The Importance of Viewing a Racially Marginalized Role Model for Racially Marginalized Women Students in Video Media

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Abstract

The current study was in hopes of expanding research to lessen the gap of racially marginalized women in STEM (science, technology, engineering, mathematics). I analyzed students' inspiration to pursue STEM interests, careers, and/or environments after watching the documentary *Picture a Scientist*, which featured women scientists, including a racially marginalized women scientist. I specifically analyzed whether students from marginalized racial groups were inspired by the Black woman scientist (and potential role model), in comparison to the two White women scientists, and whether feeling inspired by the scientists in the film influenced viewers' career aspirations in STEM. To answer my research questions, I analyzed data from a large survey completed by viewers of *Picture a Scientist*. Viewers completed the first survey immediately after viewing the film (time 1, $n = 814$) and a follow-up survey six weeks later (time 2, $n = 453$). For my analyses, I specifically focused on the film's impact on students' level of inspiration to pursue STEM. I found that Black/Latine/Indigenous students (i.e., students with racially minoritized identities) were more inspired by the Black women scientist compared to the two White scientists featured in the film. Moreover, women students were generally more inspired by the scientists than men students. Finally, feeling inspired by the scientists at time 1 predicted changes in STEM career aspirations at time 2. The current research provides initial evidence for the effectiveness of using video media to introduce racially marginalized women students to the most beneficial role models to increase their representation in STEM.

The Importance of Viewing a Racially Marginalized Role Model for Racially Marginalized Women Students in Video Media

In 2020, approximately 56% of women and 68% of males were participating in the labor force in the United States (U.S. Bureau of Labor Statistics, 2022). These reports demonstrate that women's representation in the workforce has been on the rise during the second half of the 20th century. This increase in women's employment indicates an improvement in the acceptance of women engaging in the labor force and securing employment. Nevertheless, women are still largely underrepresented in science, technology, engineering, and mathematics (STEM) fields, making up only 28% of the labor force in these fields (The STEM Gap, 2022). This disparity is exacerbated at higher levels of rank and prestige, with a lower proportion of women in each higher-ranked occupation in the STEM hierarchy (NSF, 2021). Moreover, the lowest percentage of women among all STEM occupations is within the highest-paying fields—computer science and engineering occupations. Beyond this lack of representation, women are also underpaid in STEM, making approximately $15,000 less than men per year (The STEM Gap, 2022), accounting for only 82% of men's earnings in 2020 (U.S. Bureau of Labor Statistics, 2021). Women also face discrimination and harassment in many STEM fields. This mistreatment creates hostile environments for women working in STEM and those studying in STEM majors (Eaton et al., 2020; Moss-Racusin et al., 2012; Steele et al., 2002; Witze, 2018). As a result of underrepresentation and unwelcoming environments, women, compared to men, are at a higher risk of experiencing heightened social identity threat in STEM, or the fear that their identity will be devalued in STEM environments (Banchefsky et al., 2019; Murphy et al., 2007; Steele et al., 2002). Social identity threat can lead to multiple adverse outcomes including a decreased sense of belonging (i.e., a subjective feeling of fitting in and being included as a valued and legitimate member in a particular setting; Lewis et al., 2017; Baumeister & Leary, 1995) and lower trust of others and colleagues in STEM environments (Johnson et al., 2019). Women often view academic environments as threatening when they encounter a perceived lack of control, hostile environments, and/or male-dominated environments (Casad et al., 2018; see also Gonzales et al., 2002). Thus, male-dominated environments, such as STEM, are often inflexible and exclusionary environments that are not supportive nor attractive to women and minorities (The STEM Gap, 2022).

This disparity of women's representation in STEM is even more pronounced for women belonging to marginalized racial groups. Indeed, Black and Latina women are among the least represented in STEM compared to their representation in the overall U.S. population (NSF, 2021). Moreover, Black women in STEM get paid significantly less than their White counterparts—a gap of approximately $33,000 less in annual salary (The STEM Gap, 2022). Because of their multiple marginalized identities across race/ethnicity and gender, Black and Latina women students experience heightened social identity threat and a lower sense of belonging and trust in STEM compared to White women students and Black/Latino men students (Rainey et al., 2018; Casad et al., 2018). Even when racially marginalized women have equal levels of performance to their White and/or male peers in STEM, concerns of threats to their social identities can result in withdrawal from STEM occupations (Dasgupta, 2011). Importantly, a lack of representation in STEM fields consequentially leads to stronger feelings of social identity threat (Murphy et al., 2007). Experiencing social identity threats, therefore, feeds into a vicious cycle. Black and Latina women will leave or avoid STEM fields because of the threat to their identities. This may exacerbate the representation disparity of Black and Latina women in STEM and further increase the risk of social identity threat (Dasgupta, 2011).

