneur role models who are not in the peer group. This intervention should increase the entrepreneurial self-concept of female students and, thereby, enhance their entrepreneurial proclivity.

*Hypothesis: Female STEM students demonstrate higher entrepreneurial proclivity when they are exposed to relatable role models in entrepreneurship than when they are exposed to unrelatable ones; these effects are due to increases in their entrepreneurial self-concept.*

## **Method**

### *Analytic strategy*

We first performed a preliminary analysis, in which we attempted to capture the effect of the intervention on all students, including male and female students. We first conducted a one-way ANOVA to assess if our manipulation was effective and if the relatability differed among the two conditions. One-way ANOVA was also used to see if the three entrepreneurial self-concepts (entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration) were different between conditions. Second, following the preregistration, we conducted an OLS regression with robust standard errors. The independent variable (*relatable condition*) is set to 1 if they watched the relatable video and 0 if participants watched the unrelatable video. Lastly, we conducted an additional exploratory analysis, which was not preregistered. We coded each of the three entrepreneurial intention items into a 3-point response scale (0 = No, 1 = Don't know, 2 = Yes) and then averaged them to calculate the entrepreneurial intention. We also ran a path analysis to examine whether intrinsic entrepreneurial motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration were underlying processes driving the condition effect. Then, we conducted the same analysis using only female students who indicated an academic interest in STEM in their university application to test our hypothesis.

## Preliminary analysis

### *Data*

The field experiment involved incoming freshman students at a large Carnegie R1 university from June to July 2022 who participated in freshman orientation. All incoming freshman students are required to complete one of the 28 available sessions before enrolling in classes, of which participants in 8 sessions were part of the experiment. Each session was assigned to one of two conditions. In one of the eight sessions, a technical issue—a storm that disrupted the transmission of electricity to our site—prevented the video from being presented. Hence, participants (N= 260) in that particular session were excluded from the analysis, leaving 1,422 total participants, of which 608 were in the relatable role model condition and 814 were in the unrelatable role model condition.

Students in the relatable role model condition viewed a short video on entrepreneurship in STEM. Role models were young, recent alumnae or upper-level students currently enrolled at the same university and talked about their journey to entrepreneurship. All individuals shown in the videos were actual entrepreneurs. Half of the entrepreneurs interviewed were female, while the other half were male. In the unrelatable role model condition, students watched a video similar to the one described above, but the individuals who appeared in the video were older and dressed in formal or somewhat outdated clothing. They talked about their current feelings and attitudes after several decades of experience as an entrepreneur. After watching the assigned video, participants completed a survey including entrepreneurial self-concept and proclivity scale. We preregistered our theory, hypotheses, and testing approach at the Center for Open Science registration platform ([osf.io](https://osf.io)).

Of 1,422 students who received the survey email, 454 completed the survey. Table 1 shows the number of participants and completion rate in each video condition. A Chi-Square test was conducted to determine if the survey completion rate differed between the video conditions. We did observe a statistically significant difference between conditions,  $\chi^2(2, 2,988) = 12.05, p = 0.002$ .

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Insert Table 1 about here  
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Following our preregistered protocol, 52 of the 454 participants who failed any one of three attention check items were excluded from the analysis. The analysis was performed on 402 remaining participants, each in one of two conditions: the relatable role model condition (N = 200) and the unrelatable role model condition (N= 202).

### *Measures*

#### *Entrepreneurial intention*

Three items were used to assess the entrepreneurial intention of respondents, measured on a 3-point scale variable (Yes, No, I don't know): “ Do you plan to start a company within 24

months?” “Do you want to start a company at some point in your career?” and “Do you want to join a team that is starting a company?” Following the preregistration, the entrepreneurial intention variable is set to 1 if a participant answered “yes” to any one of three items; otherwise 0. This variable is shown as Entrepreneurial Intention (Preregistered) in Table 2.

In the exploratory analysis, we recoded each of the three entrepreneurial intention items into a 3-point response scale (0 = No, 1 = Don’t know, 2 = Yes) and then averaged them to calculate the entrepreneurial intention. This variable is shown as Entrepreneurial Intention (Exploratory) in Table 2.

### *Relatability*

Three items were used to assess the relatability measure on a 5-point scale (1 = strongly disagree; 5 = strongly agree). Participants were asked to indicate the extent they agree with the following three statements: “I felt that the individuals in the video were relatable,” “The people in the video were similar to me,” and “I felt a personal connection with the entrepreneurs in the video.” The items were averaged to get the relatability variable.

### *Entrepreneurial intrinsic motivation*

Participants were asked to indicate the extent they agree with the following five statements on a 5-point scale (1 = strongly disagree; 5 = strongly agree). “I would find it interesting to be an entrepreneur,” “I would enjoy doing activities that an entrepreneur does,” “Being an entrepreneur would be fun,” “I would find it exciting to start a new company and run it,” and “I would feel good doing things an entrepreneur does.” We averaged out the five items to capture the entrepreneurial intrinsic motivation variable.

