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Not Just Teaching *How*: Supporting a Culture Shift in STEM Education

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INTRODUCTION

During the fall semester of my junior year, I became involved with Swarthmore's Tech for Social Good (T4SG) student organization. The club aims, "to channel technical talent and resources on campus to benefit our community at large given an existing need, and hope to promote a culture of technology & social impact on campus." (T4SG website, n.d.) Students with computer science backgrounds come together in this club and offer technical assistance for organizations that need the support. I was a technical lead for a project that aimed to develop a website for the organizer of Chester Youth Courts. Another important aspect of the club was its ability to provide educational resources for students on campus. They offer a variety of workshops throughout the semester that range from web development to this directed reading specifically focusing on technology and social justice. In this directed reading, we covered a variety of topics that centered on the social implications of technology. We read about the ethics around data privacy, the racism seen in algorithmic bias, technology and its influence on accessibility, etc. Ultimately, the focus was less on the concepts of computer science and more on the impact.

Having reflected on my experience with this directed reading, I was left with many questions about the computer science curriculum and computer science education in general. One major question was around the topics we discussed, many of which were not covered within regular Swarthmore computer science classes. While these topics are extremely important to our discipline, these conversations are left out of the curriculum that seems more focused on *how* to do things using computer science rather than *why.* It was also really interesting to think about how this directed reading consisted of eight students, seven being women of color and there only

being one white male, in addition to the white male professor. The make up of this class was the complete opposite of a typical computer science class that is (at least) forty-five students and mostly male. Further, in this space the professor took on a role that was more of a facilitator rather than a lecturer. Again, this was strikingly different from what usually occurs in a class where professors lecture and show examples of topics, and students just listen. All these differences stuck out because they deviated from what is considered the "norm" in computer science courses, but it left me wondering about more ways to disrupt this norm.

As a first generation Latina pursuing a computer science degree, being in classrooms where I am often the only woman and only person of color within peer groups, I have coped with the "norm" of computer science courses being predominantly white and predominantly male by trying to stay under the radar. Thus, the directed reading was a particularly significant experience for me because I felt comfortable and empowered to talk about my concerns about technology and its impact as well as learn about some of the methods behind the tools being developed. For other students like myself, who may just passively experience the normativity of computer science courses, restructuring computer science to emulate the methods of the directed reading may be a potential starting point for developing an environment that is welcoming and inclusive.

This directed reading is an instance of a STEM course including some conversations of the social impact its discipline has on social issues and it included racially diverse students. It is no secret that racial disparities and the lack of social awareness within STEM are issues within STEM fields, and perhaps this directed reading offers a model of how to address these issues, and points to the future of what STEM education could be like. However, within this example, it is the case that this shift from a quintessential computer science course was driven by students. Thus, I am left wondering *why* professors don't incorporate the model of the directed reading

with its open conversations about social issues and the impact of the discipline, into more of their classrooms. Thus, within this thesis, I will hope to answer the question: How are professors supported to address the social issues pertaining to their discipline? By analyzing literature and through three interviews with current computer science professors, I hope to identify ways in which faculty do and/or do not feel supported to address issues of racial injustice and other social issues, in order to shed light on what institutions can do to better support faculty.

LITERATURE REVIEW

In order to understand *why* faculty members may need support in addressing social issues pertaining to their disciplines, it is important to highlight a social issue that impacts STEM diversity. I will begin my literature review by introducing racial injustice in STEM. I'll explain what racial injustice in STEM means, what it looks like, and why it is important to confront in order to better support students of racial minoritized communities.

Racial Injustice in STEM

As defined by the *Race Reporting Guide* of 2015, racial justice is " The systematic fair treatment of people of all races, resulting in equitable opportunities and outcomes for all. Racial justice—or racial equity—goes beyond 'anti-racism.' It is not just the absence of discrimination and inequities, but also the presence of deliberate systems and supports to achieve and sustain racial equity through proactive and preventative measures"(para.1) The lack of this systematic fair treatment in turn creates racial injustice. Currently, college access alone is an area of racial injustice as there are many barriers that impact minoritized students disproportionately more than their white counterparts, resulting in what is known as the achievement gap - disparity in

academic achievement between different racial groups (Coleman, 1996). There are striking racial disparities within STEM fields. As a result of these disparities, racial injustices within higher education institutions manifest themselves in the ways in which students of color lack access to resources and lack the support to navigate predominantly white STEM fields, in often predominantly white institutions.