The underrepresentation of Black and Latina women in STEM facilitates harm to their sense of belonging and interest in STEM domains (Johnson et al., 2019; Pietri et al., 2019). Further, a lack of diversity in STEM not only harms Black and Latina women but also harms scientific progress generally. Indeed, diverse research teams lead to unique perspectives and increased research output when compared to less diverse research teams (Powell, 2018). Consequently, a critical question is: what tools and techniques can be employed to break this vicious cycle of underrepresentation? The goal of the current study was to explore a possible solution to bridge the gap between racially marginalized women and their lack of representation in STEM fields and environments. Specifically, I explored the benefits of learning about successful women scientists through participant viewing of the documentary *Picture a Scientist*. I analyzed the impacts this film has had on inspiring students to pursue STEM environments, interests, and/or careers. Moreover, I examined whether the Black woman scientist featured in the film, in comparison to the White women scientists, is particularly inspirational for women students with racially minoritized identities. Due to past research, I hypothesized that students with marginalized racial identities will be more inspired by the Black women scientist, as opposed to the other two White women scientists featured in the film.

Background and Literature Review

The Unique Challenges for Women With Racially Minoritized Identities

According to the double jeopardy theory, women with racially minoritized identities experience unique threats and discrimination due to possessing two historically minoritized identities (i.e., their racial and gender identities; Crenshaw, 1995; Klonoff et al., 1995; Williams et al., 2014). Women with racially minoritized identities, therefore, experience significantly decreased belonging in STEM compared to both White women and racial minority men (Rainey et al., 2018). Casad and colleagues' (2018) model of threatening academic environments suggests that social identity threat occurs when racially marginalized women are aware of their stigmatized identities in STEM settings. This awareness causes women to perceive STEM environments as threatening as they fear that their gender and/or racial identity will lead to doubts about their suitability and belonging in STEM. Providing evidence for their proposed model, Casad and colleagues (2018) first found that women with racially minoritized identities experience higher threat and disengagement in STEM compared to White women. Specifically, this research found that women, in general, feel a lack of control when they perceive an environment as threatening. In turn, this lack of control results in increased academic disengagement and lower self-esteem among women in STEM environments (Casad et al., 2018; see also Gonzales et al., 2002). Casad and colleagues' (2018) findings align with the theory of double jeopardy as racially marginalized women experience greater threat in STEM compared to White women, who possess only a single marginalized identity (i.e., their gender identity). The model of threatening academic environments by Casad and colleagues (2018) ultimately provides evidence for racially marginalized women experiencing increased social identity threat, specifically as they encounter double jeopardy due to the awareness of both of their stigmatized identities in STEM settings (i.e., their gender and racial identities).

Identity-Safety Cues in Role Models

Importantly, researchers have identified identity-safety cues (i.e., cues that suggest one’s identity will be valued in a given setting; Davies et al., 2005) to help mitigate social identity threat. A particularly powerful social identity-safety cue is a successful individual that shares a common marginalized identity or a *role model* (Dasgupta, 2011). Specifically, a role model is an individual that students feel similar to, inspired by, and can see themselves becoming in the future (see Dasgupta, 2011, for a review). Given that Black and Latina women students have two important marginalized identities, one question is whether a scientist role model matching only their race or gender identity may be an effective identity-safety cue. Previous research has found that scientists are more effective role models when women can feel similar to that scientist (Cheryan et al., 2011). According to the theory of stigma solidarity, individuals feel most similar to an individual or group whom they believe has suffered from similar past stigma or discrimination (Craig & Richeson, 2012; Craig & Richeson, 2016). Thus, the belief that an individual or group has faced similar past discrimination leads an individual to have higher identification with that individual or group (Craig & Richeson, 2012; Pietri et al., 2019). Importantly, work from the intersectional literature on the ethnic prominence perspective provides evidence that Black and Latina women tend to be more sensitive to racism than sexism (Levin et al., 2002). Based on this previous research, a role model matching Black and Latina women's race/ethnicity would be more beneficial for these women than a role model matching only their gender.

Pietri and colleagues (2019) directly explored this possibility among Latina women. Specifically, these researchers found Latina women were more likely to believe a Latino or Latina scientist had shared discrimination compared to a White woman or White men scientist. Moreover, when Latina women viewed scientists as having shared discrimination, they felt stronger feelings of similarity with the scientists. This increased similarity with the scientist ultimately resulted in Latina women feeling stronger trust and belonging in a STEM environment (Pietri et al., 2019). Relatedly, previous work also provides evidence for the increased benefit of Black women having access to Black role models. For instance, Johnson and colleagues (2019) randomly assigned Black women students to assess their perceived belonging in a school where one of the four conditions was present: a Black woman STEM professor, a Black man STEM professor, a White woman STEM professor, or a White man STEM professor. Due to beliefs about past shared racial bias and discrimination, Black women students felt greater similarity and identification with the Black woman and man professor compared to the White woman and man professor. Consequently, the Black women students anticipated more belonging in a STEM-focused school with Black professors compared to schools with White professors. Therefore, Black professors, regardless of gender, served as an identity-safety cue for Black women students (Johnson et al., 2019; Pietri et al., 2018). Moreover, Johnson and colleagues (2019) found that Black women in STEM majors felt increased belonging in their university and STEM fields broadly when the university reported Black women role models in their institution and in their STEM major. Thus, Johnson and colleagues' (2019) work demonstrates the importance of Black women students interacting with a role model of the same race to increase perceived belonging and trust in STEM (i.e., feeling welcome in STEM; Charleston, et al., 2014; Palmer et al., 2011).