### *Entrepreneurial self-efficacy*

We captured entrepreneurial self-efficacy by asking four items on a 5-point scale (1= not confident at all; 5=completely confident): “how confident are you in your ability to engage in the following activities related to being an entrepreneur or an individual who starts a company, either alone or with others? 1) successfully identify new business opportunities, 2) create new products, 3) think creatively, and 4) start a business with a new idea. The items were averaged to calculate the entrepreneurial self-efficacy variable.

### *Entrepreneurial identity aspirations*

We asked six items to assess the entrepreneurial identity aspirations measure on a 5-point scale (1 = strongly disagree; 5 = strongly agree): “I think I can become an entrepreneur,” “I can see myself as an entrepreneur,” “Becoming an entrepreneur can be an important part of who I am,” “When I think about it, the term “entrepreneur” would fit me pretty well,” “I think about becoming an entrepreneur,” and “I would feel proud to be an entrepreneur.” We averaged out the six items to measure the entrepreneurial Identity aspirations variable. Table 2 shows the descriptive statistics, Cronbach’s alphas, and correlations for variables.



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Insert Table 2 about here  
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## Results

Table 3 shows the means of reliability, entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, entrepreneurial identity aspiration, and entrepreneurial intention (preregistered & exploratory) and the t-test result of comparing reliable and unreliable role model conditions. We first examine the validity of our manipulation by examining if reliability differed between groups. In an independent t-test on participants assigned to two conditions: reliable (N = 200, M = 3.33) and unreliable role model conditions (N = 202, M = 3.22), we fail to reject the null hypothesis that participants' perceived reliability of the videos in reliable and unreliable role model conditions are not significantly different,  $t(400) = -1.44$ ,  $p = 0.150$ . Hence we infer that the videos used in this analysis did not differ in reliability from the viewers' perspective.

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In compliance with our preregistered protocol, we conducted an OLS regression with robust standard errors to test the effect of exposure to the reliable role model condition. The independent variable (*reliable condition*) is set to 1 if participants are in the reliable role model condition and 0 if participants are in the unreliable role model condition. For the dependent variable, the *entrepreneurial intention* is set to 1 if a participant answered “yes” to any one of three items; otherwise, 0.

First, we tested if the participants in the reliable role model condition were more likely to exhibit entrepreneurial intentions than those in the unreliable role model condition. As shown in Table 4 Model 4, we found that entrepreneurial intention was marginally higher in the reliable role model condition compared to the unreliable role model condition ( $b = 0.077$ ,  $p = 0.085$ ). Then, we tested if the participants in the reliable role model condition had higher entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration than the unreliable role model condition. Table 4 Models 2 and 3 indicate that participants in the reliable role model condition exhibited higher entrepreneurial self-efficacy ( $b = 0.20$ ,  $p = 0.016$ ) and entrepreneurial identity aspiration ( $b = 0.201$ ,  $p = 0.028$ ) than participants in the unreliable role model condition. However, those in the reliable role model condition did not significantly differ from those in the unreliable role model condition in entrepreneurial intrinsic motivation (Table 2, Model 1). Next, we regressed entrepreneurial intention on entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration while controlling for the experimental condition. Table 4 Model 6 shows that entrepreneurial intrinsic motivation ( $b = 0.061$ ,  $p = 0.014$ ) and entrepreneurial identity aspiration ( $b = 0.217$ ,  $p < 0.001$ ) were positively related to entrepreneurial intention.

Based on the evidence, we conclude that our intervention led to the statistically significant difference in entrepreneurial intention between the reliable and unreliable role model conditions, and the entrepreneurial identity aspiration was the underlying process driving

the difference in entrepreneurial intention between the relatable and unrelatable role model conditions. However, as our miniplate check failed to detect a difference in relatability between the two videos, the observed relationships are unlikely to be driven by differences in relatability.

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Insert Table 4 about here  
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We conducted an additional exploratory analysis that was not preregistered to further examine the potential impact of the video interventions. We coded each of the three entrepreneurial intention items into a 3-point response scale (0 = No, 1 = Don't know, 2 = Yes) and then averaged them to calculate the entrepreneurial intention (exploratory) because these 3-point response scales could also be perceived as a continuous scale. Then, we ran a path analysis to examine the effect of our intervention.

First, we tested the direct effect of the experimental conditions on entrepreneurial intention. We found that entrepreneurial intention was marginally higher in the relatable role model condition than in the unrelatable role model condition ( $b = 0.10, p = 0.058$ ). Next, we ran a path analysis to examine whether intrinsic entrepreneurial motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration were underlying processes driving the conditional effect. Following (Preacher and Hayes 2004)'s recommendations, we tested our model using non-parametric percentile bootstrapping to create confidence intervals for each effect with the lavaan package (Rosseel 2012).