In her book, *Black, Brown, Bruised: How Racialized STEM Education Stifles Innovation* (2020), Ebony Omotola McGee draws on the narratives of hundreds of Black, Latinx, and Indigenous individuals about their experiences as underrepresented racially minoritized students and faculty members that have succeeded in STEM. McGee's book brings to light the challenges that racially minority students have to endure in order to obtain degrees in often predominantly white academic and professional realms. Common barriers that came up in McGee's work were experiences of "isolation, feeling or being positioned as an imposter, and racial stereotypes, and other forms of racialized bias that distract underrepresented, racially minoritized students from their studies and sap their energy" (2020, p.2). Furthermore, "These underrepresented, racially minoritized students find it hard to establish relationships with faculty who do not share their racial identity or maybe it's vice versa. Their advisors are usually white or Asian and do not understand what the students are going through" (2020, p.1). In addition, students of racially minoritized and underrepresented backgrounds are often subject to racial microaggressions by both peers and professors. All of this, along with policies of colorblindness and burdens of tokenism, are manifestations of racial injustice within STEM disciplines in higher education because students of color are having to navigate racially uncomfortable situations and endure the emotional stress of these situations with little to no support- an experience their white counterparts never have to deal with.

This emotional labor and stress is referred to as *racial battle fatigue,* a term first coined by William A. Smith and his colleagues. Racial battle fatigue is the result of race-related stressors; this can be accompanied with "feelings of powerlessness, invisibility, loss of integrity, or pressure to represent one's group" (McGee, 2020, p.38). Racial battle fatigue not only impacts student experiences in predominantly white institutions and STEM classrooms, but it may also impact their well-being in other aspects of life post graduation. Racial injustices within STEM do not end within higher education institutions. Other forms of racial injustice manifest themselves in STEM workplaces, as well. For example, "as of 2016, the median earnings of Blacks ($58,000) and Hispanics ($60,758) working in STEM occupations significantly lagged those of Whites ($71,897) and Asians ($90,000). On average, Black STEM workers earn 81 percent of their White counterparts' pay" (McGee, 2020, p.38). The economic disparities that occur as a result of structural racism are clear indicators that not all people within STEM navigate their educational experiences and their workplace experiences the same way. Thus, it is clear that there are many instances of racial injustice that follow underrepresented, racially minoritized students from their schooling as undergraduate students into their work environments. As these issues become increasingly apparent, there is a movement towards diversifying STEM.

Researchers have found that when it comes to problem solving, diverse perspectives and problem solvers is far more important than individual ability (Benjamin 2016; McGee 2016) "Being able to see a problem differently from others on the team is often a critical breakthrough , and thus *diversity is integral to the effectiveness of a work team"* (McGee, 2020,p.21). Ultimately, as STEM fields impact every aspect of life as it focuses on problem solving, it is important to move away from homogeneous work teams and to work towards having teams of diverse individuals to further innovation. "Increasing racial diversity on STEM university

campuses and in STEM industries would foster greater innovation, thereby leading to less racially insensitive environments and more effective STEM products and services" (McGee, 2020, p. 4). Thus, having diverse students with different backgrounds and perspectives helps drive innovation and problem solving because diverse perspectives lead to the ability to solve a broader range of problems, using the unique backgrounds and knowledge of all team members collectively.

It is also important to consider how the lack of diversity in STEM affects faculty of color. An important theme that came up in the Sun and Simon-Roberts's (2020) study was the impact of age, gender, and ethnicity on teaching. The study focused on faculty of diverse backgrounds: "Of the fourteen participants, there were eight African Americans, four international individuals, and two European Americans. This sample is not representative of the profiles of higher education institutions of the United States in general"(85). Many of these faculty members experienced culture shock and racism, and had concerns of the overall lack of representation in their institutions. There were few supports to help faculty navigate these uncomfortable situations. Faculty members of diverse backgrounds are experiencing this discomfort that parallels minority students' experience when attending predominantly white institutions, and especially minority students within predominantly white fields such as those of STEM. Thus, as there is a push for *diversity* and *inclusion* in STEM it is important to consider the ways in which faculty can not only help each other navigate racially uncomfortable situations, but also provide support for their diverse body of students.

Thus, it has become clear that the need for racial/ethnic diversity in STEM is necessary in order to have meaningful progress within disciplines, but it is even more necessary to address the cultural structures of racial injustice that impact not only students, but also faculty. It is

important to note that simply increasing diversity by having more students of diverse backgrounds will not solve the institutional and (sub)conscious problems of racial injustice. It is important to think about the actual practices through which colleges, specifically college faculty in STEM can create environments that are diverse *and* inclusive. Are these faculty members supported to do so? If not, how can they be better supported?

