Sociology 1104: Higher Education: Institutions, Inequalities and Controversies
Final Paper

Investigating Classroom EcosySTEMs:
How Diversity of STEM Teaching Staff Impacts Students

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Abstract

Despite the diverse gender, racial, and socioeconomic backgrounds of Harvard students studying Science, Technology, Engineering, and Math (STEM), the demographics of professors who teach these STEM courses are still predominantly white and male. Previous researchers and educators have shown that largely due to stereotype threat (stereotypes associated with academic outcomes of a particular race or gender), a student's racial and gender identity directly influence their perception of ability and resulting performance in STEM fields. Additionally, educators—including at the Bok Center for Teaching and Learning at Harvard—have demonstrated how inclusive teaching practices can instill in students greater confidence to achieve in the immediate classroom setting and increase their sense of belonging in STEM. However, much less is known about how the gender and racial identity of the teaching staff affects students. My research focuses on this question: How does gender and racial diversity of teaching staff in STEM courses at Harvard affect students' classroom experience and beyond? Through quantitative survey results, I found that students who shared either a gender or a racial background with their STEM teaching staff had an improved immediate classroom experience and felt a higher sense of belonging in that STEM department than students who did not share such a background with their STEM teaching staff. Students who shared a gender background with their professor were also more likely to view their professor as a role model. These sentiments were further explored in my interviews with students. Students felt that it was important to have STEM instructors of a shared background because they believed these instructors innately employed better teaching strategies to accommodate students of different backgrounds, were more empathetic to minority students' struggles and increased their sense of departmental belonging, and also served as strong role models and "future selves" for students of diverse backgrounds. My results show that there is an urgent need for increasing the diversity of STEM teaching staff at Harvard: doing so improves students' classroom experiences and sense of belonging, while prolonging such a process would be detrimental to all students.

I affirm my awareness of the standards of the Harvard College Honor Code.

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Introduction

Last semester, I walked into Science Center C for the first day of a physics lecture. The course was an introduction to mechanics course taught with an engineering/computer science focus. As I looked around the room, the mix of about 100 students included freshmen and sophomores interested in engineering, as well as a couple of juniors like myself that were finishing up the last of the large science courses for our concentration in biology. Although the gender breakdown of students wasn't entirely 50-50, I was glad to see a healthy number of female students interested in physics and engineering. It was already a huge step up from my high school physics class where I was one of two females in a class of all male students.

Then the professor began to speak. He, a 60-year-old white male, introduced the course and the teaching staff by having them stand up, one by one. My heart sank as one by one, all six TFs that stood up, besides one female lab TF, were male grad students. I felt discouraged that the diversity—particularly in gender—that I witnessed on the student end was not reflected by the demographics of the teaching staff. Although this lack of diversity was not entirely surprising to me (I had previously taken STEM courses where there were more male than female TFs), it was the first course where the gender disparity in teaching staff was so stark. Throughout my junior spring, I developed a heightened awareness to the potential effects of this lack of gender diversity in teaching staff. I saw how female physics students were reticent to ask questions to the professor or other male TFs for fear of "sounding dumb." The professor's way of dismissing some questions during lecture only made it worse. I saw how the most well attended office hours were those held by the sole female lab TF—students crowded around her as she patiently explained concepts where other TFs would have incorrectly assumed prior knowledge. Particularly, female students (including myself) gravitated towards her—she was, after all, the one member of the teaching staff who looked most like them.

My firsthand witnessing of the lack of teaching staff diversity in many STEM courses has led me to my research question for Sociology 1104: How does gender and racial diversity of teaching staff affect the quality of students' learning experience in STEM courses at Harvard? I am particularly curious to investigate what factors students prioritize about their learning experience and be able to analyze to what extent teaching staff from different gender and racial backgrounds are able to meet students' criteria for what makes a good learning experience. Then, I want to investigate whether gender or race of teaching staff has an effect on students'

perseverance or continued interest in the subject—do students of different diverse backgrounds who learn from more diverse teaching staff feel more compelled to believe in their own abilities to excel in the subject matter, or more excited to continue taking courses in that particular field?

I plan to focus my research on STEM courses because many STEM courses have large enough numbers of teaching staff to be categorized as having "more or less" diverse teaching staff. Additionally, previous studies have shown that teaching staff diversity has a high impact on students' interest in science and math but that teaching staff diversity is not as important in humanities subjects for impacting students' interest. I hope that my findings will be able to shed light on Harvard's science and math departments and potentially be able to shape those departments' hiring processes of teaching staff, in order to best encourage students' interest and positively impact students' learning experience.

Literature Review

Previous studies and literature about student diversity in higher education have direct implications tied to my research project. Researchers in the past have investigated how gender and racial identity and stereotypes of different identities have a direct effect on students' performance. Stereotype threat, a phenomenon introduced in Claude Steele's *Whistling Vivaldi,* explains that students that are invested in doing well in college often underperform solely because of the stereotypes associated with academic outcomes of their particular race or gender. They feel extra pressure to overcome these stereotypes, but in feeling this pressure, actually do worse than they would otherwise. For example, Steele found this to be true by studying women taking math tests and black students taking a verbal reasoning test. And this phenomenon could be reversed—when these same students were told before the test that on *this particular test*, either women or black students did just as well as male or white students, their level of performance increased and even surpassed that of the dominant demographic group. This demonstrated that once the feeling of needing to overcome the dominant stereotype was removed, both women and black students performed equally as well as other students (Steele, 2010: 39, 51).

Another study engaged first-year minority students in an exercise where they read personal essays of older students who struggled with belonging at college but eventually grew confident in their belonging over time. The message conveyed to these students was that adversity experienced was common and transient. Students that received this intervention went on to perform as well academically as their white peers, while minority students that did not receive the intervention performed more poorly (Walton and Cohen, 2011: 1448). Certainly, race and gender stereotypes play a role college students' immediate classroom performance, and these differences can be addressed with specific interventions encouraging greater sense of belonging.

Not only does identity impact a student's immediate performance, but it is also correlated with a student's persistence in the STEM field. In a study that tracked a cohort of bachelor degree-seeking students over six years, women switched at a much higher percentage (32.4%) out of STEM fields than men (25.5%). When the same study looked at racial demographics, the difference was even more stark—36% of black students switched out of STEM fields, as compared to 28% of white students (Chen and Soldner, 2013: 18). The role of the teaching staff has been demonstrated to be key to changing some of these trends for women in STEM. A study showed that female students who had female professors as opposed to male professors in STEM courses were more likely to continuously participate in class, ask for help outside of class, develop more positive implicit attitudes towards the STEM field, self-identify more strongly with the field, and felt more efficacious about their current and future ability to succeed in the STEM field. Male students did not seem to be affected as much by the gender of the professor, indicating that the same-sex matching of professor to student was much more important to role modeling for female students than male students (Stout et al., 2011: 268). It seems from these studies that diversifying faculty is of great benefit to students in STEM fields. However, while diversity in the PhD pool has increased greatly, the number of tenured faculty from underrepresented backgrounds is still very few (Hopp, 2017). Some bold changes to hiring practices may be needed in order to accelerate this process, and Gibbs argues that it is entirely possible to achieve parity of faculty diversity within one tenure cycle if administrators do make substantial effort during hiring to diversify.

While past literature has shown that racial and gender identity is important in influencing a student's classroom experience and interest in persisting with their STEM field of study, there is still a large information gap about how intersectionality of race and gender in faculty demographics affects students' classroom experience and beyond in STEM. I plan to use my research to fill in some of this information gap. Based on what has already been studied, I predict that the gender and race of a teaching staff member will have a higher impact on the sense of belonging and persistence in the STEM field for female and minority students, respectively. I predict that both a female and/or minority student's sense of belonging in the classroom and in the STEM field at large will increase if they can identify more with their teaching staff (e.g. female and/or ethnically matched TF or professor).