Therefore, a lack of racially marginalized exemplars in STEM fields limits racially marginalized women students of the ability and opportunity to feel a sense of belonging in STEM environments. This effect worsens when Black women have high levels of fear that their minoritized identities will result in mistreatment and discrimination, also known as having high stigma consciousness (Pinel, 1999). Specifically, Black women high in stigma consciousness report lower belonging and trust in STEM environments unless there are Black women scientists in that environment (Johnson et al., 2019). Thus, Black women high in stigma consciousness require Black *women scientists* to increase their sense of belonging in STEM environments (Johnson et al., 2019). However, it is also possible that scientists and potential role models with non-matching or outgroup racially marginalized identities, may also act as identity-safety cues for Black and Latina women (e.g., a Latina woman acting as a role model for a Black woman, or a Black woman acting as a role model for a Latina woman). As mentioned above, stigma solidarity suggests that individuals will feel a connection and similarity with groups who experience similar marginalization (Craig & Richeson, 2016).

Lewis and colleagues (2023) specifically tested whether stigma solidarity generalizes to the context of role models. The researchers specifically tested whether Black women role models and non-Black women role models, who still have racially minoritized identities, would serve as effective identity-safety cues for Black women in a fictitious company. Lewis and colleagues (2023) found that Black women perceived all phenotypic variations of Latina women (White-Latina, Afro-Latina) and Black women employees to have experienced past discrimination and bias in the workplace on a *qualitatively* similar level (i.e., participants view Black women and Latina women as experiencing similar types of bias). At the same time, Black women participants viewed an Afro-Latina and a Black woman employee as facing *quantitatively* more bias than the White-Latina employee (i.e., participants view Black and Afro-Latina women as experiencing more bias than phenotypically lighter Latina women even though they are experiencing similar types of bias). Thus, Black women felt more similar to a Black (non-Latina) and an Afro-Latina woman employee compared to a White-Latina employee. Moreover, the Black and Afro-Latina women employees promoted more belonging and interest in their company compared to a White-Latina employee (Lewis et al., 2023). At the same time, participants still felt more similar to the White-Latina employee than a White (non-Latina) woman employee. Although these findings were nuanced with regard to the phenotypically of the Latina employee impacting her effectiveness as a role model for Black women, this research provides initial evidence that other racially minoritized women, such as Latinas, can act as role models for Black women.

Unfortunately, all women with racially minoritized identities are underrepresented in STEM, and thus, having Latinas act as role models for Black women (or Black women act as role models for Latinas) is not a practical solution. Thus, the current underrepresentation of women of color in STEM results in Black and Latina women students lacking exposure to role models that can effectively inspire their interests in STEM fields, ultimately perpetuating the underrepresentation of Black and Latina women in STEM (Dasgupta, 2011). Therefore, it is critical to create new opportunities for racially minoritized women students to learn about scientists with similarly minoritized identities. However, ensuring that women students of color learn about their most inspirational role models would place an increased burden upon the few women in STEM (i.e., require them to attend panels and be a part of recruitment processes). Indeed, women generally and women of color in academic spaces experience more service burdens compared to their White men counterparts, which ultimately harms research productivity (Guarino & Borden, 2017; Turner et al., 2011). Thus, working to increase racially marginalized students' inspiration to join STEM should not be placed on the small number of racially marginalized women already in STEM, as this can lead to faster burnout and can potentially hamper their own experience in STEM.

Effectiveness of Video Media

Racially minoritized scientists as role models are necessary to increase racially minoritized students' sense of belonging and interest in STEM environments, particularly among those high in stigma consciousness. Critically, role models do not require consistent and/or high-quality contact and can include any successful individuals whom one knows about through brief, direct contact or via media exposure (Gibson, 2004; Study 2). Consequently, in-person, direct contact with role models is not necessary to experience increased STEM career aspirations and interests. Rather, contact with role models or successful exemplars through media exposure can also be beneficial (Dasgupta, 2011). As one example, researchers found that when girls watched the X-files in middle school, featuring scientist and agent Dana Scully, they were more likely to enter STEM professions as adults (Geena Davis Institute on Gender in Media, 2018).

Of note, individuals can develop strong psychological connections with characters in media. In particular, parasocial contact refers to individuals feeling a relationship and a sense of connection with a character portrayed through media (Schiappa et al., 2005). Such characters can include newscasters, fictional characters, and other television personalities (Giles, 2002). Video media tends to be a particularly effective medium for fostering parasocial contact, more so than written forms or audio recordings (Pietri et al., 2021). Parasocial contact allows viewers to feel a sense of closeness to the character portrayed, ultimately causing the individual to take on the perspective of the character (Cohen 2001, 2006; Cohen et al., 2018). Of importance, feeling this sense of parasocial contact with a character can ultimately relate to important downstream effects. For instance, feeling a sense of closeness with media characters, who possess racially marginalized identities, can encourage positive perceptions of the character as well as their whole racial ingroup (Gillig et al. 2018; Schiappa et al. 2005; Wong et al. 2017).

Critically for the current research, feeling a sense of closeness or parasocial contact with a scientist can also increase the viewers' interest in STEM (Pietri et al., 2021). Specifically, Pietri and colleagues (2021) found that individuals were more likely to believe that a Black woman computer scientist had positive traits and felt more parasocial contact with her when she was featured in a video, compared to only reading about the same scientist. Moreover, Black women students expressed greater interest in computer science when they watched a video of a Black woman computer scientist, compared to reading about the scientist, or not receiving information about the scientist (i.e., a control condition; Pietri et al., 2021). Thus, video media can be a powerful tool to promote a sense of closeness with women scientists and to introduce women students of color to inspirational role models.

