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Seeing herself in science: Broadening participation in biology through promoting student familiarity with scientists

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Abstract

While women and girls face multiple complex barriers in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) disciplines, one central challenge is the bias and discrimination resulting from misguided perceptions of who can be successful in science. Scientist role models can be powerful drivers of student engagement and persistence in science, technology, engineering, math, and medicine (STEMM) disciplines. To address students' perceptions of—and their ability to identify with—scientists, we asked biology students to identify scientists by name and one with whom they personally relate. We also measured students' self-efficacy and science career commitment to examine the relationship between these factors and students' perceptions of scientists. We observed a mismatch between the gender of our student population and the scientists they identified. Specifically, we found that even though 73% of our student population identified as women, only 17% of the scientists named were women. Further, when asked to name a scientist that they personally identified with, only 41% of women students named a woman scientist. When asked why students identified with their chosen scientists, 21% of women students related to a scientist because they shared the experience of marginalization or shared adversity in STEMM based on their gender. While we did not observe overall gender-based differences in self-efficacy, we found that women students who identified with a woman scientist had greater STEMM career commitment compared to women who lacked gender-matching scientific role model via undergraduate class survey. Our findings highlight: 1) Students are less familiar with scientists with counterstereotypical identities, 2) Relating to a scientist matters more for students who don't 'see' themselves in STEMM and can serve as a source of motivation for students experiencing marginalization within STEMM disciplines, and 3) Women exposed to scientist role models reported higher commitment to STEMM career. Together, our work underscores the need to expose students to counter stereotypical examples of scientists to increase familiarity and relatability of scientists for all undergraduate students in biology.

Introduction

While women and girls face multiple complex barriers in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) disciplines (Eaton et al. 2020; Espinosa 2011; Sheltzer & Smith 2014a; Stets et al. 2017), one central challenge is the bias and discrimination resulting from misguided perceptions of who can be successful in science (Block et al., 2019; Pascarella et al., 1997). Early perceptions of successful science career paths in science are formed early in students' lives (Chambers, 1983) and become stronger as students move from primary education into post-secondary education and into the workforce (Miller et al., 2018). Scientist perspective is shaped by depictions in the media, textbooks, and curricular materials as eccentric, older, white men (Tanner, 2009). In undergraduate settings, textbooks often reaffirm these concepts of who can and cannot be scientists (Costello, Driessen, et al., 2025; Costello, Ewell, et al., 2025; Simpson et al., 2021; Wood et al., 2020). Within STEMM departments, white men are more likely to be invited as seminar speakers (Schroeder et al., 2013) and hired as faculty (Holman et al., 2018; Sheltzer & Smith, 2014) relative to individuals whose identities do not match the dominant stereotype of a scientist (i.e, counter stereotypical examples of scientists) (J. N. Schinske et

al., 2016a). Consequently, wherever the exposure to women scientists is low, the discriminating environment perpetuating homogenous belonging poses a barrier for women seeing their identities represented within those spaces (González-Pérez et al., 2020). Women lack having adequate role models to guide career paths, where role models are defined as individuals who provide an example of the kind of success that one can achieve, often exhibiting the behaviors needed to achieve such success (Lockwood, 2006).

Previous research showcases the importance of regular exposure to relatable scientist role models (Gladstone & Cimpian, 2021; Morgenroth et al., 2015) reviewed in (Costello, Ewell, et al., 2025). Broadly, role models with shared social or cultural identities improve students' sense of belonging and engagement in STEMM disciplines (Gladstone & Cimpian, 2021). Sense of belonging is reported as directly impacting student performance and retention (Margolis et al., 2000). Additionally, familiarity with scientists and representative role models can reduce self-stereotyping of stigmatized identities, such as women in male-dominated STEMM disciplines (Betz & Sekaquaptewa, 2012; Costello, Driessen, et al., 2025; González-Pérez et al., 2020; Lockwood, 2006; O'Brien et al., 2017). Student familiarity with examples of diverse scientists also improves students' ability to relate and creates a positive and fair impression (Fairlie et al., 2014; Marx & Roman, 2002; J. N. Schinske et al., 2016b; Steinke et al., 2009; Yonas et al., 2020). Women who have access to role models in science possess higher self-confidence, STEMM identity, and a larger network of kindred personal connections (Casad et al., 2018; Cotner et al., 2011; Drury et al., 2011; Stout et al., 2011; Van Camp et al., 2019). Due to the positive impacts that relatable scientist role models have on women students, we predicted that in biology courses, the ability to 'see oneself' in a scientist would reinforce future career commitment in STEMM fields (Plant et al., 2009; Stout et al., 2011) and mitigate negative impacts of scientist stereotypes. We define scientist stereotypes as clusters of perceived personal traits that are often applied to scientists. Stereotypes can be problematic because they often exaggerate group differences and mask within-group variability (Losh, 2010). In the context of calculus, Stout et al. (2011) found that women students with calculus professors who were women reported higher self-efficacy, STEMM identity, and commitment to STEMM, even if those students maintained negative gender stereotypes about women in math. Cheryan and colleagues (2011) argued that exposure to role models who counter traditional STEMM stereotypes positively impacts students' beliefs in their likelihood of success more than role models who match one facet of a student's minoritized identity (e.g., gender identity). For example, exposure to women scientists who embodied strong STEMM stereotypes (e.g., clothing and hobbies associated with stereotypical computer scientists) led to stronger feelings of isolation and *reduced* beliefs in the ability to be successful in STEMM for women students (Cheryan et al., 2011, 2013). Thus, engaging with successful scientists with whom students can personally relate can positively shape students' beliefs about their potential in a field, possibly mitigating other systemic barriers faced by students with minoritized identities (Costello, Ewell, et al., 2025; Gladstone & Cimpian, 2021; Lockwood & Kunda, 1997; Marx & Roman, 2002; Stout et al., 2011).