As shown in Figure 1, the result revealed that entrepreneurial identity aspiration was driving the observed conditional effect of the video intervention on entrepreneurial intention. Consistent with the results from OLS regression, participants in the relatable role model condition have higher entrepreneurial identity aspirations than those in the unrelatable role model condition with a point estimate of 0.11 and the 95% confidence interval of (0.01, 0.21). The estimate is reasonably precise and suggests a positive average effect. At the same time, entrepreneurial identity aspiration was positively associated with entrepreneurial intention. We measure a point estimate of 0.63, and the 95% confidence interval is (0.55, 0.71). The estimate is reasonably precise and suggests a positive average effect.

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Insert Figure 1 about here  
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Because entrepreneurial intrinsic motivation, self-efficacy, and identity aspiration are highly correlated (Table 5), we ran three additional separate mediation models to disentangle the effects of three mediators. Consistent with the result of the path analysis, Figure 4 shows that the indirect effect of the relatable role model condition on entrepreneurial intention through entrepreneurial identity aspiration was significant,  $b = 0.07, 95\% CI = (0.01, 0.14)$ . The result indicates that 70% of the effect of the relatable role model condition was mediated through entrepreneurial identity aspiration. Interestingly, Figure 3 illustrates the mediating effect of entrepreneurial self-efficacy, which was not apparent in the other analysis. It was observed that

the indirect effect of the relatable role model condition on entrepreneurial intention through entrepreneurial self-efficacy was significant,  $b = 0.04$ , 95% CI = (0.01, 0.08), mediating 40% of the effect of the relatable role model condition on entrepreneurial intention.

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## Hypothesis testing

Next, to test our hypothesis in which we proposed that female STEM students demonstrate higher entrepreneurial proclivity when they are exposed to relatable role models in entrepreneurship than when they are exposed to unrelatable ones, we excluded students who did not choose preferred pronouns as she/her and did not choose an academic plan as STEM fields in their university application. Conceptually, female students with an interest in STEM were randomly assigned to one of two experimental conditions shown on the first day of the two-day orientation program, either the relatable role model condition ( $N = 189$ ) or the unrelatable role model condition ( $N = 248$ ). In one of the sessions (session 616), the video was not shown due to a technical issue. Hence, the participants in that particular session were dropped ( $N = 20$ ), and the remaining participants were 417.

Out of 417 students who received the survey email, 156 students completed the survey. Table 6 shows the number of participants and completion rate in each condition. A Chi-Square test was conducted to determine if the survey completion rate differed between the conditions. We did observe a marginal difference between the two conditions,  $\chi^2(2, 153) = 5.37, p = 0.07$ .

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Insert Table 5 about here  
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Following the preregistration, among 156 participants, 20 participants who failed any one of three attention check items were excluded from the analysis. As a result, there are 136 participants in all, each in one of two conditions: the relatable role model condition ( $N = 59$ ) and the unrelatable role model condition ( $N = 77$ ). Table 7 shows the descriptive statistics, Cronbach's alphas, and correlations for variables.

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Insert Table 6 about here  
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## Results

Table 8 shows the means of relatability, entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, entrepreneurial identity aspiration, and entrepreneurial intention (preregistered & exploratory) and the t-test result of comparing relatable and unrelatable role model conditions. We first examine the validity of our manipulation by examining if relatability differed between groups. In an independent t-test on participants assigned to two conditions:

reliable (N = 59, M = 3.36) and unreliable role model conditions (N = 77, M = 3.07), we observed that the participants' reliability in reliable and unreliable role model conditions are significantly different,  $t(134) = -2.11, p = 0.04$ , indicating that our manipulation was successful on female students with interest in STEM.

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Insert Table 7 about here  
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Then, we tested if the participants in the reliable role model condition were more likely to exhibit entrepreneurial intention than those in the unreliable role model condition. We found that entrepreneurial intention was not higher in the reliable role model condition compared to the unreliable role model condition ( $b = 0.099, p = 0.12$ ). Next, we tested if the participants in the reliable role model condition had higher entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration than the unreliable role model condition. We found that those in the reliable role model condition did not significantly differ from those in the unreliable role model condition on the entrepreneurial intrinsic motivation ( $b = -0.084, p = 0.57$ ), entrepreneurial self-efficacy ( $b = 0.197, p = 0.13$ ), and entrepreneurial identity aspiration ( $b = 0.081, p = 0.60$ ). Lastly, we regressed entrepreneurial intention on entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration while controlling for the experimental condition. We found that entrepreneurial intrinsic motivation ( $b = 0.047, p = 0.09$ ) and entrepreneurial identity aspiration ( $b = 0.201, p < 0.001$ ) were positively related to entrepreneurial intention. Based on the evidence, we did not have sufficient evidence to support that exposure to the reliable role model condition increases entrepreneurial intention among female students in STEM through three entrepreneurial self-concepts (entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration).