Summary of Research Question

How does gender and racial diversity of teaching staff in STEM courses at Harvard affect students' classroom experience and beyond? I plan on answering this research question by asking three subquestions:

1. How does diversity of teaching staff impact students' immediate classroom experience in STEM courses?

2. How does diversity of teaching staff impact students' desire to pursue that particular STEM field?

3. How does diversity of teaching staff impact the students' ability to find role models or mentors in STEM fields?

Methods

Survey Recruitment and Respondents

My first method of data collection involved sending a Qualtrics survey via email for students to take. To optimize for Maximum Variation sample set, I sent the survey to students living in Leverett, representing the maximum variety of potential perspectives on STEM

experience. I originally planned to reach out to the Women's Center and other cultural groups like OAASIS (Asian Women's affinity group) and ABHW (Association of Black Harvard Women) to ensure that I drew insight from students of gender and ethnically diverse backgrounds. These respondents would be important for my Critical Case and Theory Based samples, since their responses would provide compelling insight about the effect that diverse teaching staff has on diverse students' experience and would help me to develop a theory of why that is so. However, I found that my survey respondents over the Leverett mailing list already represented diverse ethnic and gender demographics, allowing me to use just those survey respondents for data analysis.

In total, 49 students responded to my survey, representing an estimated 10% of students living in Leverett who had had prior experience in a STEM course at Harvard. Out of the 32 respondents who recorded complete demographic information, 21 (65%) were female, 10 (31%) were male, and one respondent identified as genderfluid. 25 (78%) of respondents were STEM concentrators while 7 (22%) of respondents were not. 16 (50%) of respondents were white, while 16 (50%) of respondents were of a minority racial identity. Finally, 13 (41%) of respondents were first-generation college students, while 19 (59%) were not. Below is a table of the survey respondents' demographics.

Gender	**Female**	**Male**	**Other (genderfluid)**			
	21	10	1			
Concentration	**STEM**	**Non-STEM**				
	25	7				
Race	**White**	**Asian**	**Black/African American**	**Hispanic/Latino**	**Native Hawaiian/Pacific Islander**	**Other**
	16	8	2	1	1	1
First-gen status	**First-gen**	**Non first-gen**				
	13	19				

Survey Content

After consulting with Marty Samuels, Associate Director for Science at the Bok Center, I allowed students to choose which STEM class they wished to focus on in the survey. In the survey, I asked questions related to 1. Students' immediate classroom experience, 2. Sense of belonging in that STEM department/continued interest in the field, 3. Role models and

mentorship.[1] At the very end of the survey, I collected demographic information of the student (race, gender, first-gen status) and also collected demographic information of the teaching staff (professor and TF) of the particular course the student was referring to. By collecting this information at the end of the survey rather than the beginning, I hoped to avoid Question Order Bias and Confirmation Bias. Students will not be primed to thinking about their identity when answering the survey questions, since that may cause them to change their results slightly, so ordering the demographic information at the end is critical for ensuring that students are delivering honest feedback about the course experience. I hoped that by sampling enough of different student demographics and by not having race or gender be front of mind for the student taking the survey, I could shield the research from Confirmation Bias. I had a hypothesis going into the research about the effect that diversity of teaching staff may have on students' learning experience, but I did not want that hypothesis to get in the way of unbiased data collection. Finally, at the very end of the survey, I asked students that were interested in speaking to me further about their experiences to include contact information so I could reach out at a later date for a focus group interview invitation.

To ensure confidentiality of students, I only recorded demographic information and not names, unless the student consented to providing me their email and was willing to be interviewed further.

Focus Group Interview Methods

For the in-person focus group interview, I focused on more freeform discussion of a student's experience in order to get to the "**Why**?" of what caused a student to have either a positive or negative experience in their STEM course. The first questions of the interview were structured to be non-directive, in order to protect my research from Confirmation Bias: I only asked students to elaborate of the diversity of the teaching staff if they first brought it up in a response to a question.

[1] My motivations for investigating role models originated from a paper written by Stout et. al demonstrating that female students were more likely to identify female professors as role models, and also from conversations about survey content design with Noelle Lopez and Marty Samuels at the Bok Center.

I conducted two focus groups, interviewing seven students in total, and audio recorded the entire interview with the students' permissions. At the end of each of the two focus groups, I also asked students to record an optional short video talking either about **why** they felt having a diverse teaching staff was important or elaborating on an especially insightful point they had made earlier in the interview. My goal for conducting in-person focus groups was to collect as many soundbytes of student experience as possible and to complement the quantitative survey results with qualitative data that could be presented on screen and shared in the final paper.

Schematic of Data Sources and Questions

How does gender and racial diversity of teaching staff in STEM courses at Harvard affect students' classroom experience and beyond?

Sub-questions	Data sources
How does diversity of teaching staff impact students' immediate classroom experience in STEM courses?	• Survey Questions 1-4 • Interview Questions 1-5
How does diversity of teaching staff impact students' sense of belonging or desire to pursue that particular STEM field?	• Survey Questions 5-6 • Interview Question 6
How does diversity of teaching staff impact the students' ability to find role models or mentors in STEM fields ?	• Survey Question 7 • Interview Questions 7-8

**See Appendix for complete list of Survey and Focus Group Interview Questions

Results

How does diversity of STEM teaching staff impact students' immediate classroom experience?

To look at immediate classroom experience, I asked students how comfortable they were asking questions in lecture and in section—the more comfortable they felt asking questions in the classroom environment, the better their classroom experience. I defined Complete Mismatch as both gender and race mismatch between teaching staff and student, and Complete Match as both gender and race match between teaching staff and student.

First, I found that students as a whole were less comfortable asking questions to their professor in lecture than they were asking questions to their TF in section—82% were

uncomfortable asking questions in lecture, while only 14% were uncomfortable asking questions in section (Figure 1A vs Figure 2A). I found that students who had the same gender or racial background as their professor were more comfortable asking questions in lecture (Figure 1B) than students who did not (Figure 1A), as shown by the increase in "Extremely comfortable" or "Neutral" pie graph sections.

Figure 1A

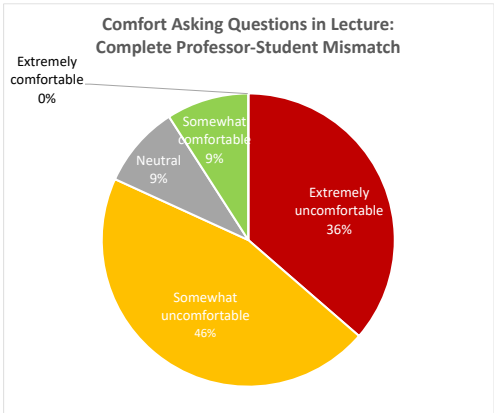

Figure 1B

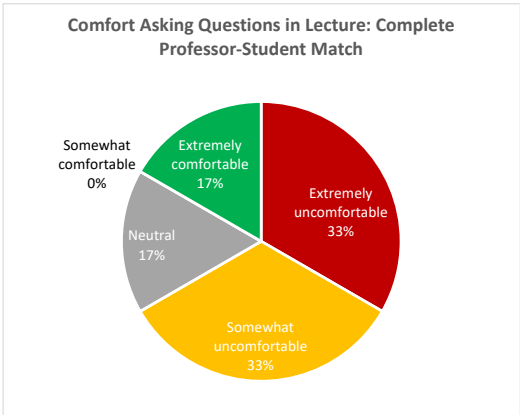

Figure 1: Students whose gender and race matched that of their professor (B) were more comfortable asking questions in lecture than students of a mismatched background to their professor (A).