Teaching Preparation for Professors

Before delving into the support that faculty may or may not need to address social issues, it is important to consider the ways in which they are prepared to assume their positions as college faculty. By looking at the ways in which college professors are prepared to teach,we can identify which skills they bring into the position as faculty and which skills they develop or need support with once they become professors.

The road into a position within academia is deceivingly linear. According to an article by Hannah Muniz (2020) posted to PrepScholar.com, there are four basic qualifications/requirements for becoming a college professor: 1) doctoral degree in the field you want to teach in, 2) teaching experience, 3) professional certification (depending on the field), and 4) publications and prominent academic presence. The requirements of a doctoral degree, professional certification, and publications can be easily measured and verified by academic institutions because they are tangible requirements; However, teaching experience can vary depending on an individual's graduate school experience.

One major source of teaching experience for incoming college professors is their experience as graduate school teaching assistants. Many graduate school programs include opportunities for future faculty to engage in graduate teaching assistant (GTA) programs.

According to Ka Sai Un's dissertation, "the concept of graduate students as college instructors seems to have begun in 1876, when Johns Hopkins University awarded fellowships to their graduate students without asking for any services in return. However, since the fellowships did not offer a significant amount of financial support, the graduate students began moonlighting by lecturing in undergraduate classes (Allen and Rueter, 2006). Later, Clark University and the University of Chicago adapted a similar fellowship system as the one at Johns Hopkins University, and the idea of graduate students providing instructional support to undergraduate students started to spread to other college campuses" (pp. 25-26). Ultimately, the program began as a way to attract more graduate students by providing financial support in exchange for assistance with various tasks for faculty, and as a result there was an increase in graduate students in various colleges and universities (Nyquist and Wulff, 1996; D'Andrea, 1996).

The Preparing Future Faculty (PFF) Program became a national initiative for preparing college professors to become faculty members in 1993. The need to prepare future faculty members arose from the demand for more college professors as there was a decline in current college faculty as the baby-boomer college faculty has begun to retire according to the US Department of Labor. The program transformed the ways in which professors were prepared to become college faculty; "the program stressed that the most effective way to prepare quality college faculty was to help them develop the knowledge and skills for the duties of college faculty members in a protected environment while the potential future faculty were still studying in graduate school. The Preparing Future Faculty program provided graduate students with opportunities to observe and experience the responsibilities of college faculty in one of their cluster colleges, which could be four year institutions or community colleges" (Un, 2006, p. 23-24). The schools they developed were often procedural steps of leading a class such as

preparing a lesson. However, not all colleges were affiliated with PFF, and not all students could participate in the PFF program, even if their school offered it. (Lee, 2001). Thus, it was left to individual colleges and universities to prepare students to be future faculty members. As a result there are not various GTA programs across the different higher education institutions around the country. The programs all vary depending on the individual school's mission, culture, and size. (Un, 2006) While there are many benefits for GTAs, such as exposure to teaching experience and providing assistance to faculty, the variety of programs and the different resources that institutions offer make it difficult for all future faculty members to receive the same training and may put some future faculty members at a disadvantage when transitioning into the role of a faculty member.

In recent years, attention has been drawn to the ways in which GTAs may be under preparing faculty. Wei Sun and Sharifa Simon-Roberts highlighted four themes that come up in the transition from graduate students to new faculty members in their study, *New Faculty Preparation, Adaptation, and Retention,* published in May 2020. One of the themes mentioned in the article is doctoral education preparedness and institutional professional training. Of the fourteen faculty included in the study, twelve had been a teaching assistant while in their doctoral program, but almost all of them reported wanting more preparation "in being faculty, such as how to advise students, apply for grants, publish, and what to do in terms of career development." Furthermore, it was noted that "very few institutions offer workshops other than early semester orientation, wherein most of the training involves understanding the Human Resources department of the institution." (Sun and Simon-Roberts, 2020, p.84) In addition, there were mentions of stress and challenges in regards to the environment of the institutions in which

they were working. Ultimately, this points to a need to examine the support faculty receive in regards to their teaching practices within higher education institutions.

From the literature, it seems that the current teaching preparation practices for future college faculty varies depending on an individual's graduate school experience and thus results in faculty coming in with different sets of skills. Having different forms of preparation for different disciplines seems to make sense. Teaching chemistry is not the same as teaching computer science; however, in regards to teaching practices and experiences, not all faculty seem to have the same background. These differences in teaching background could impact the way STEM is taught and could have different implications for higher education STEM students. In the next section, I delve into the social impact of STEM education and how teaching practices could pragmatically influence the ways students interact with STEM material.