The Current Research

The current research explored whether women scientists (potential role models) who were represented in video media, were sources of inspiration for racially marginalized women students to pursue STEM interests, environments, and/or careers. I specifically explored the impacts of a racially marginalized role model, presented in video media, on women who are also of racially marginalized identities. I also analyzed whether reported feelings of inspiration influenced students' STEM career aspirations.

To answer my research questions, I analyzed data for a large survey given to viewers about the documentary *Picture A Scientist*. *Picture A Scientist* outlines issues surrounding sexism and harassment in STEM. Critically, for my research questions, this documentary follows the experiences of three women scientists. Two of the scientists (i.e., Nancy Hopkins and Jane Willenbring) discussed the prejudice and bias they experienced as women in STEM. The third scientist (i.e., Raychelle Burks) discussed the unfair treatment she experienced in STEM environments due to the intersectionality of her minoritized identities (i.e., being both a woman and a Black scientist). As part of the large survey, participants indicated how inspired they felt by each of the individual three scientists. Participants also indicated their level of STEM career aspirations immediately after watching the documentary and six weeks after the first survey. I was curious whether students with racially minoritized identities would feel more inspired by the

Black woman scientist over the two White women scientists, given that past research suggests that women students with racially minoritized identities will feel more inspired by a scientist with a racially minoritized identity compared to a White woman scientist (Johnson et al., 2019; Pietri et al., 2019). Therefore, I hypothesized that students with marginalized racial identities will be more inspired by the woman scientist with a marginalized racial identity, as opposed to the other two White women scientists featured in the video. I specifically hypothesized that racially marginalized women students would be the most inspired by the racially marginalized woman scientist. I also explored whether feeling inspired by the women scientists generally predicted changes in STEM career aspirations immediately after watching the film and across the six-week period between the two surveys.

Method

Participants

I analyzed data from a large survey of individuals who watched the documentary *Picture a Scientist*. My research questions focus specifically on the impact of women scientist role models, featured in video media, for students. Thus, for my analyses, I focused specifically on student participants who took part in this survey. A total of 2779 individuals watched *Picture a Scientist* and completed the survey. Among these 2779 participants, 816 identified as students (29.4% of participants). The survey included film memory check questions to ensure that all participants were attentive and had watched the full film. Specifically, participants had to get two of the three easy memory check questions correct to be included in our sample (e.g., "Of the three main people whose stories were featured in the film: a) all three were male; b) two were female, and one was male, c) all three were female [correct answer]"). Only one student did not meet this inclusion criteria. For the current analyses, the final sample consisted of 814 students after removing the individual who failed the memory check criteria as well as removing an individual with a missing response. As part of the survey, participants completed a variety of demographic questions including: race, gender, age, STEM major, plans to teach in the future, plans to mentor in the future, etc. Of our final sample of participating students, 103 (12.7%) identified as ‘male,’ 692 (85.0%) identified as ‘female,’ 18 (2.2%) participants identified as ‘other,’ and one student (0.1%) chose not to answer the gender question (i.e., “What is your gender?”). Age ranged from 18 to 63 years old with a mean age of 26.18 ($SD = 6.172$). The majority of our student sample ($n = 521$, 64.0%) were White, 15 (1.8%) were Black/African American, 70 (8.6%) were Hispanic/Latine, 67 (8.2%) were East Asian, 53 (6.5%) were multiracial, 50 (6.1%) were South Asian, two (0.2%) were Southwest Asian, 17 (2.1%) were Middle Eastern, one (0.1%) identified as Native Hawaiian/Pacific Islander, one (0.1%) identified as American Indian/Native American/Alaska Native/Indigenous, 14 (1.7%) participants identified as ‘other,’ and three (0.4%) participants chose not to answer.

As expected, much of our sample consisted of STEM students with 772 (94.8%) participants being in STEM fields/majors. Moreover, 519 (63.8%) were STEM graduate students in a terminal doctorate program, 79 (9.7%) were graduate students in a terminal master’s program, 15 (1.8%) were professional students, and 201 (24.7%) were undergraduate students. Among the students who were in STEM majors, the areas of study were 215 (26.4%) in biological sciences, 98 (12.0%) in biomedical sciences, 59 (7.2%) in chemistry, 90 (11.1%) in engineering, 27 (3.3%) in computer science/technology, 20 (2.5%) in mathematics, 16 (2.0%) in medicine, 19 (2.3%) in social sciences, 227 (27.9%) in ‘other’ STEM fields.

Procedures

Across multiple countries, *Picture a Scientist* screenings were hosted at colleges and universities. Students began by voluntarily signing up to watch *Picture a Scientist* through their college or university, regardless of this study. 153 (18.8%) of students watched the film through a society or professional organization, 626 (76.9%) watched through their university or college, and 33 (4.1%) watched through their company or an organization. Two (0.2%) participants chose not to answer. After the study received IRB approval, an e-mail was sent to all students who were signed up to watch the film. Students were voluntarily able to participate in our survey, after viewing the film. All students completed an informed consent document before starting the survey.