Additionally, when students shared the same gender and racial background as their TF, there were no students that were "Extremely uncomfortable" asking questions in section (Figure 2B) as compared to 14% of students who did not share the same gender and racial background as their TF (Figure 2A).

Figure 2A

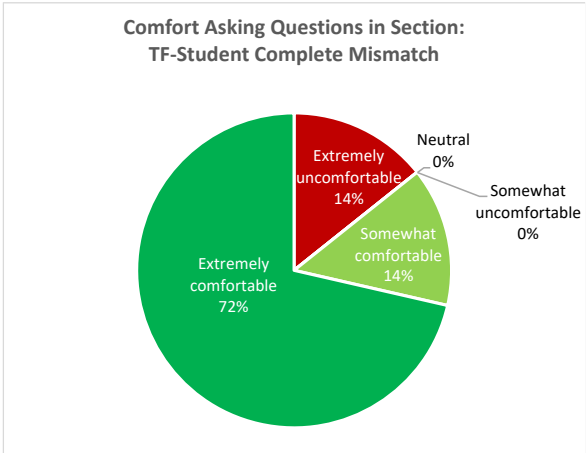

Figure 2B

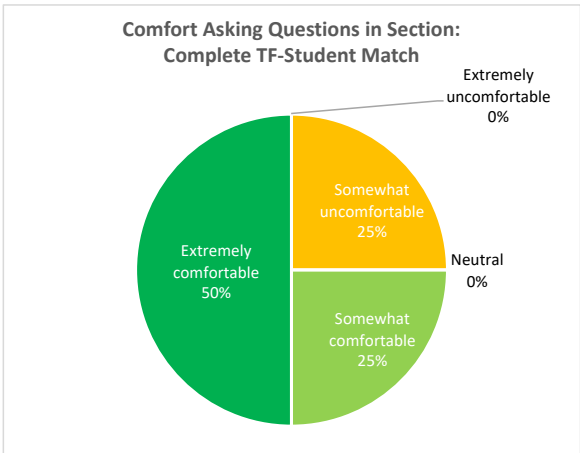

Figure 2: Students whose gender and race matched that of their TF (B) were more comfortable asking questions in section than students of a mismatched background to their TF (A).

Looking at the effects of gender alone, I found that students were more comfortable asking questions in lecture (Figure 3) and in section (Figure 4) when the gender of their professor or TF matched their own. It is important to note that the majority of gender mismatches in professor-student were between male professor and female student (85% of gender mismatches in Figure 3A), and the majority of gender mismatches in TF-student were also between male TF and female student (93% of gender mismatches in Figure 4A). This suggests that most of the discomfort of asking questions in lecture or in section can be attributed to the discomfort a female student feels asking a male professor or TF a question.

Figure 3A

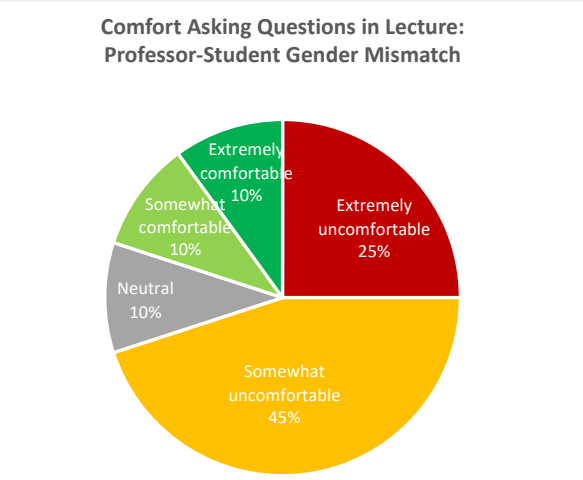

Figure 3B

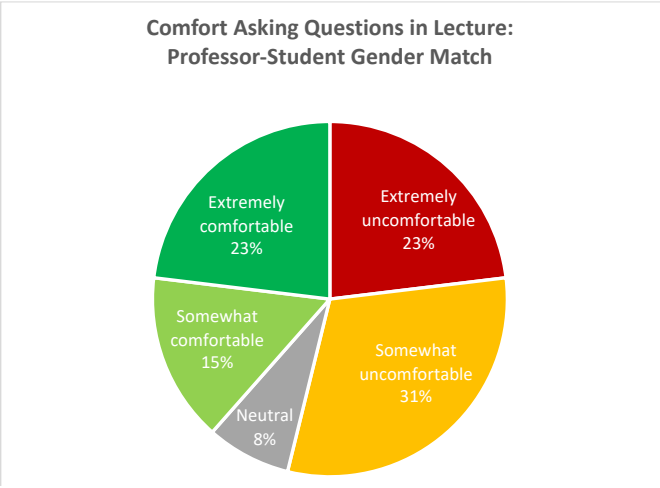

Figure 3: Students whose gender matched that of their professor (B) were more comfortable asking questions in section than students of a mismatched gender to their professor (A).

Figure 4A

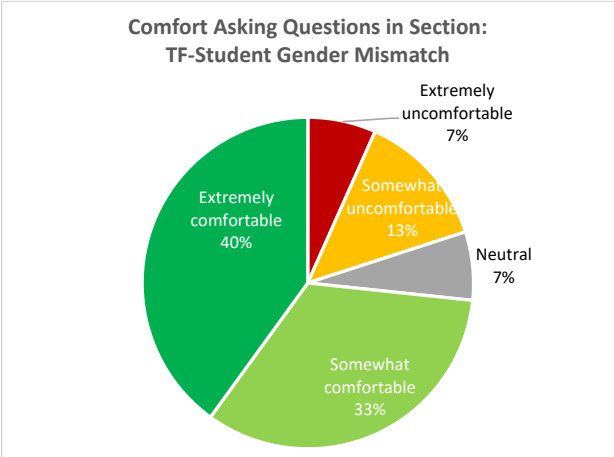

Figure 4B

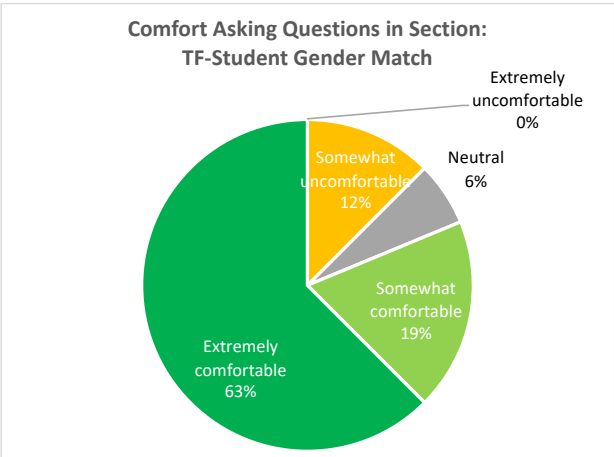

Figure 4: Students whose gender matched that of their TF (B) were more comfortable asking questions in section than students of a mismatched gender to their TF (A).

In my focus group interviews, students spoke to the reasons why they felt more or less comfortable asking questions. One female student cited that after asking a question to a male physics professor, "He would…come close and look down upon you…he would just say, well, I don't know, what do you think? And like there's this power dynamic with the person basically telling you that you just don't have the attitude…I think the entire class had this vibe of condescension." Another female student also spoke about the difficulty she experienced asking questions in a math course where she was the only female student: "I felt like I was always the only one asking questions though some people were just as confused as I was. And I kept asking [the professor] to please be more clear because I just can't understand anything he's saying. And he had to go over the same lecture four times. I thought, I know this isn't even dumb, but [he] just makes me feel that way. And I ended up just dropping the class because I'm not getting anything out of this." In these two experiences, female students felt that gender power dynamics and the condescending environment that their male professors created were detrimental not only to their learning experience but to the atmosphere of the entire class.