STEM Education and Its Social Impact

STEM education plays an important role in higher education because of its global impact on the workforce. Students pursuing an education in science, technology, engineering, or mathematics fields are encouraged to be problem solvers and innovative thinkers, and to apply their skills to continue improving our daily lives through the development of more efficient and easier ways to tackle our everyday problems. These everyday problems are often social, cultural, and global issues, and require understanding of the communities in which they impact. As described by the Association of American Colleges and Universities, STEM education aims to prepare undergraduates to solve issues such as, "cybersecurity, health disparities, competing global economies, sustainability, education, equity, and civil rights" (AACU, 2016). Furthermore, in order to meet this goal, STEM undergraduate students must have, "the capacity

to apply disciplinary-specific knowledge to solving the world's most complicated problems in culturally nuanced contexts and the ability to effectively communicate the importance of these problems and solutions" (AACU, 2016). However, because of the lack of racial/ethnic and gender diversity in STEM fields, it is often the case that the individuals expected to solve world issues are not representative of the wide variety of communities whom they aim to help.

STEM fields in higher education and in the workforce continue to be some of the most segregated in the United States. "Black and Hispanic workers continue to be underrepresented in the STEM workforce. Blacks make up 11% of the U.S. workforce overall but represent 9% of STEM workers, while Hispanics comprise 16% of the U.S. workforce but only 7% of all STEM workers. And among employed adults with a bachelor's degree or higher, blacks are just 7% and Hispanics are 6% of the STEM workforce" (Funk and Parker, 2018, para. 5). The STEM workforce continues to be dominated by white males; "according to the NSF, the STEM workforce is 89% white and 72% male, while the overall workforce is 78% white and 53% male. Right now in the U.S., there are currently more non-white children than white children, and nearly half of all children born are female. STEM fields do not currently reflect the diversity of our country" (Rollins, 2020, para. 3). These racial disparities within STEM have a variety of implications for the ways in which people within the STEM workforce help solve global issues.

As previously stated, there is an innate assumption that students within STEM fields will be the problem solvers for society at large. However, as seen in Juan C. Garibay's study in 2015, it is possible to graduate with a STEM degree with superficial knowledge of the social implications of STEM skill applications. In 2015, Garibay used a national sample of 6,100 undergraduates through the "Cooperative Institutional Research Program's (CIRP) Freshman Survey and College Senior Survey to investigate the differences between STEM majors and

non-STEM majors and the value they place on their role in creating a more equitable and just society. Garibay found that STEM students who seek to become engineers, computer scientists, and scientific researchers have low levels of social awareness and view the importance of working for social change as less important to their career goals. In addition, students who have spent time as a STEM major are more likely to show signs of lower social awareness at the end of college, and majoring in a STEM field does not enhance student understanding of diverse global communities. The study found that STEM undergraduates are more likely to believe that the individual cannot change society or influence social issues than students majoring in humanities or the social sciences. STEM majors, compared to non-STEM majors, are students that most likely describe themselves as not socially concerned about marginalized groups and more focused on solving "first world" problems" (Garibay, 2015). This study highlighted that STEM majors (which tend to be predominantly white and predominantly male) are oftentimes not as socially aware of either the problems they're trying to solve or the communities in that their work may be impacting. This lack of social awareness points to the need for a social justice component within STEM to at least raise social consciousness; A social justice component within STEM would center human rights awareness, critical thinking, and the ideals of tolerance of diversity in order to address social issues in STEM. Furthermore, it calls for STEM educators to address the racial disparities within the field that are a result of, and contributor to, racial injustice. Ultimately, Garbiay's study points to faculty support and/or preparation for addressing these issues. If professors are not supported to speak about the impact of STEM content on real social problems and are not supported to create an inclusive environment in classrooms, it is possible that students disregard the connection between their class content and the world around.