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Similarly, we conducted an additional exploratory analysis that was not preregistered, in which we coded each of the three entrepreneurial intention items into a 3-point response scale (0 = No, 1 = Don't know, 2 = Yes) and ran a path analysis to examine the effect of our intervention.

First, we tested the total effect of experimental conditions on entrepreneurial intention. We found that entrepreneurial intention (exploratory) was not significantly higher in the reliable role model condition than in the unreliable role model condition ( $b = 0.06, p = 0.47$ ). Next, we ran a path analysis to examine whether intrinsic entrepreneurial motivation, entrepreneurial self-efficacy, and entrepreneurial identity aspiration were underlying processes driving the condition effect. However, did not have sufficient evidence to support our hypothesis.

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Insert Figure 5 about here  
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Lastly, because entrepreneurial intrinsic motivation, self-efficacy, and identity aspiration are highly correlated (Table 7), we ran three separate mediation models to disentangle the effects of three mediators. However, all three mediator effects were insignificant.

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Insert Figures 6, 7, and 8 about here  
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## **Discussion**

In this study, we conducted a large-scale field experiment to achieve greater gender parity in entrepreneurial career options for women studying STEM. We hypothesize that female students who observe relatable female STEM entrepreneurs will develop a stronger entrepreneurial self-concept and, as a result, will develop a stronger entrepreneurial intention. According to the analysis, students who were in the relatable role model condition showed greater entrepreneurial intention in both male and female students. We also found that the underlying process driving the condition effect was entrepreneurial identity aspiration and entrepreneurial self-efficacy. When we ran the same analysis with students who chose she/her as their pronouns and have an interest in STEM, we found that participants in the relatable role model condition found that video to be more relatable than those in the unrelatable role model condition. However, we did not observe a statistically significant difference in entrepreneurial intention between the two conditions.

We aim to improve the intervention based on the results and plan to conduct field experiments this year. First, our biggest goal for this year is to increase the survey response rate. We plan to communicate in advance with individuals who speak directly to the incoming freshman students at the freshman orientation to inform them about the purpose of the experiment. At the orientation, group leaders who are undergraduate students ask participants to participate in the survey right after watching the video. We believe communicating with the group leaders in advance would be an effective means to increase the response rate. Second, we plan to improve relatability items by acquiring an in-depth understanding of the meaning of relatability to entrepreneurs. This process would require us to conduct pilot tests on the videos and talk to students directly.

This preliminary report of an ongoing research study makes a contribution to the existing scientific literature by developing and testing theory to advance our understanding of the gender gap in STEM entrepreneurship. In addition, the interventions have the potential to enhance practice by offering a low-cost and efficient method of increasing diversity in STEM entrepreneurship among undergraduate populations in universities.

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## TABLE AND FIGURES

Table 1. Number of participants and completion rate in each video condition

Condition	Survey not completed	Survey completed	Total	Completion rate
Relatable	608	223	831	26.84%
Unrelatable	814	231	1,045	22.11%
Total	1,422	454	1,876	24.20%

Table 2. Descriptive statistics, Cronbach's alpha, and correlations of the variables

Variable	Obs	Mean	SD	Alpha	1	2	3	4	5	6	7
1 Entrepreneurial intention (Preregistered)	402	0.28	0.45	NA	1						
2 Entrepreneurial intention (Exploratory)	402	0.67	0.51	0.73	0.76*	1					
3 Relatability	402	3.28	0.77	0.75	0.23*	0.20*	1				
4 Entrepreneurial intrinsic motivation	402	3.68	0.92	0.92	0.45*	0.53*	0.40*	1			
5 Entrepreneurial self-efficacy	402	3.05	0.82	0.79	0.33*	0.35*	0.33*	0.43*	1		
6 Entrepreneurial identity aspiration	402	3.17	0.91	0.89	0.54*	0.66*	0.43*	0.72*	0.59*	1	
7 Relatable condition	402	0.5	0.5	NA	0.09*	0.09*	0.07*	0.02	0.12*	0.11*	1

Note: \* represents  $p < .05$

Table 3. Mean of relatability, entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, entrepreneurial identity aspiration, and entrepreneurial intention and t-test result of comparing relatable and unrelatable role model conditions.