How does diversity of STEM teaching staff impact students' sense of belonging in the STEM department?

To assess for students' sense of belonging, I asked students the question, "How much do you feel you belong in the department where the course was taught?" I first compared the experience of minority students who had white professors with minority students who had minority (non-white) background professors and found that minority students who had minority professors felt significantly higher sense of belonging (80% stated either "A great deal" or "A lot") in that STEM department than minority students who had white professors (only 34% stated either "A great deal" or "A lot") (Figure 5).

Figure 5A

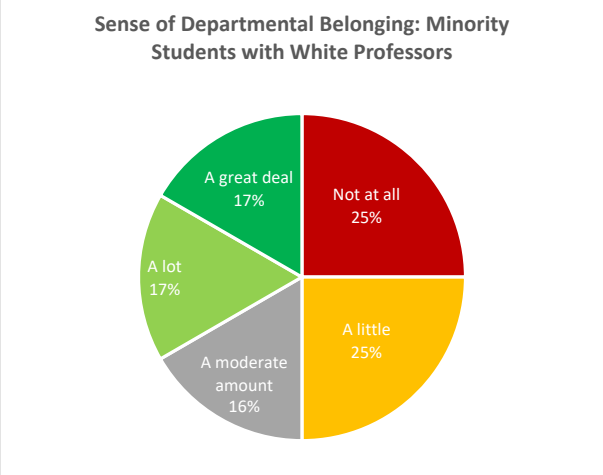

Figure 5B

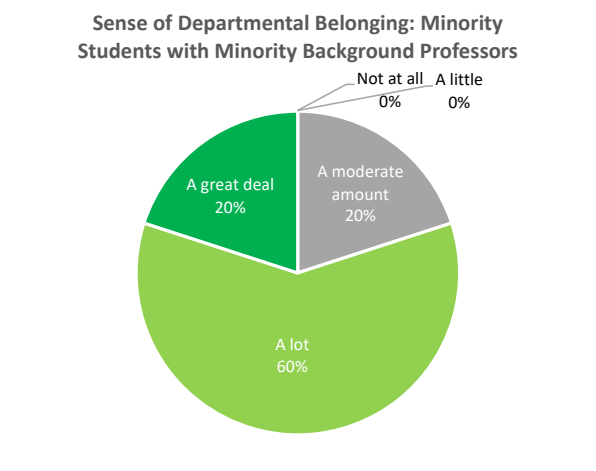

Figure 5: Minority students who had a minority background professor (B) felt significantly higher sense of belonging in the STEM department than minority students who had a white professor (A).

I then found that minority students who had a white professor but a minority background TF also felt a significantly higher sense of departmental belonging (50% stated either "A great deal" or "A lot") than minority students who had a white professor and a white TF (only 26% stated either "A great deal" or "A lot") (Figure 6).

Figure 6A

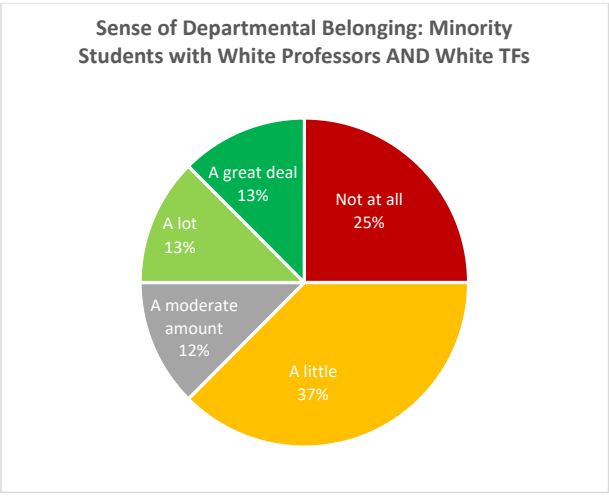

Figure 6B

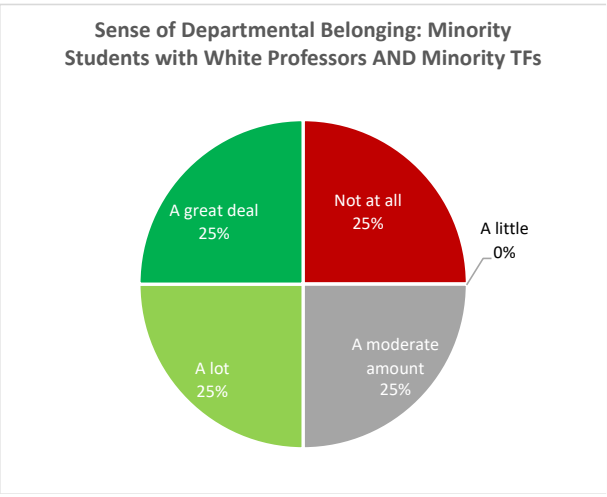

Figure 6: Minority students who had a white professor and minority TF (B) felt significantly higher sense of belonging in the STEM department than minority students who had a white professor and a white TF (A).

To determine whether white students' sense of belonging was impacted by race of the professor, I then compared white students who had a minority background professor with white students who had a white professor and found that there was no significant negative effect on sense of belonging for white students taught by minority background professors (Figure 7).

Figure 7A

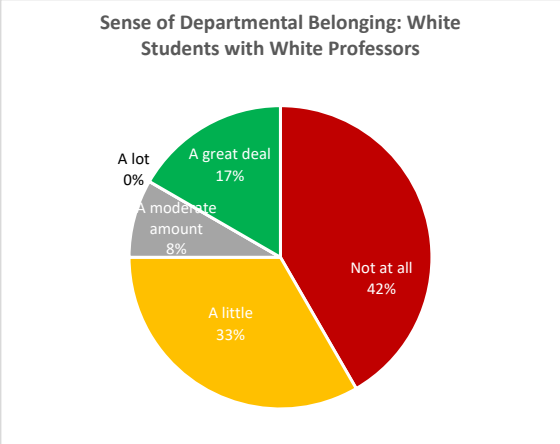

Figure 7B

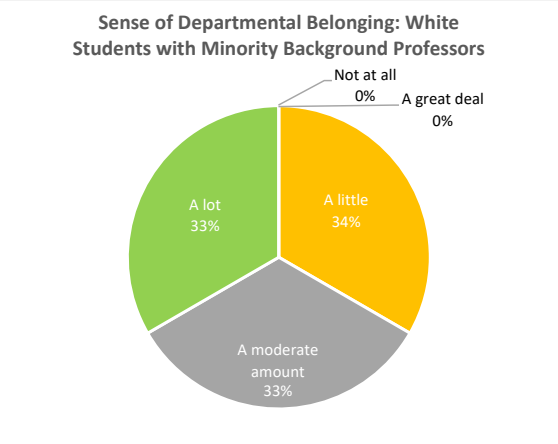

Figure 7: White students who had a minority background professor (B) did not have a lower sense of belonging in the STEM department than white students who had a white professor (A).

Finally, I found that first-gen college students felt a significantly higher sense of belonging in the department when they were taught by minority background professors (75% stated either "A great deal" or "A lot") than by white professors (22% stated either "A great deal" or "A lot") (Figure 8).