Picture a Scientist shares the stories of three women as they work to navigate their way through their STEM careers with the marginalized identity of being women. Specifically, Nancy Hopkins, a White woman, shares her personal experience of harassment in the workplace and realizes that men scientists get significantly more lab space than their women coworkers. Jane Willenbring, another White woman, shares her experience of sexual harassment and verbal assaults from her men coworkers. Raychelle Burks, a Black/African American woman, shares her experiences of discrimination and stigma as she suffers from the consequences of possessing two marginalized identities (i.e., gender and race). As mentioned earlier, participants were asked memory check questions to ensure that they watched the film. Participants then answered general questions about their impressions of the film and actions they may take to combat gender bias. For the purpose of this thesis and my study, I will focus on a subset of questions from the survey, which are relevant to my research questions and predictions.

As part of this survey (time 1), student participants answered questions regarding the three women featured in *Picture a Scientist*. As indicated earlier, two of these women were

White women, Nancy Hopkins and Jane Willenbring, and one of the scientists, Raychelle Burks, was a Black/African American woman. (I will refer to the scientist by their initials moving forward in the thesis, Nancy Hopkins = NH, Jane Willenbring = JW, and Raychelle Burks = RB.) Students also indicated their interest in pursuing a career in STEM.

At the end of the survey, participants were asked if they would be willing to participate in a second follow-up survey. If participants agreed, they provided their e-mail information. Six weeks later, participants received an e-mail with a link to the second survey. Among the full sample of students, 661 (81.2%) students agreed to take the follow-up survey. Among those who agreed to take the survey, 453 (68.5%) completed the follow-up survey (time 2).

Measures and Materials

After finishing the film, students were told we were interested in their impressions of each of the woman scientists featured in the film (e.g., "We are curious about your feelings specifically about Raychelle Burks, Ph.D., the professor..."). Students rated their level of agreement on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) to statements measuring the level of inspiration they felt from each women scientist (e.g., "I was inspired by Dr. Burks"). Generally, I measured inspiration by asking participants if they were inspired by the scientist, if they could see themselves being like the scientist, and if they hoped to be like the scientist. Students rated their agreement with these three statements for each woman scientist in the film (inspired by RB: $\alpha = .84$, $M = 6.02$, $SD = 1.00$; inspired by NH $\alpha = .84$, $M = 6.02$, $SD = 1.00$; inspired by JW $\alpha = .87$, $M = 5.79$, $SD = 1.14$). These data represented students' inspiration at time 1.

Students were then told we were interested in their general feelings about STEM careers (e.g., "We are curious about your general feelings about STEM [science, technology, engineering, & mathematics”]). The students then reported their agreement on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) to statements measuring their level of interest in pursuing a STEM career (e.g., “I would enjoy a career in STEM”; $\alpha = .850$, $M = 6.07$, $SD = .93$). Overall, there were four statements assessing their STEM career aspirations. These data represented students’ STEM career aspirations at time 1.

During the follow-up survey (time 2) that was taken six weeks after students watched the film, participants were again asked about their interest in pursuing a STEM career (i.e., their STEM career aspirations). This was the same measure administered in the initial time 1 survey ($\alpha = .87$, $M = 6.19$, $SD = .83$). These data were used to assess if *Picture a Scientist* had possible long-term effects on students’ career aspirations.

Design Analyses

Prior to running the primary analyses, I ran a bivariate correlational analysis to determine if participants who did complete our follow-up survey varied meaningfully from the participants who did not complete the survey (coded as 1 = completed the survey, 0 = did not complete the survey) on the variables of STEM career aspirations. I used a Bonferroni correction to account for running multiple tests. With this corrected *p*-value ($p = .013$), I did not find any significant correlations with time measures. Specifically, the correlations between completing versus not completing the survey, after using a Bonferroni correction, did not significantly correlate with feeling inspired by RB, $r(656) = .03$, $p = .424$, feeling inspired by NH, $r(656) = .06$, $p = .100$, feeling inspired by JW, $r(656) = .08$, $p = .046$, or STEM career aspirations at time 1, $r(659) = 0.2$, $p = .566$. Therefore, I concluded that participants who did complete the follow-up survey did not differ meaningfully on measures of STEM career aspirations.

For the primary analyses, I collapsed across racial groups. Specifically, I focused on groups that are racially minoritized or negatively stereotyped in STEM (collapsing across Black/Latine/Indigenous participants), racial minority groups that are positively stereotyped in STEM (collapsing across all Asian participants), and White participants. I also had a subset of participants who identified as multiracial or other. However, when these participants were included in the sample, we had cells with less than five participants, making the data too identifiable. Thus, I excluded these participants from my analyses. I also did not include individuals who identified their gender as 'other' because their inclusion also would lead to cells with less than five participants in our factorial design, making the data too identifiable. I conducted all analyses using IBM-SPSS Statistics version 28.0.1.1.

For my first analyses, I ran a mixed model ANOVA with scientist (RB vs. NH vs. JW) as the within-subjects variable and participant gender and race as between-subjects factors. Thus, this analysis had a 3 (scientist) by 3 (race) by 2 (gender) mixed model design.

A repeated measures ANOVA was used to analyze whether the participants had changes in STEM career inspiration between time 1 and time 2 (six weeks after the time 1 survey was given) and whether there were any differences based on gender and race. For these analyses, I had the within-subjects variables of time (time 1 STEM career aspirations vs. time 2 STEM career aspirations) and my between-subjects variables were gender and race. Thus, this analysis had a 2 (time) by 3 (race) by 2 (gender) mixed model design.