To better understand the scientists that students can identify and relate to, we collected data on 788 students within a diverse student body of biology majors across three semesters at a public, R2

university in the Southeastern United States. Specifically, we asked:

1. Which scientists can students readily name when prompted?
2. With which scientist do students personally identify, and does that scientist match the student's gender identity?
3. Why do students personally identify with their chosen scientist?
4. Is personally identifying with a gender-matched scientist associated with student science self-efficacy or science career commitment?

We hypothesized that students would be most familiar with historic and famous scientists who embody stereotypes of scientists as primarily older, white men. Because of this, we anticipated that men students would have higher rates of identification with scientists who share their gender identity, whereas women would be less likely to report personally identifying with women scientists, because of lower familiarity. We predicted that students would primarily identify with scientists based on their notoriety and fame or because of shared research interests, with few students identifying with scientists based on social and cultural identities. Finally, we predicted that women students who personally identified with scientists who were women and/or had shared scientific interests would have higher science self-efficacy and career commitment relative to students who could not personally identify, or relative to men students who already 'see' themselves in most scientists. Our study seeks to understand how student familiarity with and ability to relate to counterstereotypical scientists is associated with science self-efficacy and career commitment for women in STEMM.

Methods

Survey development and student participant pool

We developed and implemented a Qualtrics survey to be administered department-wide to students enrolled in biology courses, including biology majors and non-majors, during three consecutive semesters – Fall 2020, Spring 2021, and Fall 2021 at the university. The university is a predominantly white (~ 63%) institution, with ~ 21% Black/African American students, ~ 4% Latinx/Hispanic students, and ~ 4% Asian/Asian American students, and ~ 68% women and ~ 32% men students (Table 1). We emailed students a link to the Qualtrics survey twice during the final week of courses each semester. Student participation in the study was completely voluntary, and no monetary or class incentives were offered. 823 students completed our survey during the Fall 2020, Spring 2021, and Fall 2021 semesters. A third party (J.A.H.) de-identified the data before we analyzed the responses. Survey items and methodology were granted an exemption from full review by the university IRB, #1544421-5 to J.A.H.

Table 1

This table presents the demographic data of a public, R2 university located within the Southeastern US, and our student sample during the 2020–2021 academic year. This data was compiled by the university Institutional Research team and shows the total number of undergraduates in attendance and their self-reported demographics. The sample data was compiled based on students' self-reported gender and racial/ethnic identities.

Data Source	Academic Year	Number of Students	Male	Female	Black	Asian	Latinx	White
Institutional Data	2020–2021	9,601	32.10%	67.90%	20.60%	3.70%	4.10%	62.60%
Survey Sample	2020–2021	788	26.8%	73.2%	17.5%	7.6%	2.9%	60.5%

The survey we developed uses a mixed-methods approach, in which we combined 1) open-ended free response questions to explore student familiarity with scientists and scientists whom the student could personally identify with and why, and 2) previously validated and published quantitative affective scales. The first open-ended free response asked students to name all the scientists they could think of in two minutes. The second free response prompt asked students to name one scientist with whom they personally identify and explain why. The example could come from inside or outside of the course. One quantitative psychological factor included a science self-efficacy scale (Baldwin et al., 1999) where students rated their belief in their personal scientific abilities (Appendix 1, Table S1). The second scale was a science career commitment scale (Chemers et al., 2011), which included students' perceptions of their scientific career (Table S2). Both factors used a 5-point Likert scale ranging from not confident (1) to extremely confident (5) or strongly disagree (1) to strongly agree (5). Finally, we collected which biology courses students were currently enrolled in, as well as a broad suite of self-reported demographic information on our students, including gender identity, race/ethnicity, first-generation college student status, sexual identity, transfer student status, and commuter student status. While we recognize that there are many social and cultural identities that face barriers in entry and retention within STEMM disciplines - racial/ethnic identities, LGBTQIA+ identities, and first-generation college students, for instance – we focus solely on gender identities. We asked students to select all gender identities that applied to them, including man, woman, transgender, genderqueer, nonbinary, agender, an open-ended "my gender is:" option, or prefer not to answer (Baum et al., 2012).

Statistical analysis

All statistical analyses were conducted in R version 4.5.2 (R Core Team, 2024) and RStudio version 2024.09.2–418 (Posit Team, 2023), with packages cited where applicable. Supporting figures and tables can be found in Appendix 1.

Question 1: Which scientists can students readily name when prompted?

To determine student familiarity with scientists, we first asked students to name all the scientists they could think of within two minutes. From the list of scientists that students named, we determined the gender and race/ethnicity of each scientist and summed how many times each scientist was named by our student population (see Table 2 for the fifteen most identified scientists). Next, we summed scientists by their gender based on traditional gender expression to determine what percentage of those that students named were men, women, or Transgender and Gender Nonconforming (TGNC), independent of how many times each scientist was named. To compare the representation of our named scientists to our student demographics, we summed the self-reported student demographic data based on gender identity and calculated the percentages of men and women students. While our survey encouraged students to consider a broad array of gender identities beyond binary categories with which to identify – i.e., trans-, gender fluid, genderqueer, nonbinary, agender – these identities were rare within our student pool (~ 2%). Additionally, none of the scientists that students named were publicized to have TGNC identities, and we are uncertain of how many of the listed historic scientists self-identified. Because of the rarity of TGNC students and scientists, we chose to focus on binary cis-man and cis-woman gender identities. Future investigations will focus on role model formation and development within a broader array of gender identities. We compared scientist representation to student demographics using a Pearson's Chi-squared test using the *chisq.test()* function and the *tidyverse* package (Wickham et al., 2019). To visualize our results, we organized both student and scientist gender groupings into a mosaic plot using the *geom_mosaic()* function within the *ggmosaic* package (Jeppson et al., 2018) and *ggplot2* package (Wickham, 2016).