Figure 8A

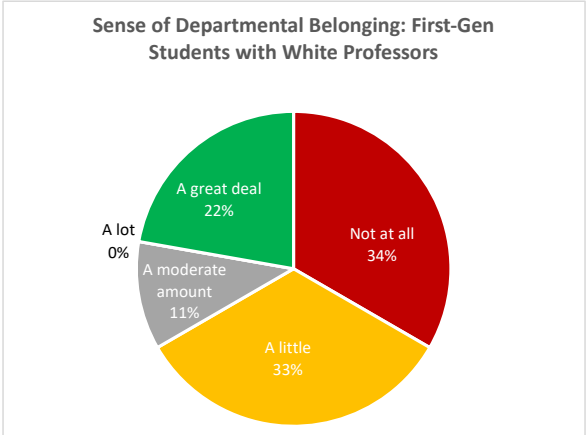

Figure 8B

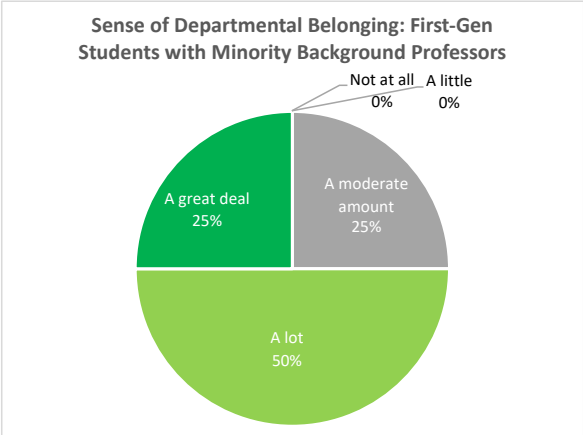

Figure 8: First-gen students who had a minority background professor (B) felt significantly higher sense of belonging in the STEM department than first-gen students who had a white professor (A).

In talking about the importance of minority background professors, focus group interviewees often alluded to specific ways in which these professors excelled at making students of all backgrounds feel included and like they belonged in the field. Interviewees mentioned that minority background professors had a "greater sense of empathy" for what a student might be going through and could "proactively anticipate and address" issues that a minority background student may be facing in the department. A first-gen student interviewee said that his concentration advisor, who was also first-gen, was great at "putting himself in students' shoes." When asked whether or not students felt a white professor could successfully create the same sense of belonging, a student said, "I think it's possible, but not probable in real life."

How does diversity of STEM teaching staff impact students' ability to find role models in STEM fields?

I found that 75% of students who completely matched the gender and race of their professor viewed them as a role model, as compared to only 27% of students who completely mismatched the gender and race of their professor (Figure 9, Row 1 and 6). Looking at gender separately, I saw that 77% of students of the same gender as their professor viewed them as a role model, as compared to only 26% of students whose gender did not match that of their professor (Figure 9, Row 4 and 5). Looking at race separately, I did not see a significant difference in ability to find role model between students who shared a racial background with their professor and students who did not (Figure 9, Row 2 and 3).

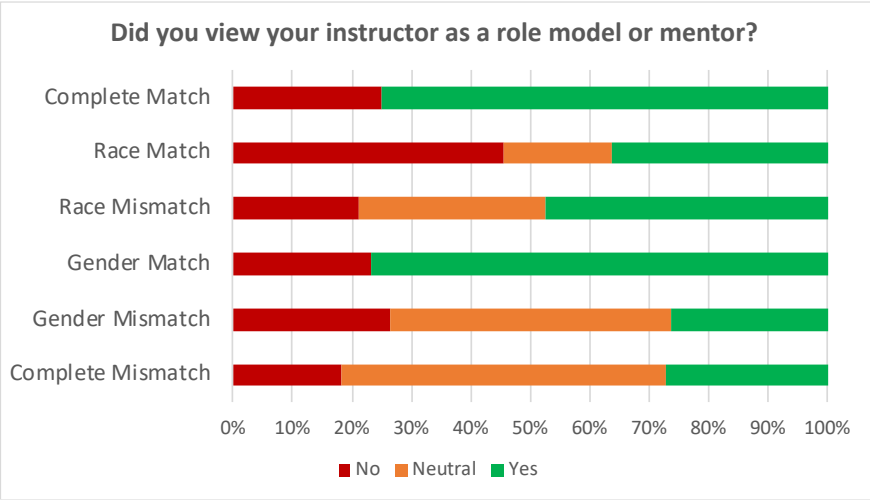

Figure 9: Students whose gender and race matched their instructor (Row 1) were more likely to view their instructor as a role model than students whose gender and race mismatched (Row 6). Students whose gender matched their instructor (Row 4) were also more likely to view their instructor as a role model than students whose gender mismatched (Row 5).

Although my survey data did not provide conclusive evidence that matching the racial background of student to professor increased likelihood of finding a role model, a survey participant wrote she "did consult a lot with a TF…it was good to talk to her as another woman of color who I admired." It seemed that the shared minority and gender background of this TF-student connection allowed the student to admire and look up to this particular TF.

Additionally, focus group participants spoke about why they felt that having a shared background with their STEM faculty member was important to finding role models. One participant stated, "Having a person who looks similar to you or went through similar things as you is like having a picture of the future you, getting over the mountain that you see in front of you. That helps so much—it's so encouraging." Another participant spoke about how his advisor is someone "who I look up to as a role model because he comes from a similar first generation, low-income background. That's something that I can relate to very easily." Finally, a third participant talked about her initial difficulty finding a role model at Harvard and who she currently identifies as her role model: "I remember when I first came to Harvard, it felt very difficult to find a role model, mainly because I found that most of my professors were male, and I just personally identified more with female teachers I had in high school. Currently, my role model is my PI (Principal Investigator) that I currently work for. I consider her my role model because we have very similar backgrounds. I know that she has overcome many obstacles. Just knowing that she's overcome them inspires me and motivates me to overcome them as well. With a lot of male mentors that I've had, perhaps they wouldn't understand or identify with any of the obstacles that I'm going through, so it's harder to consider them a role model."

Participants talked about their role models and mentors from every aspect of shared background—race/ethnicity, gender, and socioeconomic. They stated that *due to this shared background* (whether it was a visible trait like race or gender or a more invisible trait like shared SES), these mentors and role models inspired them to continue their scientific pursuits because they as students could relate more to them and envision a future self through their mentor's shared background.

Discussion

Through quantitative survey results, I found that students who shared either a gender or a racial background with their STEM professor and TF had an improved immediate classroom experience than students who did not. Additionally, I found that minority students and first-generation college students who had a STEM professor of a minority racial background felt a higher sense of belonging in that STEM department than minority and first-gen students who had a white STEM professor. White students' sense of belonging was not affected by the racial background of their STEM professor, indicating that it was in all students' best interests to have more professors of minority backgrounds—students of minority backgrounds would feel higher sense of belonging, and white students would not be affected by the change. Finally, female students were more likely to identify their STEM professor as a role model if she was also female.

In my focus group interviews, I focused on the question of why students felt that it was important to have STEM instructors of a shared background. Focus group participants explained that they believed these instructors innately employed better teaching strategies to accommodate students of different backgrounds, were more empathetic to minority students' struggles and increased their sense of departmental belonging, and also served as strong role models and "future selves" for students of diverse backgrounds.

Limitations of my study certainly exist. First, the sample size of my survey, while comprised of students of diverse demographics, was still small in size (49 respondents, 32 of whom completed all demographic fields). In order to obtain more accurate and precise results, future studies would need to be performed on larger sample sizes of students. Additionally, response bias could still occur despite my attempt to minimize it by collecting demographic information at the end of the survey: I predict that students with stronger positive or negative impressions of STEM courses at Harvard would feel more compelled to take the survey, causing me to miss the insights of students that feel more lukewarm about their STEM course experience.

In the focus group, another limitation surfaced: participants expressed that if a student belonged to a gender or racial minority group in a predominantly white and male STEM field, they would worry about appearing weak or incapable if they raised issues with how the course

was being run. This could certainly have affected my survey results. Students belonging to these minority groups may implicitly have tempered their negative experiences in STEM for fear of appearing weak and confirming the "stereotype threat" associated with their minority group. In my focus groups, I tried to control for this by inviting students of different racial and gender backgrounds to speak so no one person held the majority opinion. However, it is possible that focus group participants from underrepresented STEM backgrounds still did not feel entirely comfortable expressing their frank opinions about the challenges they faced—after all, Harvard students enjoy celebrating accomplishments, not dwelling in vulnerabilities.