Variables	Relatable role model condition (N = 200)	Unrelatable role model condition (N = 202)	t-test result
Relatability	3.33 (0.77)	3.22 (0.77)	t(400) = -1.44, p = 0.150
Entrepreneurial intrinsic motivation	3.70 (0.89)	3.66 (0.95)	t(400) = -0.37, p = 0.714
Entrepreneurial self-efficacy	3.15 (0.85)	2.95 (0.83)	t(400) = -2.42, p = 0.016
Entrepreneurial identity aspiration	3.27 (0.92)	3.07 (0.90)	t(400) = -2.21, p = 0.028
Entrepreneurial intention (preregistered)	0.32 (0.47)	0.24 (0.43)	t(400) = -1.73, p = 0.085
Entrepreneurial intention (exploratory)	0.72 (0.52)	0.62 (0.49)	t(400) = -1.90, p = 0.058

Table 4. OLS regression

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	EIM	ESE	EIA	Entrepreneurial intention		
Relatable condition	0.034 (-0.147 - 0.214)	0.197** (0.037 - 0.357)	0.201** (0.022 - 0.379)	0.077* (-0.011 - 0.166)		0.03 (-0.044 - 0.104)
Entrepreneurial intrinsic motivation (EIM)					0.059** (0.010 - 0.108)	0.061** (0.012 - 0.110)
Entrepreneurial self-efficacy (ESE)					0.009 (-0.046 - 0.064)	0.008 (-0.048 - 0.063)
Entrepreneurial identity aspiration (EIA)					0.220*** (0.156 - 0.284)	0.217*** (0.154 - 0.281)
Constant	3.663*** (3.532 - 3.795)	2.954*** (2.840 - 3.069)	3.068*** (2.943 - 3.194)	0.243*** (0.183 - 0.302)	-0.660*** (-0.796 - -0.525)	-0.670*** (-0.808 - -0.532)
Observations	402	402	402	402	402	402
R-squared	0	0.014	0.012	0.007	0.303	0.304

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 5. The number of female participants interested in STEM and completion rate in each video condition

<b>Condition</b>	<b>Survey not completed</b>	<b>Survey completed</b>	<b>Total</b>	<b>Completion rate</b>
Relatable	102	67	169	39.64%
Unrelatable	159	89	248	35.89%
Total	261	156	417	37.77%

Table 6. Descriptive statistics, Cronbach's alpha, and correlations of the variables for female participants with interest in STEM

Variable	Obs	Mean	SD	Alpha	1	2	3	4	5	6	7
1 Entrepreneurial intention (Preregistered)	136	0.15	0.36	NA	1						
2 Entrepreneurial intention (Exploratory)	136	0.49	0.45	0.71	0.70*	1					
3 Relatability	136	3.19	0.79	0.79	0.20*	0.16*	1				
4 Entrepreneurial intrinsic motivation	136	3.52	0.86	0.9	0.34*	0.41*	0.24*	1			
5 Entrepreneurial self-efficacy	136	2.88	0.75	0.74	0.18*	0.20*	0.36*	0.32*	1		
6 Entrepreneurial identity aspiration	136	2.89	0.76	0.84	0.48*	0.60*	0.68*	0.58*	0.43*	1	
7 Relatable condition	136	0.43	0.5	NA	0.14*	0.06*	0.18*	-0.05	0.13*	0.05*	1

Note: \* represents  $p < .05$

Table 7. Mean of relatability, entrepreneurial intrinsic motivation, entrepreneurial self-efficacy, entrepreneurial identity aspiration, and entrepreneurial intention and t-test result of comparing relatable and unrelatable role model conditions in female participants with interest in STEM

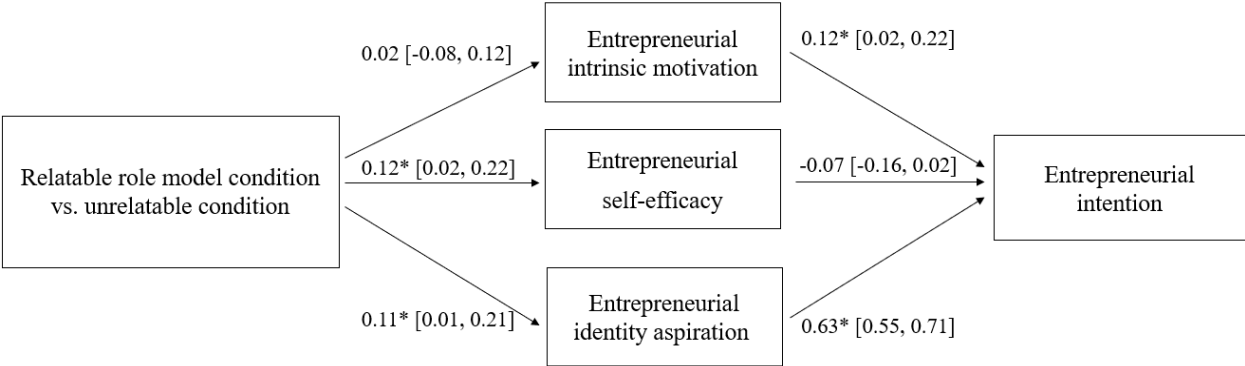
	Relatable role model condition (N = 59)	Unrelatable role model condition (N = 77)	t-test result
Relatability	3.36 (0.79)	3.07 (0.78)	t(134) = -2.11, p = 0.04
Entrepreneurial intrinsic motivation	3.47 (0.80)	3.56 (0.91)	t(134) = 0.56, p = 0.58
Entrepreneurial self-efficacy	3.00 (0.77)	2.80 (0.72)	t(134) = -1.54, p = 0.13
Entrepreneurial identity aspiration	2.94 (0.84)	2.86 (0.70)	t(134) = -0.62, p = 0.54
Entrepreneurial intention (preregistered)	0.20 (0.41)	0.10 (0.31)	t(134) = -1.63, p = 0.11
Entrepreneurial intention (exploratory)	0.52 (0.49)	0.46 (0.42)	t(134) = -0.72, p = 0.47