Narendra Neeel Khichi Jr. conducted a study that used an intervention module that focused on social issues and social inequity to investigate student beliefs of the social issues and social inequity topics, in their dissertation, *STEM Education and Social Issues: Perceptions and Pedagogy*. "Further, the study examined to what extent a redesigned STS (Science, Technology and Society) course at the New Jersey Institute of Technology influenced student perceptions of social issues and how their work can potentially be seen as a catalyst for social change. Student written responses, a researcher reflective interview, a questionnaire, and a focus group were used in this qualitative action research study" (Khichi, 2018, p. i). The students in Khichi's study were first or second year STEM students in the Honors College taking an STS course and in majors from Biomedical Engineering, Biology, Computer Science, Information Technology, Physics, to name a few. The findings in Khichi's study suggested that students in general were not exposed to and had little to no background on nuances of various social issues before entering a college setting and while they had a surface-level understanding of social issues, it wasn't until they were in college that they were actually able to learn and discuss the moral and ethical aspects of the issues. After having gone through this experience, Khichi noted one of his key findings was that "most students in the study believed that STEM students should learn about social issues and find it both relevant and important to their career and their individual impact on the world. While a small minority argued they did not enroll at NJIT to study these issues and classes like this should not be a part of a STEM curriculum" (p. 122). The course in this study provided an opportunity for students to engage in conversations about the social implications of STEM, but also allowed students to engage in conversations about topics such as race, gender ethnicity, and sexual orientation. In a diverse STEM classroom, these conversations may be helpful for students' understanding of different experiences, especially in understanding

and providing communal support for the experiences of underrepresented students in STEM. The question then becomes are STEM professors prepared to facilitate conversations on social issues and topics within their classrooms and discipline curriculum? Relatedly, do they have the content knowledge to facilitate these conversations?

Ultimately, I am working under the hypothesis that better support and preparation for faculty may help address social issues such as the lack of racial/ethnic diversity and the low rates of social awareness within STEM disciplines. If professors have a background on how to educate and work with diverse students, and also have the support to include topics of social awareness within their curriculums, then perhaps these issues would be addressed. Through further analysis of literature and through three interviews with computer science professors, I delve deeper into my research question in order to find ways to better understand faculty and their potential needs.

METHODS

Given the time restriction of this one-credit thesis, I was only able to conduct three semi-structured interviews with three computer science professors. I decided to interview computer science professors because of my own background with computer science. Each interview lasted around 30 to 45 minutes depending on how much the professor elaborated in their responses. For each interview, I asked five main questions (listed below), and added some follow-up questions depending on the flow of the conversations.

All interviews took place over Zoom. I asked to record the Zoom meeting and only used the audio recording to transcribe. The main areas I aimed to cover in interviews were 1) their

preparation for teaching as a faculty member, 2) what they felt supported them as faculty, and 3) what support they received for addressing social issues in their classrooms. See Appendix for full interview transcripts.

Interview Questions:

1. How long have you been teaching as a faculty member?
2. Please describe the preparation you received for your role as a professor?
3. What motivated you to become a professor?
4. What social issues do you see pertain to your discipline and how do you address them?
5. Are there things you wished you were better prepared for as a professor?

Further, I read and analyzed the works of various STEM education scholars, as well as the work of activists working towards more equitable education in order to understand the ways faculty are or are not supported to address social issues.

DISCUSSION AND ANALYSIS

My literature analysis paired with the conversations I had with faculty, shed light on some of the obstacles that STEM faculty face when working to address social issues within their disciplines. Through my research the three majors themes that arose were: 1. A shift in the forms of knowledge uplifted in STEM; 2. The need to adjust faculty preparation; and 3. The need to reimagine STEM culture and systems. These three major themes pointed to the need for STEM educators to be better prepared to address social issues within their fields, as well as the need for

STEM as a division to reimagine its culture where there is a shift in the purpose of STEM education.

A shift in STEM knowledge

As was mentioned earlier in the literature review, STEM in higher education plays an important role in higher education because of its impact on societies. STEM disciplines are regarded as areas that aim to provide solutions to societal problems. Thus, it is expected that higher education institutions produce competent graduates to meet these needs. Until recently, the competence of graduates has been tied to their abilities to further the progress of communities both economically and innovatively. There is the expectation that STEM fields will produce advancements that will transform the way we approach problems, and that will advance our economy through the production and usage of such advancements. This is based on the belief that, "the science, engineering, technology, and mathematics disciplines (STEM) have a significant and directly causal role to play in economic productivity and innovation..." (Blackie et al, 2016, p. 755). This further reiterates the ways in which STEM students are being prepared to solve problems for society and create new tools that will push society and the economy forward; However, they are not being prepared with the cultural competence to understand the communities they are aiming to help or the ways in which their work may impact said communities. As is pointed out by Hunter (2013), normalizing the link between STEM and economic and technological progress "constrains our thinking about the role of higher education in society"(pp. 707-723). In a society that wants competent STEM graduates to solve world problems and to drive economies, we also need STEM graduates with the cultural competence to

understand the impact of their work. Competence can no longer mean just knowing *how*; it must also mean understanding *why?* and *for whom?*