Table 2
A list of the top fifteen scientists named by students in their responses to name all the scientists they could think of within two minutes. Included for each scientist are the number of times listed (sum of occurrences), as well as their binary gender and race/ethnicity.

Top Scientists Listed	Name of Scientist	Number of Times Listed	Binary gender	Race/Ethnicity
1	Albert Einstein	651	Man	White/Caucasian
2	Charles Darwin	447	Man	White/Caucasian
3	Isaac Newton	405	Man	White/Caucasian
4	Gregor Mendel	206	Man	White/Caucasian
5	Marie Curie	190	Woman	White/Caucasian
6	Thomas Edison	151	Man	White/Caucasian
7	Stephen Hawking	145	Man	White/Caucasian
8	James Watson	135	Man	White/Caucasian
9	Francis Crick	125	Man	White/Caucasian
10	Rosalind Franklin	122	Woman	White/Caucasian
11	Nikola Tesla	115	Man	White/Caucasian
12	Galileo Galilei	110	Man	White/Caucasian
13	Bill Nye	77	Man	White/Caucasian
14	Benjamin Franklin	66	Man	White/Caucasian
15	Aristotle	59	Man	White/Caucasian

Question 2: *With which scientists do students personally identify, and does that scientist match the student's gender identity?*

We asked students to identify a scientist with whom they personally identify and why. First, we inspected each student's response to determine if the name they reported was a scientist. For example, we excluded names like Dr. Doofenshmirtz, Tony Stark, and Dr. Pepper. Next, we obtained the gender identity and race/ethnicity of the scientist and directly compared that to the student's self-reported gender identity to determine whether the student personally identified with a scientist or not. For students who personally identified with a scientist (n = 529, we coded whether (yes/no) a student matched the gender identity of their chosen scientists. To determine if knowledge of same-gender role models differed by student gender identity, we performed a Pearson's Chi-squared test on our coded data and visualized our results by generating a mosaic plot.

Question 3: *Why did students personally identify with their chosen scientist?*

To understand why students personally identified with scientists, we used open and thematic coding (Saldaña, 2021) to identify and organize common themes within free response questions (Braun & Clarke, 2006; Cassell & Symon, 2004). Coding was completed in a series of organized steps to ensure consistency between researchers (MTN, DLC, & JAH). All researchers reviewed the student survey responses, and by employing an inductive approach (Cho & Lee, 2014), we drafted a structured coding rubric based on common themes that emerged from the data. Then, researchers met to discuss and revise the coding rubric prior to finalization. This guaranteed that the most prominent themes were included as categories. Researchers met to code student responses using the finalized rubric. Overall, we created a rubric that organized student responses into one of seven categories: shared research interests, popularity within the media, gender, race/ethnicity, marginalization of gender/related adversity, marginalization of race/related adversity, or no reason, which encompassed responses that did not list a specific reason why they personally identified with a scientist (Table 3). Two researchers (MTN & DLC) collaboratively categorized student responses by grouping them into our categories. Researchers came to a consensus prior to organizing within a category. To determine if men and women students cited different reasons why they personally identify with scientists, we constructed a Chi-square table by summing the number of times a student gave each response as an answer, disaggregated by student gender identity. Then, we performed a Pearson's Chi-squared test to determine if there were differences between gender groupings, and we visualized our results with a mosaic plot.

Table 3
A comprehensive list of the top reasons why students personally identify with scientific role models. These generated groupings were used to categorize qualitative responses to understand why students personally identified with a scientist, as well as coded examples for each. Bolded terms represent the reason(s) for grouping the response within the specified category.

Reasons for Identifying with any Scientist(s)	**Example**
Scientific/research interest(s)	*"I think* **I personally identify with Rachel Carson** *because* **she was a conservationist** *whose work forced tighter environmental regulations.* **Her and I are alike because I want to work for the EPA one day.***"*
No reason	*"***Thomas Edison"** *Or* *"I've always been* **a big fan of Marie Curie.** *She is very inspirational to me in all that she has done."*
Marginalization of gender/related adversity.	*"I guess I would have to go with* **Rosalind Franklin** *because* **her work was defining and major, yet it was pushed aside because she was female** *and had her male counterparts take credit.* **Many women, even today, myself included, still feel the setbacks of being a woman in a** *still majorly male-dominated* **field like STEMM.***" (Female student)* *Or* *"Rosalind Franklin*, **because she didn't get the recognition she deserved**, *and I feel* **like this often happens to women** *in the world we live in today."* *(Male student)*
Recognition from media	"**Albert Einstein** *because* **he is one of the most famous scientists of all time.***"*
Gender	"**Ada Lovelace.** *The first computer programmer.* **She was a woman**, *and it was very big for a woman to do something like this.*"

Question 4: *Is personally identifying with gender-matched scientist associated with student science self-efficacy or science career commitment?*

We created two composite metrics for science self-efficacy and career commitment by calculating the mean for the 10 questions of the science self-efficacy scale (Baldwin et al., 1999) and the four questions of the science career commitment scale (Chemers et al., 2011). To understand how student gender, identities of scientific role models, and reasoning why students identified with their role model impacted science self-efficacy and career commitment, we constructed a linear analysis of variance (ANOVA) model for science self-efficacy and career commitment separately. Our models included student gender identity of those who listed a scientist that they personally identified with, whether the student had a role model that matched their gender identity, the reasons why students personally identified with scientists, and all possible interactions among the main effects as the predictors and tested for significance using the *Anova()* function from the *car* package (Fox et al., 2019).

Results

Question 1: *Which scientists can student students readily name when prompted?*

Overall, 788 students completed our research survey. 73% (577 of 788) of students identified as women, while 27% (211 of 788) identified as men. Those 788 students were able to identify 295 unique scientists – 83% (244 of 295) of those scientists were men, 17% (51 of 295) were women. Even though 7 of every 10 participating students were women, only 2 of every 10 named scientists were women, highlighting a significant mismatch in the gender identity of the student population and the gender of the scientists that those students could name ($\chi^2 = 88.47$, $p < 0.0001$, Fig. 1).