Finally, the last limitation is that especially in focus group interviews, I found that teaching staff diversity is not everything to improving a student's experience in STEM. For example, participants also highly praised peer teachers—undergraduates usually just a year or two out of the course—who understood the student experience and were altruistic with their time during office hours and help rooms. Regardless of gender or racial background, it seemed that these undergraduate peer TFs and CAs (Course Assistants) significantly helped students' learning experience. Additionally, while my study looked specifically at how gender and racial background of STEM teaching staff affects students, it is possible to achieve more inclusive classroom dynamics regardless of gender and racial background of the teaching staff. Focus group participants spoke that their most positive experiences in STEM courses were with professors who used techniques that proactively encouraged participation and collaborative work, ensuring that no student felt alone tackling a hard problem. It is possible to assume that all professors and TFs, if dedicated to undergoing the right training, could be instrumental to improving students' immediate classroom experience and sense of belonging.

Nevertheless, my focus group interviews seemed to confirm that a student's conception of a role model in STEM is closely tied with sharing the gender, racial, or even socioeconomic background of a professor. In this way, a white, male professor would have an extremely difficult time justifying that he would be a better role model for a diverse student body than a professor from a minority background, who likely has experienced firsthand struggles similar to those experienced by minority students.

Conclusion and Future Steps

My research results show that there is an urgent need for increasing the diversity of STEM teaching staff at Harvard: doing so improves students' classroom experiences and sense of belonging, and prolonging such a process would be detrimental to all students. There are multiple avenues for which to do this: first, I propose that current STEM professors regardless of background work towards hiring TFs from a diverse set of backgrounds. In my research, I have found that even having one member of the teaching staff that a student can identify with can improve their immediate classroom experience and sense of belonging. Additionally, I suggest that Harvard STEM departments mandate that all professors must attend workshops on Inclusive Teaching with the Bok Center. The Bok Center provides guidance to significantly tailor teaching structure and tone for creating a more inclusive classroom—doing so across all STEM disciplines would potentially help cultivate a stronger sense of belonging for students of diverse, underrepresented backgrounds.

Finally, a longer-term strategy would be to restructure how the STEM department and how Harvard thinks about tenure. Currently, there is a large divide between the diversity in the student body and the largely white, male-dominated tenured STEM faculty. Even though President Wilson spoke about how the diversity of tenure-track instructors is increasing, there are still two issues: the first is that the lengthy process of getting tenure at Harvard means that this change in diversity of STEM teaching staff is still likely over a decade away. Second, not every academic who is on tenure-track actually succeeds in getting tenured—at Harvard, the process of getting tenure is notoriously opaque, and additionally, attrition of tenure-track women in STEM is over 20% higher than that of tenure-track men (Fandos and Pisner, 2013; Fu and Lee, 2017). If administrators care urgently about improving students' experiences in STEM courses, there need to be structural changes to the way that tenure approvals work for women and minorities in STEM.

I often think back to my experience in the physics mechanics course last semester and wonder whether or not my experience would have been different had the male professor chose to employ an equal number of male and female TFs, or if he had chosen to improve the racial diversity of the TFs. What I have discovered from my research is that the gender and race of a STEM instructor profoundly impacts a student's experience in multiple facets: shared

background improves a student's immediate classroom experience, improves minority and first-gen student's sense of belonging in STEM departments, and students to better identify the instructor as a role model in STEM.

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Appendices

A. Survey Questions

*Questions 4-7 adapted from prior study measuring STEM students' self-efficacy and belonging (Trujillo and Tanner, 2014: 9, 11, 13)

[Page 1]

Please list the STEM course you will be reflecting about:

1. How often did you attend office hours to ask for help?

2. How comfortable were you asking questions in lecture?

3. How comfortable were you asking questions in your TF's section or office hours?

4. How confident would you be tutoring a future student in the course?

5. Did your overall experience in this course make you more or less likely to pursue a concentration in the field where the course was taught?

6. How much do you feel you belong in the department where the course was taught?

7. Do you see yourself as a STEM (science, technology, engineering, math) person?

8. To what extent did you view your instructor as a role model/mentor in the field?

[Page 2]

Head/main professor's race:

Head/main professor's gender:

TF race:

TF gender:

[Optional] If you went to a different TF's office hours regularly for help, please list below the TF's race and gender:

Student current concentration:

Student race:

Student gender:

Are you a first-gen student?

Are there any additional comments that you would like to add about the faculty's influence on your course experience that haven't been covered?

Would you be interested in participating in a 1-hour focus group that covers a more in-depth discussion about faculty diversity's impact on students' experiences in STEM courses? If so, please provide your email:

B. Focus Group Questions

1. What are things that you found encouraging about this particular STEM course, and why?

2. What are things that you found challenging about this particular STEM course, and why?

3. Did you go to office hours regularly? Why or why not? What would have changed the way you sought out help?

5. Do you think your experience was unique, or shared by many students in the course? If so, did you notice any patterns to the shared experience?

6. How did this course change your opinion or interest in the STEM field it was a part of?

7. How important is it to you to have instructors with your background in your field of study? Why?

8. Who have been your greatest role models at college? In the classroom? Why?

C. Figures from Survey Data, Consolidated

Figure 1A

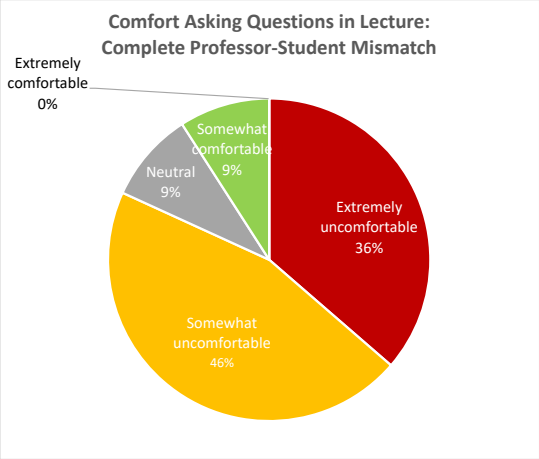
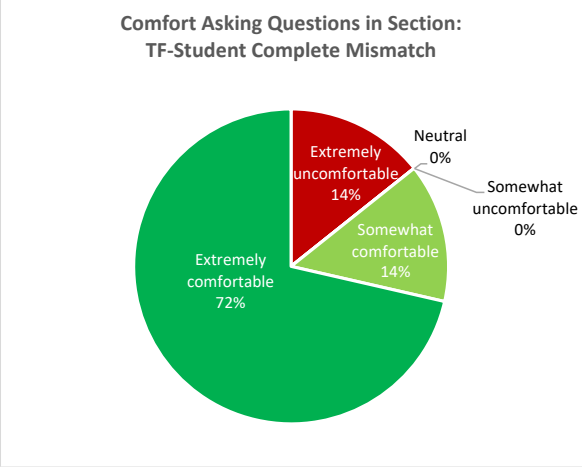


Figure 1B

Figure 2A



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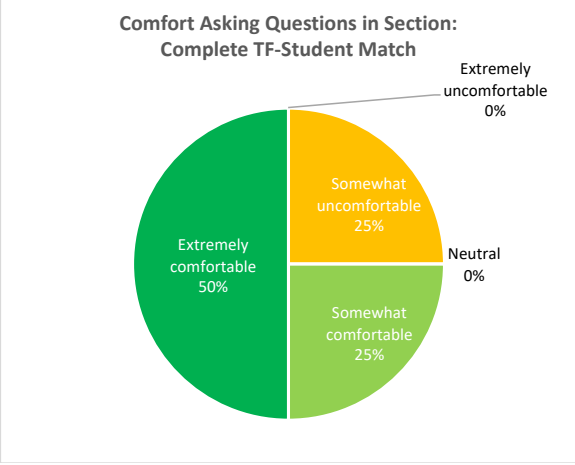