We were curious whether variability in being inspired by the scientists in the film predicted changes in career interests in STEM. We ran a regression analysis where we controlled for STEM career aspirations at time 1 scores to predict STEM career aspirations at time 2. We averaged the measures of being inspired by each scientist together to create a single index of being inspired by the scientists generally.

Results

For my first analyses, there was a significant effect of scientist on the level of inspiration the participants felt, $F(1, 716) = 9.43$, $p = .002$, $\eta_p^2 = .013$. Generally, participants were more inspired by Scientist RB (i.e., the Black woman scientist; $M = 6.00$ $SD = 1.01$) than Scientist JW (i.e., one of the White women scientists; $M = 5.80$ $SD = 1.14$), $MD = 0.25$, $SE = 0.08$, $p = .007$. There was no significant difference between Scientist RB and Scientist NH (i.e., the other White woman scientist; $M = 5.92$, $SD = 1.08$), $MD = 0.16$, $SE = 0.08$, $p = .178$, and between Scientist JW and Scientist NH, $MD = 0.09$, $SE = 0.06$, $p = .300$.

There was also a significant effect of gender, $F(1, 716) = 11.75$, $p <.001$, $\eta_p^2 = .016$. Women ($M = 5.96$ $SD = 0.87$), in general, felt more inspired by the scientists than men ($M = 5.54$ $SD = 0.92$) $MD = 0.43$, $SE = 0.12$, $p < .001$ (See Table 1). There was no significant effect of race, $F(1, 716) = 1.88$, $p = .153$, $\eta_p^2 = .005$. Moreover, there were no significant interactions between gender and race, $F(1, 716) = 0.18$, $p = .837$, $\eta_p^2 < .001$, and between scientist and gender, $F(1, 716) = 0.21$, $p = .650$, $\eta_p^2 < .001$. The three-way interaction between scientist, gender, and race was also not significant, $F(1, 716) = 0.48$, $p = .622$, $\eta_p^2 = .001$. The interaction between race and scientists showed the predicted pattern, although, did not reach significance, $F(1, 716) = 2.90$, $p = .056$, $\eta_p^2 = .008$.

Looking at this interaction, Black/Latine/Indigenous participants felt more inspired by Scientist RB (i.e., the Black woman scientist) compared to Scientist NH, $MD = 0.49$, $SE = 0.20$, $p = .043$, and Scientist JW, $MD = 0.59$, $SE = 0.19$, $p = .008$. Thus, as predicted, students with marginalized racial identities were most inspired by the scientists who also possessed a marginalized racial identity (See Table 2).

Among White participants, there was no difference in feeling inspired by Scientist RB and Scientist NH, *MD* = 0.02, *SE* = 0.08, $p > .999$, or feeling inspired by Scientist RB and Scientist JW, *MD* = 0.12, *SE* = 0.08, $p = .330$. However, White participants felt more inspired by Scientists NH than Scientist JW, *MD* = 0.14, *SE* = 0.05, $p = .025$. Finally, Asian participants felt equally inspired by all three scientists (all *p*-values > .999) (See Table 2).

The repeated measures ANOVA analyzing STEM career aspiration changes between time 1 and time 2 showed there was no significant main effect of time, $F(1, 394) = 1.87$, $p = .172$, $\eta_p^2 = .005$, gender, $F(1, 394) = 0.24$, $p = .621$, $\eta_p^2 = .001$, or race, $F(1, 394) = 1.69$, $p = .185$, $\eta_p^2 = .009$. Moreover, there were no significant interactions between time and gender, $F(1, 394) = 0.02$, $p = .936$, $\eta_p^2 = .00$, or time and race, $F(1, 394) = 0.80$, $p = .449$, $\eta_p^2 = .004$. The three-way interaction between time, race, and gender was not significant, $F(1, 394) = 2.47$, $p = .086$, $\eta_p^2 = .012$ (See Table 1).

Unsurprisingly, our regression analysis showed STEM career aspirations at time 1 was a significant predictor of STEM career aspirations at time 2, $b = 0.67$, $SE = 0.03$, $t(396) = 20.35$, $p < .001$. Importantly, we also found that the average measure of being inspired by the three scientists was also a significant predictor, $b = 0.11$, $SE = 0.04$, $t(396) = 3.10$, $p = .002$, of STEM career aspirations at time 2. Thus, being inspired by the women scientists in the film predicted changes in STEM career aspirations over a six-week period.

Table 1

Means and standard deviations of the levels of inspiration and STEM interest categorized by race and gender.

Scientist	White (*n* = 521)				Black/Latine/Indigenous (*n* = 86)				Asian (*n* = 137)			
	Women		Men		Women		Men		Women		Men	
	M	*SD*	M	SD	M	SD	M	SD	M	SD	M	SD
Scientist RB	6.08	0.95	5.62	0.94	6.19	1.23	5.87	1.27	5.92	0.92	5.32	1.25
Scientist NH	6.03	1.02	5.70	0.93	5.71	1.45	5.37	1.26	5.93	1.02	5.29	0.93
Scientist JW	5.90	1.13	5.55	1.03	5.68	1.26	5.20	1.16	5.73	1.14	5.42	0.91
STEM Career Time 1	6.07	0.94	6.14	0.99	6.25	0.82	6.17	0.77	6.22	0.60	6.46	0.67
STEM Career Time 2	6.16	0.86	6.05	0.88	6.17	0.94	6.54	0.51	6.47	0.57	6.46	0.44

Note: ‘Scientist RB’ refers to the level of inspiration students felt from Scientist RB. This pattern is also followed for Scientist NH and Scientist JW. ‘STEM Career Time 1’ and ‘STEM Career Time 2’ refer to students’ interest in STEM careers during the initial survey (time 1) and the follow-up survey (time 2).