Question 2: *With which scientists do students personally identify, and does that scientist match the student's gender identity?*

Overall, 67% (529 of 788) of students named a scientist whom they personally identified with. To determine if students personally identified with scientists that matched their gender identity, we compared the self-reported gender identity to the gender of the scientists with whom they could personally identify. We found 54% (284 of 529) of students personally identified with a scientist who matched their gender identity (Fig. 2). When we disaggregate the students with same-gender role models, we found that 87% of men (129 of 149) had gender-matching role models, compared to only 41% (155 of 380) of women (Fig. 2).

Question 3: *Why do students personally identify with their chosen scientist?*

Overall, we found that only 60% (315 of 529) of students were able to name a reason why they personally identify with their scientist, leaving 40% (214 of 529) of our students providing no reason they personally identified with their scientist (Table 4). We found that 28% (146 of 529) of students personally identified with a scientist because they shared research interests with the scientist. 11% of students (59 of 529) personally identified with their scientist because of marginalization, discrimination, or related adversity faced by the scientist based on their gender, such as Rosalind Franklin. Around 10% (54 of 529) of students identified with their scientist because the scientist's popularity within the media; 8% (42 of 529) of our students personally identified with their scientist solely on the base of their gender identity. A small percentage, 2% of students (12 of 529), identified with a scientist due to their race or ethnicity, while 0.3% (2 of 529) specifically mentioned marginalization or related adversity based on race or ethnicity. Disaggregating our responses across student gender, we found that women and men identified with scientists for different reasons ($\chi^2 = 22.05$, $p = 0.0005$). For instance, 21% (52 of 247) of women students responded that they personally identified with a scientist because of their shared experiences as individuals with marginalized gender identities, compared to only 10% (7 of 68) of men (Fig. 3). Some men students mentioned they related to a woman scientist because they too faced adversity in science, though their struggle was not related to their gender. For instance, men and women personally identified with Rosalind Franklin because of the many obstacles, namely suppression of work (e.g., *"because she is often overlooked in her accomplishments"*) due to her gender or specific gender-bound barriers (e.g., *"the*

setbacks of being a woman in a still majorly male-dominated field") that she faced as a woman in STEMM. Another 17% (42 of 247) of women students identified with scientists based broadly on their gender identity, compared to 0% of men. Men (63%, 43 of 68) were more likely to report that shared research interests were the reason they personally identified with a scientist compared to women (42%, 103 of 247) (Fig. 3).

Table 4
The top reasons why students personally identify with scientific role models. These quantitative results were obtained from a question that asked students to list a scientist with whom they personally identify and why, which were categorized into seven distinct categories (Table S2).

Reason for Identifying with Scientist(s)	**N students**
No reason	214
Scientific/research interest(s)	146
Marginalization ofgender/related adversity	59
Recognition from media	54
Gender	42

Question 4: *Is personally identifying with gender-matched scientist associated with student science self-efficacy or science career commitment?*

Science self-efficacy. Overall, we found no significant effect of student gender ($F_{1,514}$ = 1.53, p = 0.22), whether students identified a scientist that matched their gender identity ($F_{1,514}$ = 0.37, p = 0.54), the reason why students personally identified with their scientist ($F_{5,514}$= 1.57, p = 0.17), or any interactions had a significant impact on students' science self-efficacy.

STEMM career commitment. We found no significant main effects of student gender ($F_{1,512}$ = 1.35, p = 0.25), whether students identified with a scientist that matched their gender identity ($F_{1,512}$= 2.74, p = 0.10), and why students personally identified with scientists ($F_{5,512}$= 1.59, p = 0.16) on a student's STEMM career commitment. However, we did find interaction between student gender and the gender of their identified scientist ($F_{1,512}$ = 5.76, p = 0.016), where women with gender-matching scientists had higher science career commitment relative to women lacking gender-matching scientists (Fig. 4). Interestingly, the opposite trend was observed in men, where men with gender-matching identified scientists had lower science career commitment relative to men who identified with women scientists.

Discussion

Perceptions and misconceptions of who *belongs* in science disciplines may deter students with stigmatized identities from STEMM (Block et al., 2019; Hurtado et al., 2010; Pascarella et al., 1997;

Weisgram & Bigler, 2007). The goal of our study was to document and analyze 1) the demographic makeup of scientists who biology students can readily identify; 2) scientists students can personally identify with and whether those scientists matched the student's gender identity; 3) why students personally identified with the scientist, if they did; and 4) how personally identifying with a scientist may impact students' science self-efficacy or science career commitment.

Finding 1: Students are less familiar with scientists with counterstereotypical identities

Within our student population, in which 7 of every 10 students were women, our students named only 1 woman scientist for every 4 men. Additionally, only 41% of women students personally identified with a woman scientist, compared to 87% of men students who identified with a man scientist. Perceptions of who can and cannot be scientists are shaped by environmental cues, and previous work shows how even subtle exposure to stereotypical representations of scientists negatively impacts students from minoritized groups (Cheryan et al., 2009). Stereotypical representations of scientists are common across television sitcoms (e.g., *The Big Bang Theory*, *Bill Nye the Science Guy*), in children's science education programs (Long et al., 2001), and in science textbooks (Damschen et al., 2005; Simpson et al., 2021; Wood et al., 2020). Our results echo previous work in which students listed examples of well-represented, stereotypical scientists when given the task on a survey (J. Schinske et al., 2015; J. N. Schinske et al., 2016b). Most scientists who students listed possessed stereotypical features (e.g., older, white, masculine) documented in the decades-old "Draw-a-Scientist" research that revealed children's (and later, adults') stereotypes about scientists (Chambers 1983, Ferguson et al., 2020). While rigid depictions of who has historically had access to science is not reflective of who can achieved success in STEMM, the prevalence of stereotypical images creates a barrier for the next generation of potential scientists.