Table 8. OLS regression for female participants with interest in STEM

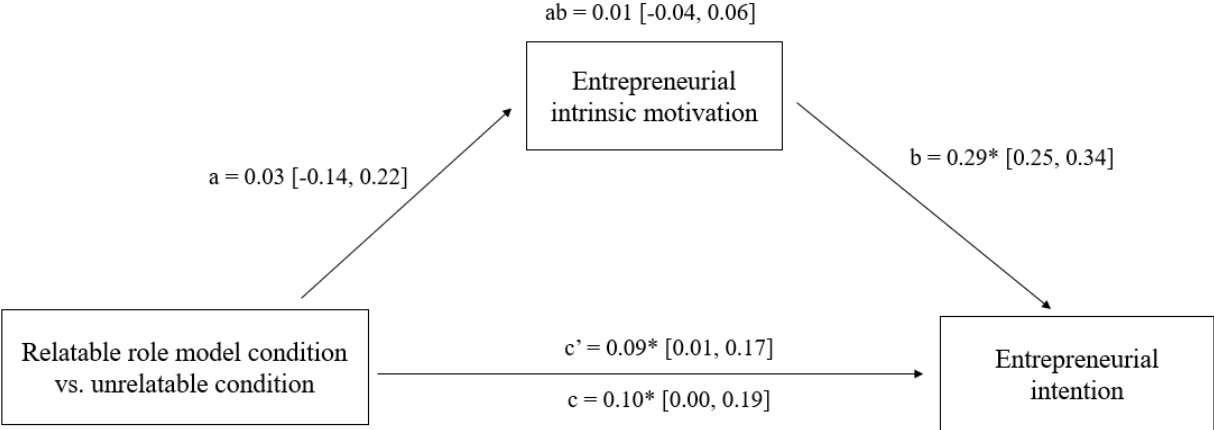
Variables	1	2	3	4	5	6
	EIM	ESE	EIA	Entrepreneurial intention		
Relatable condition	-0.084 (-0.375 - 0.207)	0.197 (-0.059 - 0.453)	0.081 (-0.186 - 0.349)	0.099 (-0.026 - 0.225)		0.092* (-0.013 - 0.198)
Entrepreneurial intrinsic motivation (EIM)					0.04 (-0.014 - 0.093)	0.047* (-0.007 - 0.101)
Entrepreneurial self-efficacy (ESE)					-0.019 (-0.093 - 0.056)	-0.028 (-0.100 - 0.045)
Entrepreneurial identity aspiration (EIA)					0.206*** (0.112 - 0.301)	0.202*** (0.110 - 0.295)
Constant	3.558*** (3.354 - 3.763)	2.799*** (2.637 - 2.961)	2.859*** (2.702 - 3.017)	0.104*** (0.035 - 0.173)	-0.536*** (-0.773 - -0.300)	-0.564*** (-0.805 - -0.324)
Observations	136	136	136	136	136	136
R-squared	0.002	0.017	0.003	0.019	0.239	0.255

Figure 1. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial self-concept.



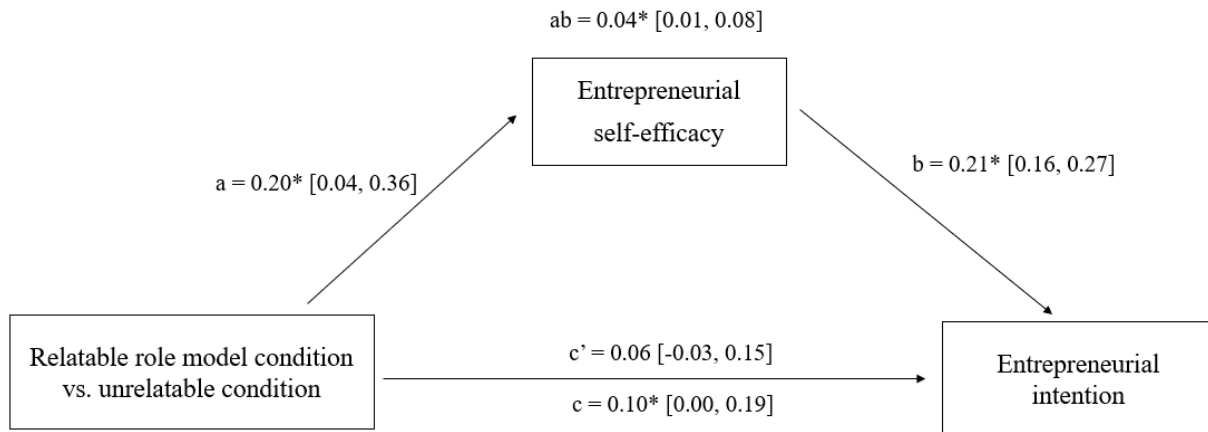
Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

Figure 2. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial intrinsic motivation.