Table 2

Means and standard deviations of the level of inspiration felt by the three scientists.

Scientist	White (*n* = 521)		Black/Latine/Indigenous (*n* = 86)		Asian (*n* = 137)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Scientist RB	6.02	0.96	6.15	1.23	5.81	1.01
Scientist NH	5.99	1.01	5.67	1.43	5.82	1.03
Scientist JW	5.86	1.13	5.62	1.6	5.67	1.10

Discussion

Aligning with past research on the effectiveness of women role models for women students in STEM (Stout et al., 2011), I found that on average women students, compared to men students, felt more inspired by the three women scientists in the film. Most importantly, my analyses found that Black/Latine/Indigenous students, regardless of gender, felt the most inspired by the scientist who matched their race/ethnicity, RB, compared to the White scientists JW and

NH. This supports my hypothesis that individuals with a marginalized racial identity would feel more inspired by RB, as she also possesses a marginalized racial identity. Additional analyses found that the students who reported being inspired by the three women scientists immediately after watching the film, at time 1, reported stronger STEM career aspirations six weeks later (time 2). I controlled for initial STEM career aspirations in this analysis, and thus, feeling inspired by the women scientists predicted changes in STEM career aspirations. These findings demonstrate the importance of representations across genders and races/ethnicities in STEM environments in order to continuously inspire those to pursue STEM interests, environments, and/or careers through the presence of role models.

The current findings align with past research regarding the effectiveness of women role models in STEM. Women scientists, as opposed to men scientists, are more effective role models for other women (Stout et al., 2011). Indeed, I found that the women students, compared to the men students, were more inspired by the three women scientists. Women students feeling more inspired by the women scientists aligns with past research on identity-safety cues, as the women students felt more inspired by the women scientists due to their shared stigmatized identity—gender.

The ethnic prominence perspective argues that a role model matching an individual's race is more important than a role model matching one's gender. Specifically, Black and Latina women feel more threatened by their stigmatized racial identity than their stigmatized gender identity (Levin et al., 2002). Research by Johnson and colleagues (2019) and Pietri and colleagues (2018; 2019) have found that among Black and Latina women, a scientist matching their race (i.e., a Black or Latine man or woman) served as a stronger identity-safety cue than a scientist matching only their gender. My study provides additional support for the ethnic prominence perspective within the domain of role models. I found that both men and women students with racially marginalized identities were more inspired by the Black woman scientist, compared to the White women scientists in the film. Therefore, my results provide evidence for the importance of a matched racial identity between students and a role model. It is important to note that I did not find a similar pattern among White or Asian students as these students did not share a racially marginalized identity with the Black scientist and are not negatively stereotyped in STEM. Given that White students do not possess a racially marginalized identity, it is unsurprising that they did not feel more inspired by the White scientist relative to the Black scientist. Additionally, *Picture a Scientist* did not feature an Asian scientist. It is possible that Asian students may have found an Asian scientist more inspirational than a White or Black scientist; however, I am unable to test this question with the current study and film.

The stigma solidarity framework argues that individuals feel more similar to other racially marginalized outgroup members who they believe has experienced similar stigma and discrimination (Craig & Richeson, 2012; 2016). Based on this possibility it is probable that Black scientists (i.e., those who have a racially marginalized identity) may function as inspirational role models for non-Black students who are also racially minoritized and historically excluded from STEM fields. My study provides some initial support for this possibility as Latine and Indigenous participants felt more inspired by the Black scientist, RB, compared to the White scientists, JW or NH. This effect may be due to the Latine and Indigenous students believing that the Black scientist has experienced similar racial stigmatization to themselves, more so than the White scientists. I did not directly measure this possibility in the current study, but this would be an interesting question for future research.

Practical Applications

Women with marginalized racial identities experience a decreased sense of belonging in STEM environments compared to men with marginalized racial identities or White women (Rainey et al., 2018). Women with racially marginalized identities deem STEM environments as threatening due to an awareness of their marginalized identities, ultimately causing a decreased feeling of belonging in STEM careers (Casad et al., 2018). As a result, Black and Latina women are underrepresented in STEM environments (NSF, 2021). Moreover, when Black and Latina women do not see STEM scientists with matching racial identities to themselves, they express less belonging and interest in STEM environments (Johnson et al., 2019; Pietri et al., 2018; 2019). This leads to a problematic cycle of racially marginalized women avoiding STEM because they are not represented in these fields, leading to continued racial and gender disparities in STEM.