Finding 2: Relating to a scientist matters more for students who don't 'see' themselves in STEMM

After identifying a scientist to whom they personally relate, we asked why students personally identified with that individual. In terms of differences in how women and men reported similarity to scientists, we found that men were more likely to report shared scientific research interests or familiarity from the media relative to women students. Women were more likely to note the gender of the scientist or that they shared experiences of being marginalized or discriminated against based on their gender. 21% of women students personally identified with a scientist because of the shared experience of being marginalized or discriminated against by others during their academic careers. For example, Rosalind Franklin was cited by 122 of our students. Franklin is often highlighted in college classrooms as a woman scientist who was not credited for her critical role in the discovery of the structure of DNA and was further defamed by James Watson in his hugely influential book, The Double Helix (Maddox, 2003; Watson, 2012). Over the last few decades, Franklin's role has been increasingly acknowledged, and the textured history of this discovery is commonly discussed in introductory biology and genetics courses.

The experiences of Franklin clearly resonated with many of our students in the present study. For instance, one student wrote that she identifies with Franklin because "*Rosalind worked so hard, but it went unnoticed until later on, and sometimes that happens to me, I go unnoticed until they realize I was right...*" Another student wrote that women are "*not treated with as much respect or taken seriously*" in her STEMM courses. Schultheis et al. (Schultheis et al., 2024) explored how students related to counterstereotypical scientists featured in their course materials. They reported that undergraduate biology students connected with scientists' research, visual identities, and personal stories, and the nature of these connections depended on the kind of information students received about the scientists. In this experimental research, when a curricular activity featuring a scientist provided no personal details or only a photograph, more students did *not* relate, and those who did relate typically connected through the scientists' research alone. In contrast, when the activity included personal information along with photos and a research description, students were twice as likely to feel connected to the featured scientist and did so in a greater variety of ways. Future work will profit from experimental approaches in presenting scientist role models to prompt relating, engagement, and career motivation among students in STEMM (Chen & Rosenzweig, 2026; Schultheis et al., 2024).

Finding 3: Women exposed to scientist role models reported higher commitment to STEMM career

Among the women we surveyed, higher commitment to pursue a STEMM career was positively associated with listing a woman scientist as someone with whom they personally related. As our results are correlative, rather than causal, we cannot assert that the presence of a potential role models leads to higher retention for women. However, previous work underscores the importance of perceiving academic similarity to STEM role models as a predictor of college students' STEM career motivation. Chen and Rosenzweig (2026) explored how college students perceived similarity to "STEM career role models" and how their perceptions predicted career motivation in STEM. They identified several ways of relating to role models (e.g., academic paths, personal challenges, or demographic identity). In examining gender-based differences in how students perceived similarity to their STEMM career role model, they found women reported greater perceptions of similar academic efforts to STEMM role models than did men (Chen & Rosenzweig, 2026). Ryder-Burge (2010) demonstrated that, for women only, the decision to major in a STEMM field increased when students' identities matched their perceptions of scientist identities. Additionally, students who identified with one or more scientist with counterstereotypical identities at the beginning of a semester were more likely to pass the class than students who did not (J. Schinske et al., 2015). While we do not know the directionality of those influences (i.e., better prepared students might be more likely to list counterstereotypical scientists), the association suggests beneficial outcomes for those who are exposed to scientists with whom they can identify (Costello, Ewell, et al., 2025). In agreement with these results, after distributing parallel surveys gauging self and scientist identity to black men undergraduates, Guy (2013) found that those who listed more similarities between self and scientist identities reported a greater likelihood of intending to pursue careers in STEMM. While greater sweeping structural changes within the STEMM enterprise are required to recruit and retain

individuals with marginalized identities, and we acknowledge that simply having access to identity-matching role models will not ensure benefits (Cheryan et al., 2011, 2013; Olsson & Martiny, 2018), scientist role models are likely associated with beneficial outcomes for students who do not regularly see themselves in science. Taken together, our findings suggest the potential of including intentional, active interventions that highlight scientists from a wide array of backgrounds could yield positive benefits for students.

What can instructors do to broaden student perceptions of who does science?

In efforts to re-envision representation of scientists in teaching materials, classrooms have integrated emerging tools that highlight scientists in introductory biology (see Costello, Ewell, et al. 2025; Simpson et al. 2021; such as Project Biodiversify (Zemenick et al., 2022); www.projectbiodiversify.org), Scientist Spotlights Initiative (Aranda et al., 2021; J. Schinske et al., 2015; J. N. Schinske et al., 2016b); https://scientistspotlights.org/), BioGraphI (Yang & Pigg, 2022), Data Nuggets (Kjelvik & Schultheis, 2019; Schultheis et al., 2023), DataVersify (Costello, Driessen, et al., 2025; Schultheis et al., 2024), Story Collider Podcast (Yonas et al., 2020), 500 women scientists (https://500womenscientists.org/), and 500 queer scientists (https://500queerscientists.com/). Diversifying the STEMM workforce will require a multi-pronged approach with structural and system-wide changes to support diverse student identities (AAAS 2024). Offering opportunities for students to learn about diverse scientist identities can be is one way instructors can support these efforts.

Limitations

We acknowledge several limitations of this study. By using open-ended questions in our survey, we were able to collect a wide array of student responses. However, some students did not specify the first name of a listed scientist or noted only the name of the scientist with whom they personally identified, rather than including an explanation of why. Many students did not personally identify with or list any scientists. For these students, it is difficult to discern whether they chose not to participate in the study question or if they could not relate to any scientists. Our university is relatively small with a predominantly white, women student population. Therefore, it is possible that we may not have collected a large enough sample size or a diverse sample size across gender identities or races/ethnicities reflective of the typical student demographic in attendance at universities across the United States.

Declarations

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Ethics declarations

The authors report there are no competing interests to declare.