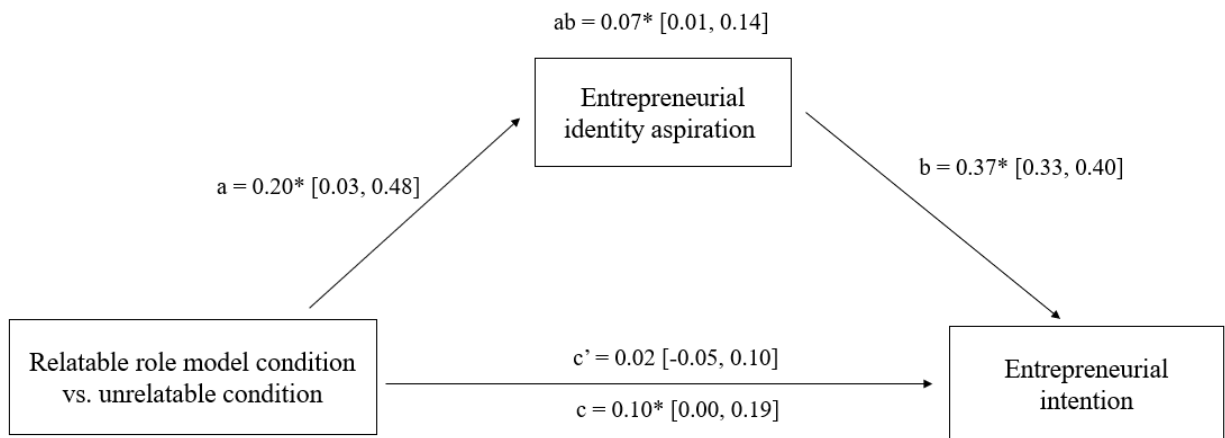
Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

Figure 3. Effect of reliable role model condition on entrepreneurial intention through entrepreneurial self-efficacy.



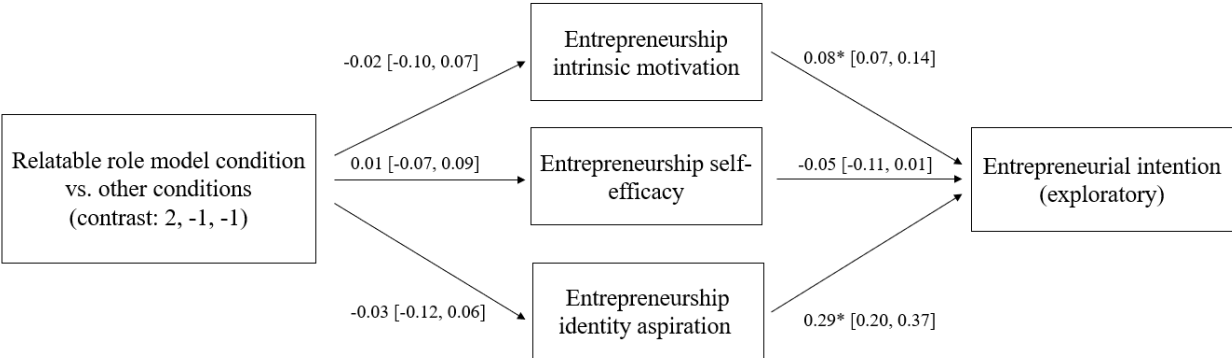
Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

Figure 4. Effect of reliable role model condition on entrepreneurial intention through entrepreneurial identity aspiration.



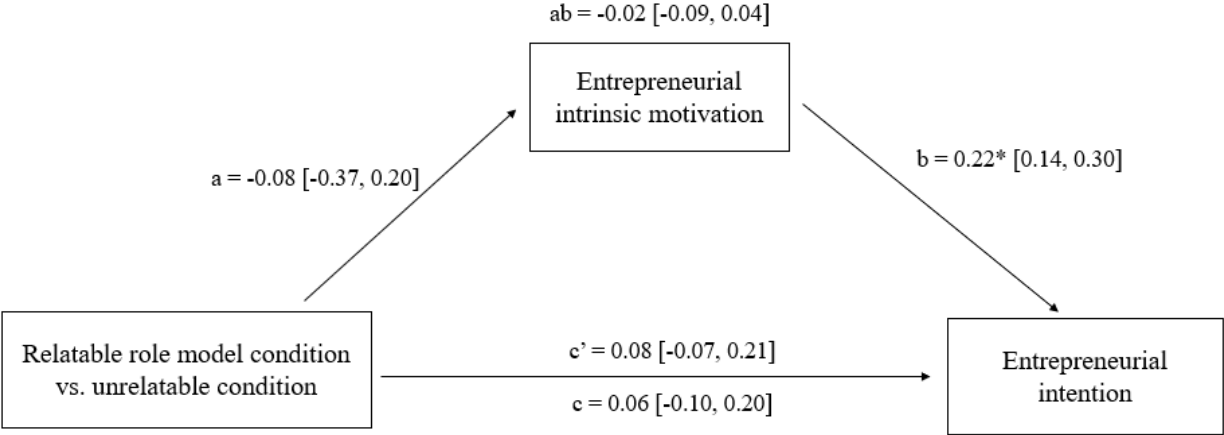
Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