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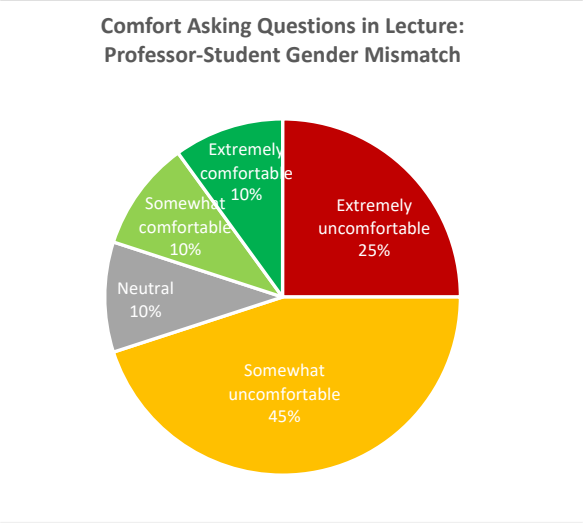

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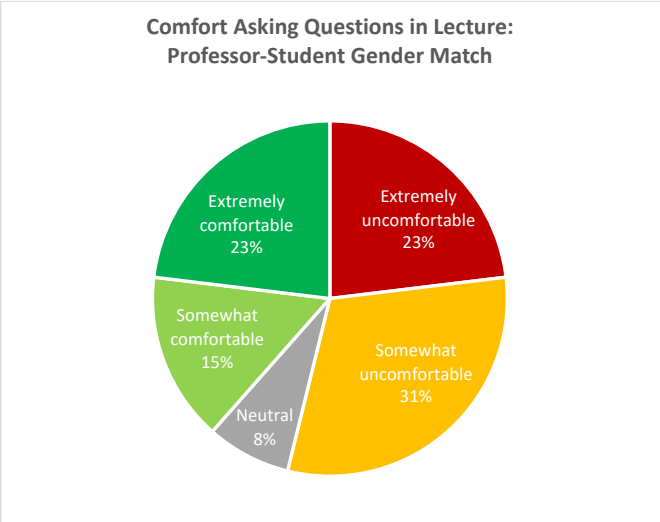

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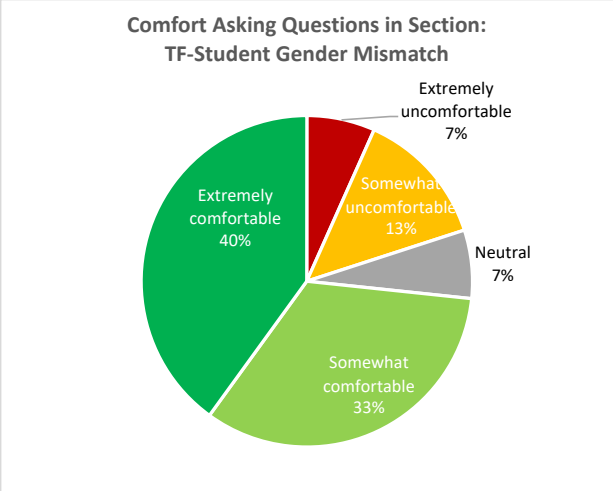

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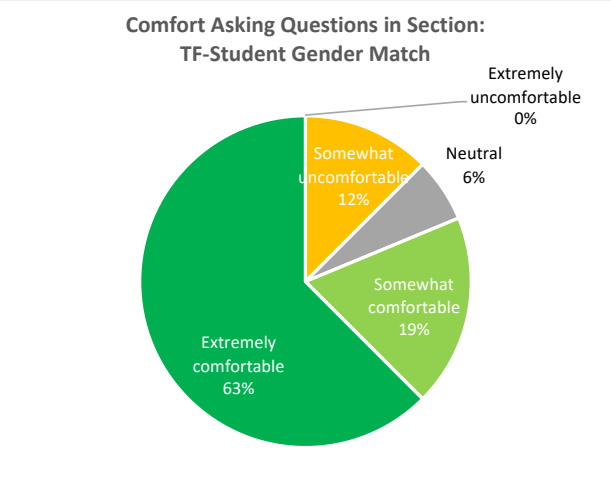

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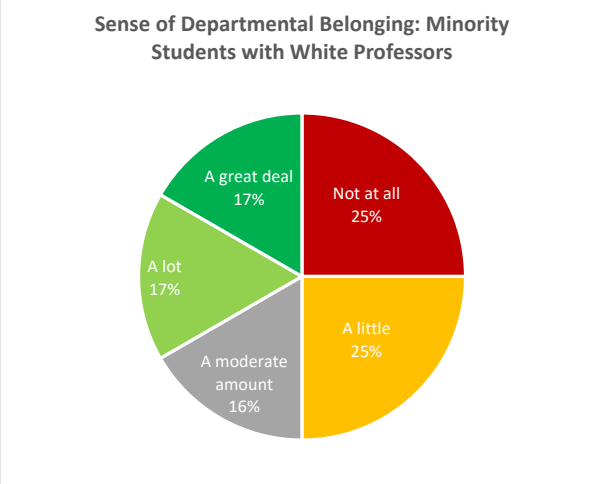

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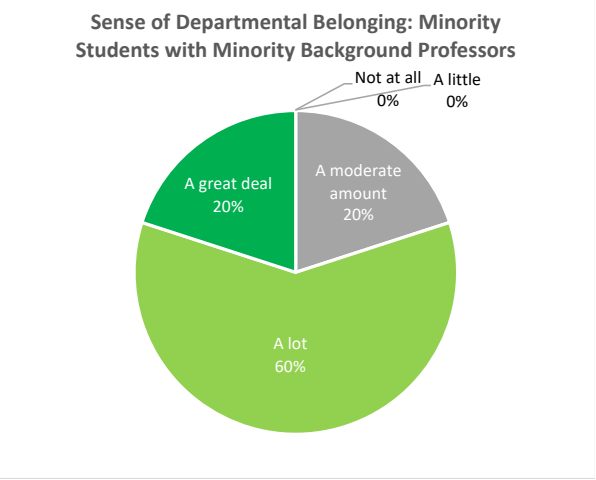

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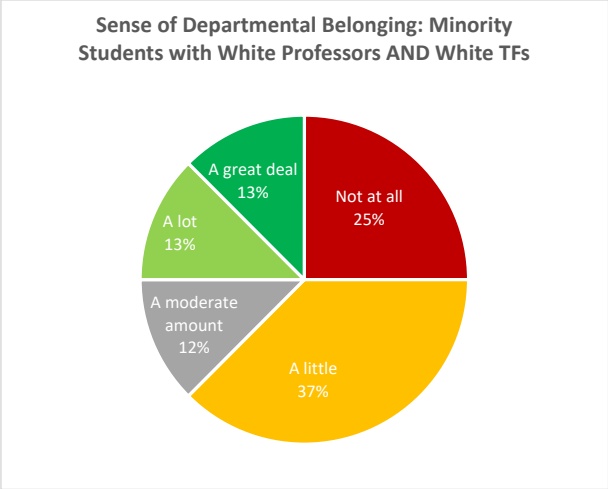