Data availability statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Removed from anonymized manuscript.

Author Contribution

C.J.B., S.R.B. and J.A.H conceived the idea; A.E.B., C.J.B., A.N.J. and J.A.H conceived and constructed the survey questions, M.T.N, C.J.B, and J.A.H developed the project framing; M.T.N, D.L.C, D.N.C, B.H.M, L.R.C., K.M.C. performed all open-ended coding; M.T.N. and J.A.H. performed all statistical analyses, M.T.N. and D.L.C. shared authorship on the first draft. All contributed to the revisions of the first draft to final manuscript.

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Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

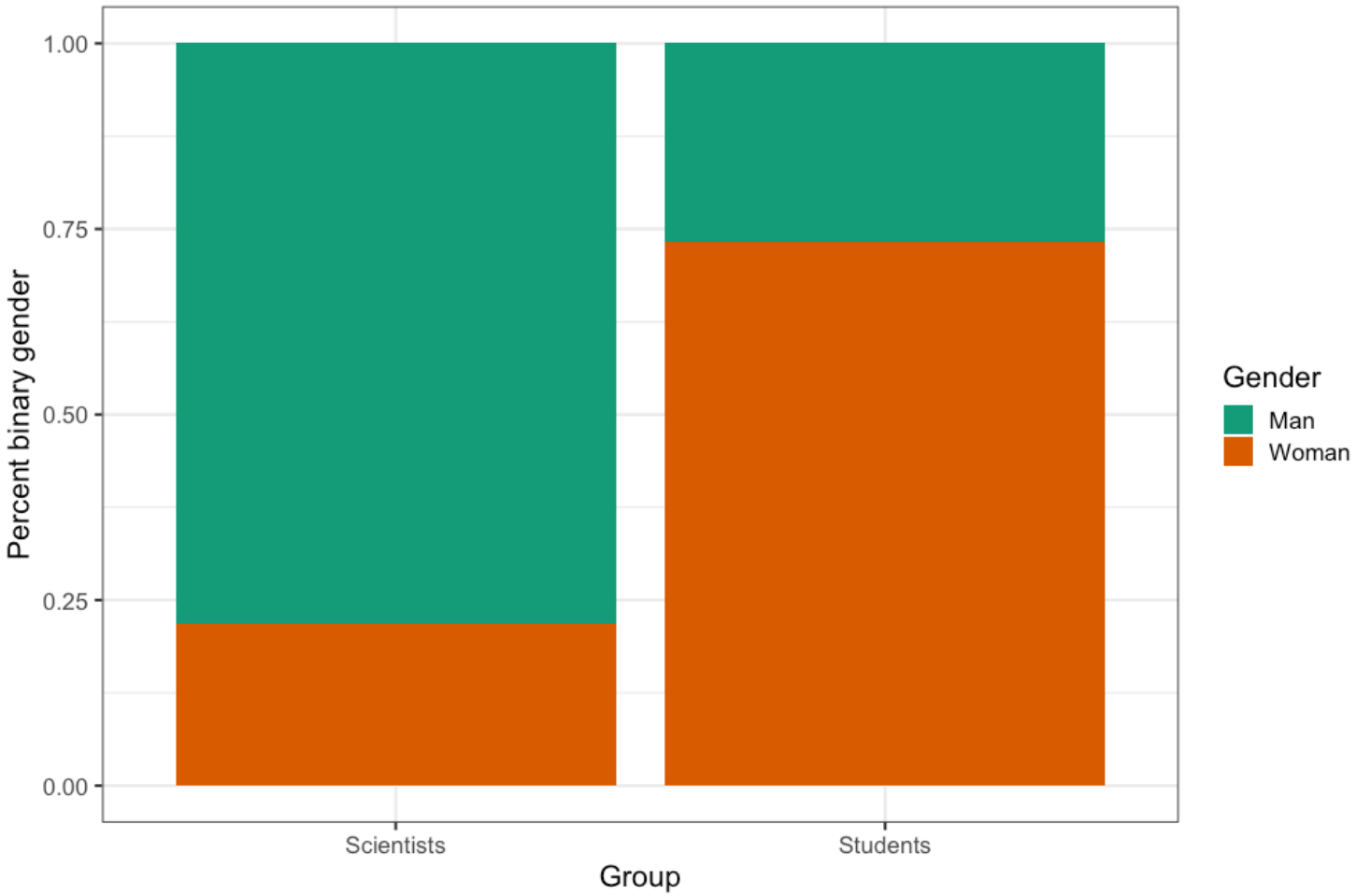


Figure 1

Self-reported gender of undergraduate students included in our sample who were enrolled in biology courses at the university during survey administration (Students) and the binary gender of scientists that students named in a survey prompt (Scientists). Binary gender options included cis-man (green) and cis-woman (orange). Gender-expansive students were excluded from the visualization of this analysis due to a low sample size and the lack of gender-expansive scientific role models mentioned.