Figure 5. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial self-concept in female participants with interest in STEM..



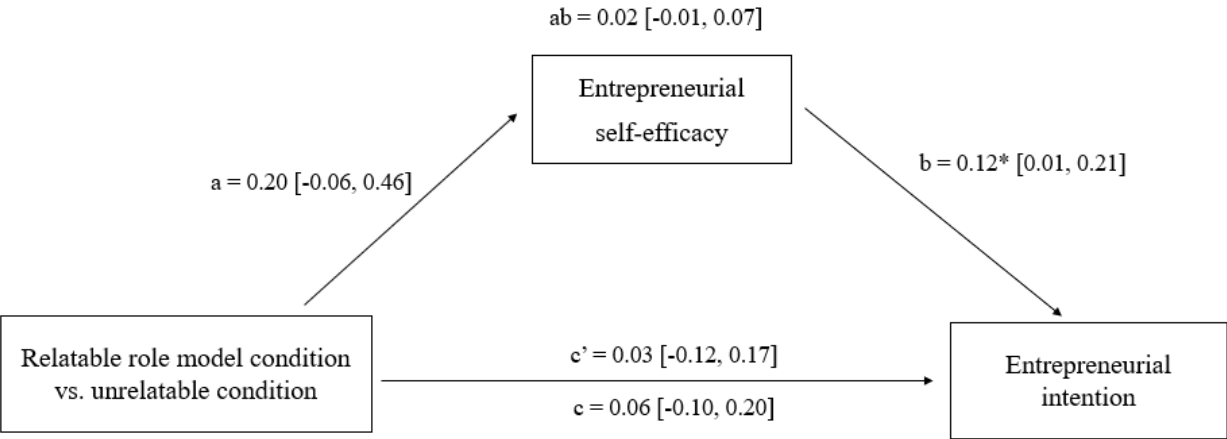
Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

Figure 6. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial intrinsic motivation in female participants with interest in STEM..



Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$

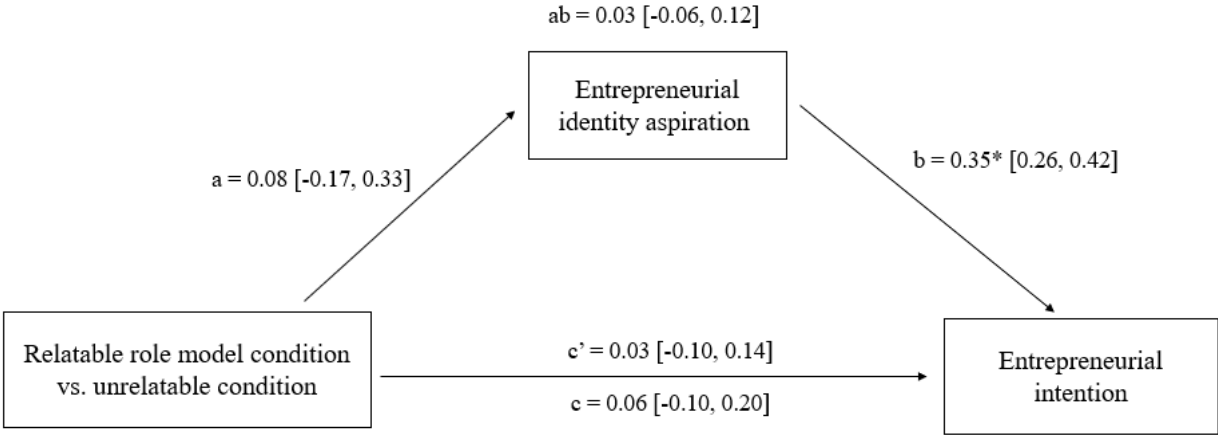
Figure 7. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial self-efficacy in female participants with interest in STEM..



Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$



Figure 8. Effect of relatable role model condition on entrepreneurial intention through entrepreneurial identity aspiration in female participants with interest in STEM.



Note: The confidence intervals not containing zero indicate a significant effect. \* represents  $p < .05$