My research provides additional evidence for the importance of Black and/or Latina women's interactions with racially marginalized role models in STEM. Specifically, my research provides evidence that Black/Latine/Indigenous students reported an increase in inspiration when they encountered a (virtual) role model who matched their racial identity (i.e., RB), compared to the role models who only matched their gender (i.e., JW and NH). Thus, it is critical to ensure that women with marginalized racial identities learn about scientists who would be most inspirational to them. However, this can create a practical problem because of the severe lack of representation of racially minoritized women in STEM.

My research addresses this issue of underrepresentation of racially marginalized women in STEM by providing evidence for the effectiveness of video media to provide inspirational role models. Video media is widely accessible to a variety of individuals, groups, and institutions. Thus, video media is an efficient and obtainable platform to reach Black and Latina women audiences. Providing Black and Latina women with access to inspirational role models that match their race/ethnicity or possess a racial identity they believe has experienced similar past discrimination, via video media is a potential technique to help break the cycle of underrepresentation of racially marginalized women in STEM. An increase in the quality and quantity of Black and Latina role models through video media can slowly increase the representation of racially marginalized women in STEM, hopefully reaching a point where racially marginalized women feel belonging and inspiration to join STEM from younger ages.

Of note, Pietri and colleagues (2021) found that visual media, compared to a written narrative, was a more effective tool to increase viewers' feelings of connection with a Black woman scientist. Moreover, the researchers demonstrated that a Black woman scientist was more inspirational for Black women students (i.e., inspired more interest in a STEM career) in video versus written format. My results build upon this past work and provide additional evidence of the benefits of inspirational role models via video media. Importantly, the study by Pietri and colleagues (2021) looked at the effects of presenting a single Black woman scientist during a short six-minute video only among Black women students, who watched the video in the context of the experiment. My study expanded upon this research by exploring whether a Black woman scientist was more inspirational than White women scientists for Black, Latine, and Indigenous students. Moreover, I looked at the benefits of a longer documentary, which students were voluntarily watching (i.e., signed-up to view the documentary, regardless of the larger study). Thus, my results demonstrate the benefits of learning about racially minoritized women scientists in a larger, field study context. Further, past research provides the importance of diversity in STEM. Freeman and Huang (2015) found that research papers with a variety of diverse scientists, compared to research teams with greater homophily (i.e., less diversity) among their scientists, had higher numbers of citations. Powell (2018) found that diverse research teams have stronger research output as a variety of racial/ethnic perspectives in science results in a mixture of mindsets, creating successful and well-versed research.

Limitations and Future Directions

The decreasing number of participant survey response rates between time 1 and time 2 may be a possible limitation of the current research. This attrition bias leaves unanswered questions about any possible significant differences between students from the original sample that did complete the time 2 survey and students who did not complete the time 2 survey. Critically, I did not find systematic differences in my primary measures of interest between participants who completed the time 2 survey and those who did not. Moreover, my sample was obtained through a convenience method, as they were able to opt in or out of taking the survey after watching the film. Therefore, our participants were not derived randomly. This recruitment strategy could have potentially caused issues regarding the generalizability of the study. There may have been an underlying factor between those who opted in to take the survey and those who opted out, resulting in biased results. For instance, perhaps students who felt particularly inspired by the scientist were more likely to complete the initial survey.

It is important to note that this study was not a true experiment as we did not manipulate any factors of the study. Future work should explore whether women students who watched the film (versus women students who did not watch the film) differ in levels of inspiration to join STEM fields. It will also be important to further analyze other modes of video media that can be widely used across varying audiences of racially marginalized women. The most effective media formats can then be utilized to increase the inspiration and representation of racially marginalized women in STEM. The current research focused on video media in the form of a documentary. For instance, it is important to question if a fictional or documentary film would be a more beneficial format for presenting role models. Moreover, perhaps media with an "interactive" format would be beneficial. An interactive format could include the ability for viewers to answer polls or questions, whether knowledge-based or derived from personal experiences, while viewing the role model. Discovering the most efficient media methods to inspire racially marginalized women to pursue STEM can hopefully lead to an increase in inspirational video media sources for Black and Latina women. An increase in the quality and quantity of racially marginalized role models in media can hopefully be shown to racially marginalized women and girls to spark interest in STEM at younger ages, therefore, working to eliminate the gap of racially marginalized women in STEM.

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Appendix A

Partial correlations between all main outcome variables.

Measures		Scientist RB	Scientist NH	Scientist JW	STEM Career Time 1	STEM Career Time 2
Scientist RB	*r*	1	.390	.443	.149	.141
	p		<.001	<.001	<.001	.003
	n	808	808	808	808	446
Scientist NH	*r*	.390	1	.729	.182	.260
	p	<.001		<.001	<.001	<.001
	n	808	809	808	809	446
Scientist JW	*r*	.443	.729	1	.152	.204
	p	<.001	<.001		<.001	<.001
	n	808	808	808	808	446
STEM	*r*	.149	.182	.152	1	.740
Career Time	*p*	<.001	<.001	<.001		<.001
1	*n*	808	809	808	814	447
STEM	*r*	.141	.260	.204	.740	1
Career Time	*p*	.003	<.001	<.001<.001		
2	*n*	446	446	446	447	447

Note: 'Scientist RB' refers to the level of inspiration students felt from Scientist RB. This pattern is also followed for Scientist NH and Scientist JW. 'STEM Career Time 1' and 'STEM Career Time 2' refer to students' interest in STEM careers during the initial survey (time 1) and the follow-up survey (time 2).