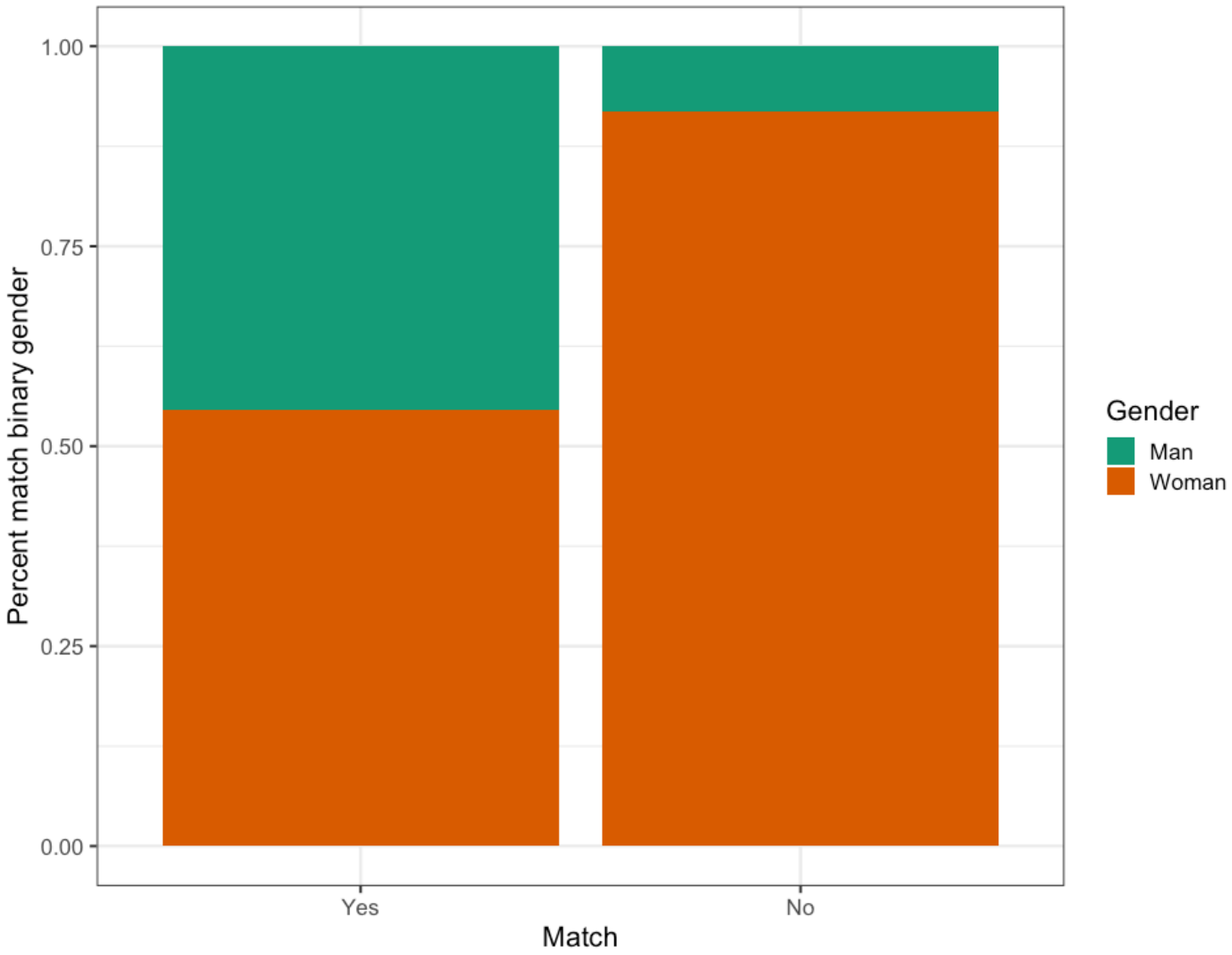


Figure 2

When asked to name a scientist with whom an undergraduate could personally identify, the binary gender of those scientists either matched the student's binary gender identity (Yes) or did not match their gender identity (No). 87% of cis-men respondents (green) gender-matched the scientist they named (comparing men that matched versus men that did not match), but only 41% of cis-women respondents (orange) matched the scientist they named (comparing women that matched versus women that did not match). Gender-expansive students were excluded from the visualization of this analysis due to a low sample size and the lack of gender-expansive scientific role models mentioned.