Viewing STEM as solely a means to advance society gives space to ignore the ways in which STEM is harmful towards communities. The belief that STEM fields are objective has been normalized, and has led STEM students and disciplines to view themselves as disconnected from the social implications of their work. "STEM undergraduates are more likely to believe that the individual cannot change society or impact social issues than students majoring in humanities or social science. STEM majors, compared to non-STEM majors, are students that most likely describe themselves as not socially concerned towards marginalized groups and more focused on solving "first world" problems" (Garibay, 2015 as quoted in Khichi, 2018, p.1). However, contrary to the belief that STEM solves problems and is unrelated to social issues, there are a variety of examples of harm and problems caused by STEM disciplines: the medical racism that has historically and currently harmed people of color (Nurridin et al, 2020); the way biology historically was used to reinforce racial hierarchies and led to the social construction of race today (Skibba, 2019); the gentrification in cities like San Francisco because of the tech boom, that has led to the displacement of minority communities (Slaats, 2017); the list of examples can go on. Ultimately, normalizing STEM as objective and progression driven has made it easy for STEM departments in higher institutions to ignore the harm that has been and continue to be done by a variety of STEM fields because students are not being encouraged to ask *why* when thinking about goals of the work nor are they ask *who* their work is for nor *who* it's impacting.

Currently, a lot of STEM focuses on both propositional knowledge and procedural knowledge. As described by Winch (2013), all areas of curriculum can be classified as either propositional knowledge (*"know that")* or procedural knowledge (*"know how").* Furthermore,

Mueller (2014) suggests that there are three different kinds of *"know how"* knowledge- *inferential know how, procedural know how,* and *personal know how. Inferential know how* is being able to use propositional knowledge to make assumptions about a certain topic; *Procedural know how* is knowing how to figure something out; *Personal know how* is accumulated through various experiences of 'actually doing' something. Since STEM disciplines are areas that require knowledge specialization and differentiation, having both propositional knowledge and procedural knowledge becomes significantly more important because both forms of knowledge will contribute to the competence of the individual in the field. However, while STEM students are indoctrinated with the *know that* and the *know how* knowledge of their fields, there is a lack of *know why* knowledge. *Know why* knowledge, or knowledge that supports cultural competence, would include preparing students with the critical consciousness to understand the implications of their work and disciplines. This is the shift in the knowledge being centered in STEM. There is a need to shift away from just understanding *how* and encouraging STEM to be more interdisciplinary and addressing its impact, and understanding *why.*

During Interview A, Professor A pointed out that a lot of the time in computer science courses, students are taught *how* to build projects, but are often not reflecting on the deeper implications of the projects they build. In this excerpt of the interview, Professor A talks about the way ethics of design are left out of the curriculum, despite it being important:

> *"I think there's a lot of issues in ethics that- a lot of these things are things that our department doesn't currently address all that we'd like to. But,you know, ethics of design… like computer science in general teaches students how to build things, but not how to design them for people or to different groups of people. You know, I mean, it's, it's sort of like, well, how can we get this thing up and running the fastest, right. Which is super important when, you know, you've got a two week project and, you know, you're worried about a million different deadlines and,you know, I understand that's why the way that it works, but, you know, I think the, the design aspect of trying to hear different voices and put those together, I think there are a lot of aspects of computer science that*

> *they come into design that we don't address well, just as a discipline, um, because it's not something that fits in with the goals of a particular course."*

In this conversation, Professor A and I were discussing social issues pertaining to computer science, and he felt more conversations should be had about *why* we design and build projects a certain way. He mentioned that if there were more time, projects could take into account issues such as, *how can I make a project more accessible?* But as he mentioned these topics are "not something that fits in with the goals of a particular course." Thus, this is an example of how STEM uplifts propositional and procedural knowledge, but does not take into account social knowledge, which would require students to consider social aspects that will be directly impacted by their work.

Further in Interview B, Professor B highlighted how in computer science the curriculum focuses on *how* to solve problems, and it ignores that computer science can cause problems too. In discussing his Ethics in Technology course, only ever taught twice at the college, Professor B reflected on how the social implications of computing were becoming increasingly apparent to him when he was a graduate student:

> *We were noticing that computing was having a lot more influence than there was a decade ago in terms of how it was impacting people that were not in the field itself, like people in the general population. And so, um, a lot of those topics were really interested, to me. So I do machine learning, I would say in my graduate career, it was mostly about trying to address small problems, small data sets. We weren't really thinking about the broader implications, but as it got there as we were getting advances in the field, we were starting to see it snowballed really quickly in terms of how it was having negative impacts on society. And so it really started to open my eyes that we should just stop thinking about computing as like solving problems. We need to think about it also as creating problems.*

In this excerpt we see again that as a discipline computer science is regarded as a field that is very focused on the *how* when approaching problems, and thus not taking into account *why* or *what happens next*?