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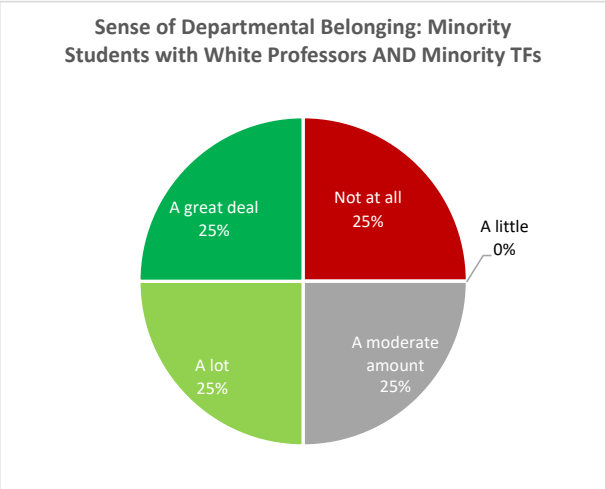

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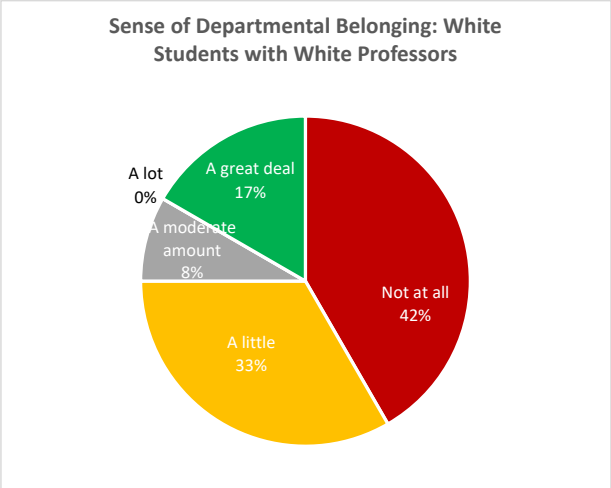

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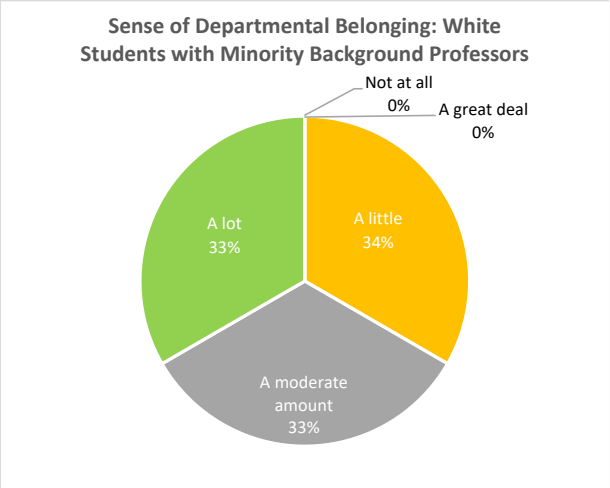

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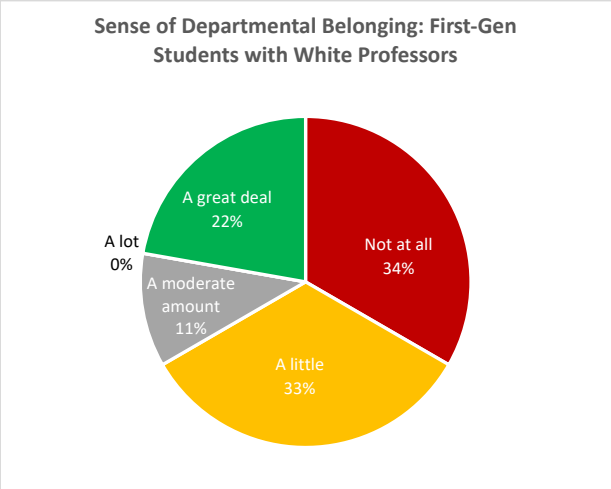

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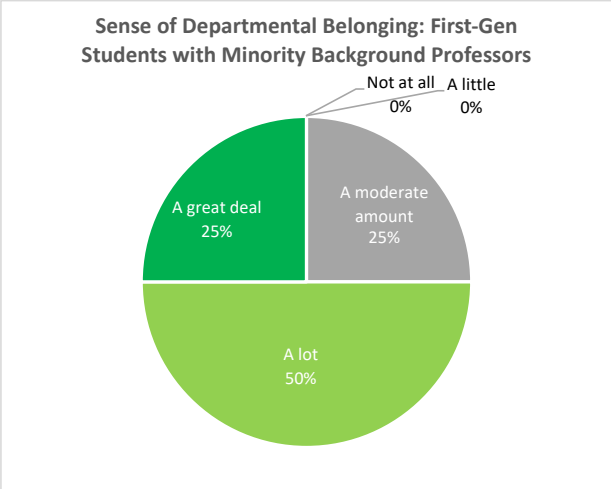
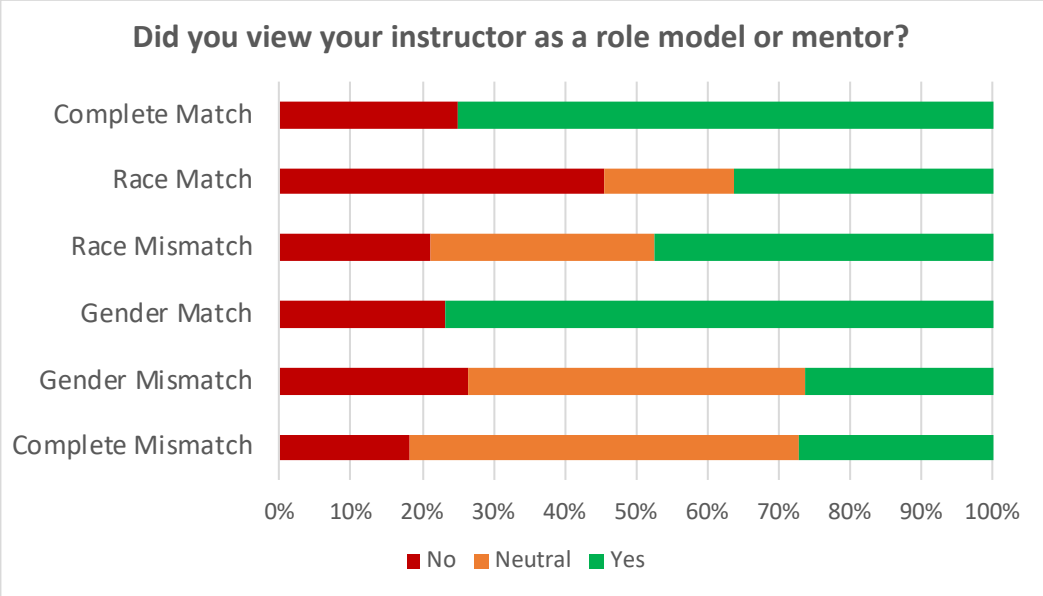


Figure 9



D. Focus Group Interview Participant Demographics

Class Year	Concentration	Race	Gender	First-Gen Student?	Interview Date	Place	Form
2020	Joint Math and CS	Asian	Female	No	11/29/18	Leverett	In-person
2021	Human Evolutionary Biology	Hispanic or Latino	Male	Yes	11/29/18	Leverett	In-person
2020	Bioengineering	White	Female	No	11/29/18	Leverett	In-person
2020	Human Developmental and Regenerative Biology	White	Male	Yes	11/30/18	Leverett	In-person
2020	Integrative Biology	Asian	Female	No	11/30/18	Leverett	In-person
2019	Math	White	Male	No	11/30/18	Leverett	In-person
2020	Psychology (CNEP track)	White	Female	Yes	11/30/18	Leverett	In-person