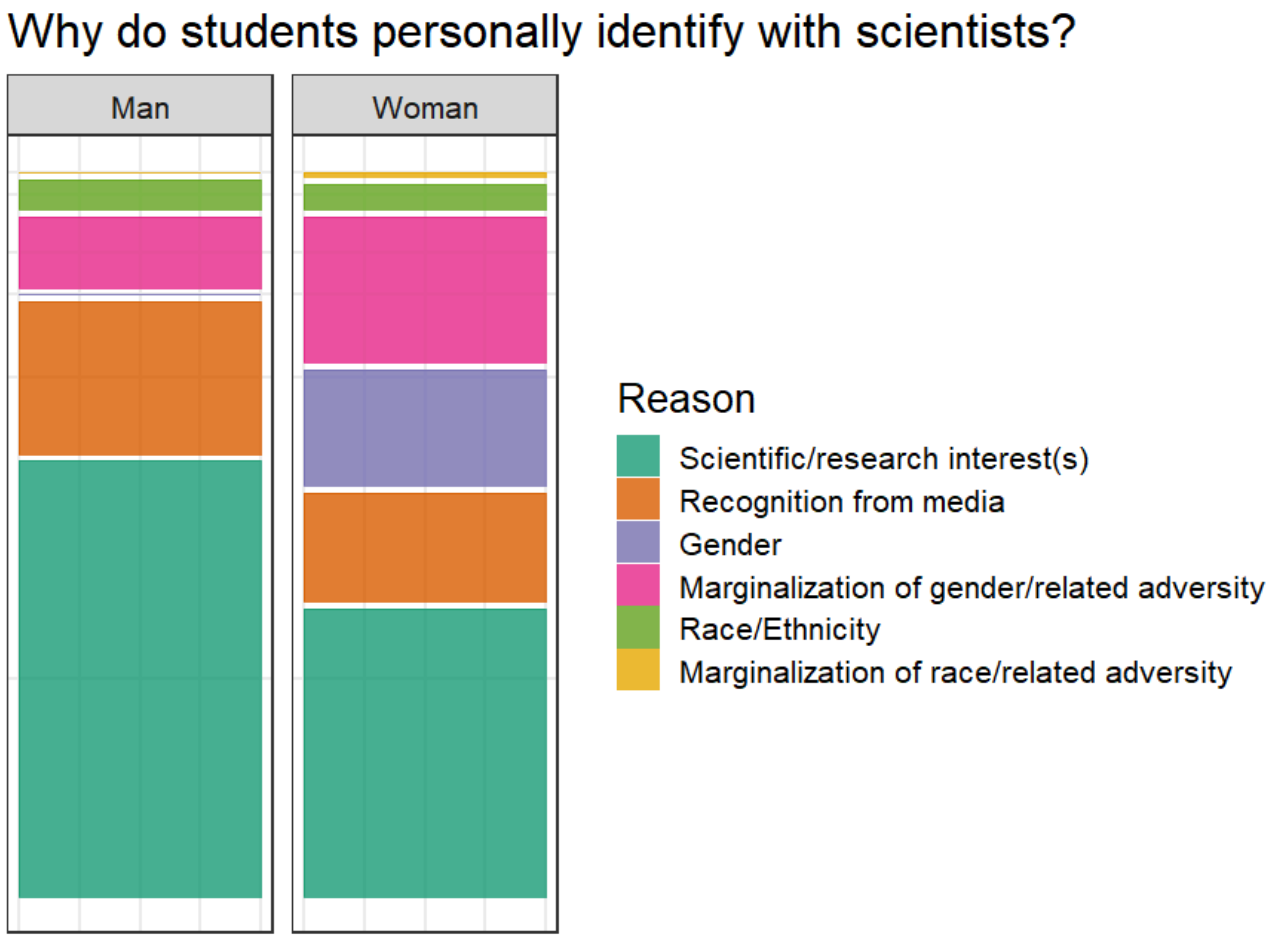


Figure 3

Reasons why undergraduate biology students (cis-men, left; cis-women, right) personally identified with scientists. Gender-expansive students were excluded from the visualization of this analysis due to a low sample size and the lack of gender-expansive scientific role models mentioned.

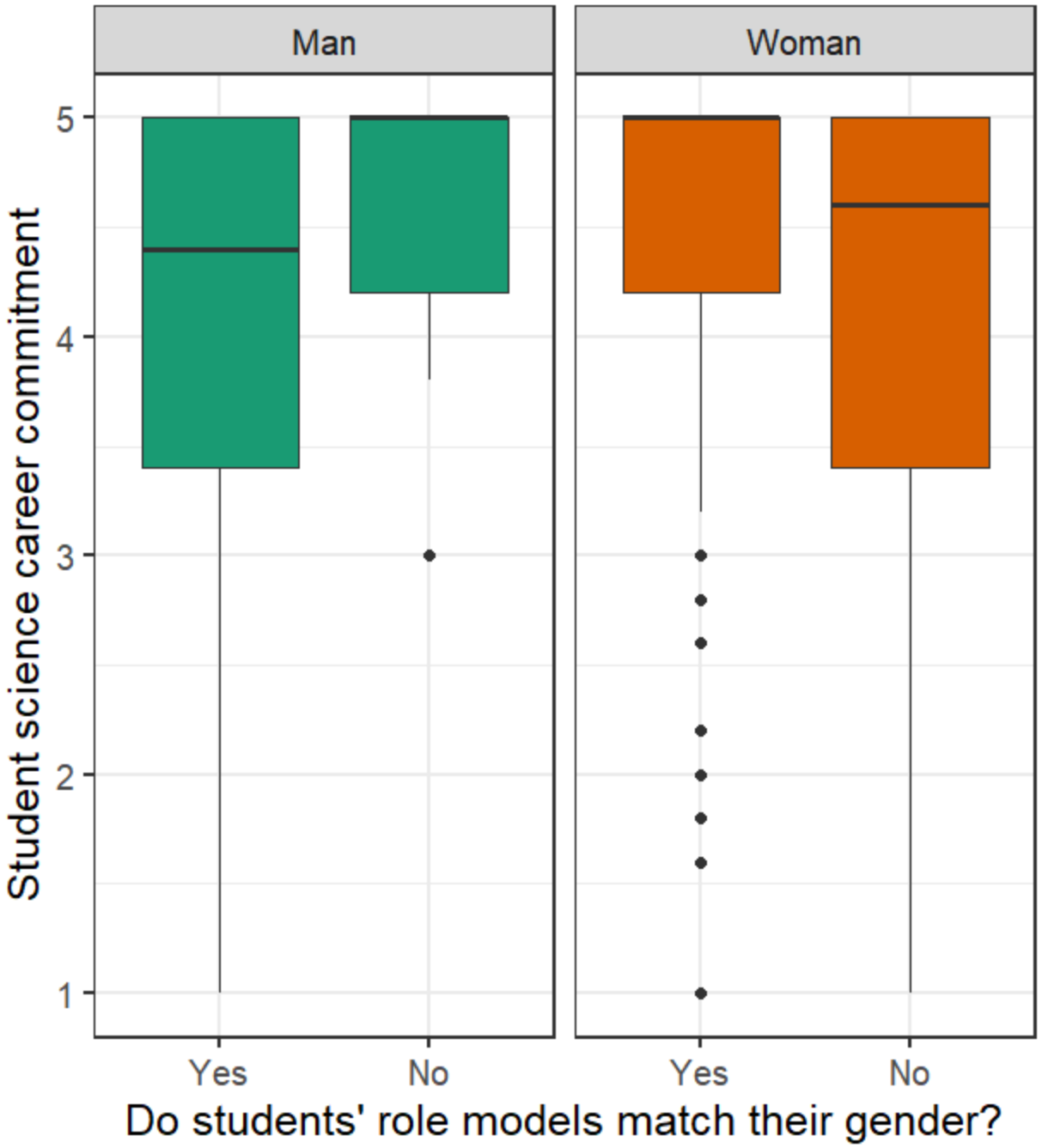


Figure 4

Science career commitment across gender groupings (cis-man, green; cis-woman, orange) and across students who had a scientist they personally identified with that matched their gender identity (Yes) or not (No). Gender-expansive students were excluded from the visualization of this analysis due to a low sample size and the lack of gender-expansive scientific role models mentioned.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix110.17.25Final1.docx