This points to a shift in what it means to be educated in STEM. As STEM continues to have significant consequences on a variety of societal issues, it is important that people within STEM not only know specialized knowledge about their specific fields, but also know about the intersections of their work and the people and communities impacted by their work. In her article, *Imagining STEM higher education futures: Advancing human well-being,* Walker (2015) is concerned with how STEM higher education prepares students whose professional contributions to society will have a positive impact on equity and human well-being. "Walker is not content to simply create a curriculum and higher education system which empowers science and engineering graduates with knowledge, skills and effective power to capitalise on employment opportunities. She advocates for an education system which will shape students in such a way that they will have the capacity and the will to make a substantial difference in the world, precisely to establish a system of greater justice" (Walker and McLean 2013, as quoted in in Blackie et al, 2016, p. 759). Students not only need to be prepared to find jobs post-graduation, but should also be prepared to use their knowledge and skills set to leave a *positive* impact on society. Thus, to be educated in STEM is not just holding specialized knowledge, but also understanding the implications of this knowledge. In order to enact this shift within STEM classrooms, faculty need to be prepared to teach STEM disciplines in ways that make room for conversations of social issues and implications of their work, and this must be a goal of all curriculums that all educators work towards.

Adjusting teaching preparation for future faculty

Overall, graduate school lacks specialized training in teaching for future faculty. A lot of their preparation comes from their graduate school experience when future faculty often serve as

graduate teaching assistants. However, these programs vary in terms of how they prepare faculty to teach. It is often the case that there are no explicit conversations about how future faculty will work with students of diverse backgrounds because there is a big emphasis on research and more content-based training for the field. Thus, when aiming to have STEM classrooms that address social issues and are also welcoming and inclusive it is important to consider what faculty need in order to be ready to do this.

In all of my interviews the professors mentioned that there was little to no explicit conversation about what it means to teach and how teaching goes beyond just transmitting content to students. As stated by Professor A, *"I think the weird thing about this job is that nobody really teaches you how to teach for the most part."* This is in line with the work of Sun and Simon-Roberts (2020), who find that, "doctoral students do not have systematic training on other responsibilities required in faculty positions, such as student advising, grant writing, publishing, and committee service activities" (p. 86). There is an emphasis on preparing future faculty with specialized content of their fields and with the skills to conduct research. Despite many graduate students funneling into careers in academia as professors, there is no training in pedagogical skills and ideas (Gaff and Lambert, 1996).

Furthermore, depending on the institution in which a future faculty member was pursuing their PhD, they become socialized in the culture of that institution (Gaff and Lambert, 1996), which can make it challenging to transition into academic spaces with different values and diverse students. As stated by Professor C, *"I think most grad schools are not teaching focused institutions. They're research focused institutions. So they don't necessarily prepare you to be a teacher as much as they prepare you to be a researcher."* If the institutions value research more than teaching then professors are socialized to agree with that, and bring that perspective into the

spaces they teach. Ultimately, this points to the ways in which graduate schools are still operating under a structure that values propositional knowledge and procedural knowledge of STEM disciplines, and are not emphasizing the social knowledge that is needed to be a successful teacher.

This may point to the need for restructuring faculty preparation for STEM professors in order to better prepare them to teach, but, perhaps more importantly, also better prepare them to work and connect with diverse students. In my conversation with professors, I asked them what they wished they had been better prepared for and many of them addressed the lack of preparation in the social aspects of being an educator. Here are some responses:

> Interview B response*: "Background on pedagogy. Um, something specific for computer science would have been great. When I got here, there were really the social aspects of like, trying to understand the different types of backgrounds. We talked about things like different learning styles, but we didn't talk about the different types of preparations that students came in with. And that was something that I learned when I got here talking to other faculty, how we think about that in our teaching. But that's not something that was covered as part of a STEM program, even in terms of trying to figure out. Trying to understand and connect with students that come from different learning backgrounds, as well as socioeconomic backgrounds as yourself."*

> Interview C response: *"So I don't think we received any preparation in terms of social justice issues, or dealing with differences in backgrounds in the classroom. The only thing we really had was a course for all the TAs in graduate school where we would talk about, you know, how to lead class effectively, and things like that, but never touching on social justice issues anyway."*

In these two excerpts, the faculty pointed towards feeling underprepared in the social aspects that came with teaching such as adjusting their classes for the different backgrounds of all students and social justice issues pertaining to STEM. These are issues that they have had to learn to deal with through their experiences as professors.

However, the under preparation can still feel like a challenge despite many years of experience. For example, Professor A - who has been a professor for eight years - spoke about

his challenge in supporting students of underrepresented identities. One of the challenges he faced was supporting students with disabilities. He explained:

> *"I think one thing that has become much more relevant now, or at least in the past three or four years, that it wasn't so much at the time was supporting students with disabilities or, um, mental health issues or other, basically any, any sort of general academic accommodations. Um, so we, I mean, uh, you know, I've seen even in the last few years, a huge uptick in the number of students who get accommodations, which is great. I mean, it's fine. I'm happy to support them. Um, but one of the big things I've struggled with even still is, is getting the students to give me that letter, right. That tells me what accommodations they get. Um, and so it's often. Just a challenge to, to navigate that, especially when you've got a lot of students, some of whom you don't even know about yet."*

In this example, Professor A was speaking to an area in which he has not had any prior experience which could be covered in a special education course.Working with students with special needs or just needs of accommodations for whatever reason, is something that all educators should be prepared to, but from this example it is possible that not all faculty feel prepared to do so.

Another challenge he, and his department at large, faces was in supporting students of color, when they express feelings of isolation within the CS courses:

> *"I think one of the big challenges for us is just, you know, if we're assigning lab partners, for example, I think this is one of the issues that has been, you know, we've heard the most, particularly from students of color that, Oh, I've, I've switched lab partners a few times and you know, people are nice to me when we're partners, but then they kind of don't talk to me again afterwards. This is the thing that we've heard a few times. I don't know what to do about that, to be honest. I mean, I can't, you know, it's like, I'm not the one being mean to you. Right? Like, I, I wish I could go to the other people and say like, 'Hey, you know, don't do that.' Right? And, and, you know, we try to be proactive about giving,' how to be a good partner' speeches and guides and write up some things like expectations for partners and all that. But, it's another thing to get people to do it. Right? And, and, you know, and it was, there's not enough students of color in certain classes to even, you know, always pair them together if that's what they want. And maybe that isn't what they want. Like we don't, you know, as an instructor, like, should I pair the two people of color together? Should I not? Like it's, it's, it's, it's tough to just know what the right decision is at all times."*

In this example, Professor A was speaking to the challenges in supporting students of color and he mentions not knowing what to do when addressing this issue, but still wanting to find a way to help these students. Better teaching preparation as a graduate student preparing to be a faculty member may be a potential solution to this issue. Professor A could just need better ways of communicating with students of color to see what they would want done and better ways of addressing the culture of the department that causes these issues.

These two examples point to some ways in which better preparation could help faculty work with diverse students. It is not possible for any faculty member to solve every problem a student faces, but it is possible to prepare faculty to communicate with diverse students. Better communication about issues like race, disabilities, gender, etc could be especially important for STEM faculty because of the lack of diversity in STEM classrooms. Being able to communicate with students of underrepresented backgrounds in order to understand their experiences and to learn from students how to better support them, may be a potential starting point for finding ways to engage students in a predominantly white field. Thus, it may be important for faculty to receive some form of preparation in facilitating conversations and connecting with diverse students.

It is important to note that some institutions do provide their faculty with some preparation and training upon arrival to the university. All the professors mentioned the computer science department having mentoring programs between faculty members that help junior faculty with their transition into teaching through observations and check-ins. Other institutions seem to have similar training programs for their new faculty members, but again these all vary depending on the institutions' values and culture (Sun and Simon-Roberts, 2020). While these trainings are

a source of support for faculty, it is all inconsistent and doesn't directly address social issues in all STEM disciplines and institutions.

Ultimately, it seems like professors in STEM, who may not have any prior educational experience, need more direct preparation in how to work with diverse students in ways that are more than just academic. Teaching preparation that helps faculty understand the depths of pedagogy and the complexities of students' identities may help faculty better support students and may help them address social issues that they struggle to address. In order for this to be addressed it is important to consider the cultures of the STEM domains, the culture of institutions, and the culture of the educator, and how all of those cultures intersect to reproduce an exclusionary STEM culture.

Readjusting Cultures and Systems

The third theme that emerged from the literature and from my conversations with faculty was the influence of STEM culture on their work as educators and on their experiences as graduate students. There is no precise definition of STEM culture. Historically, STEM culture has centered white men as many of the foundational scientific discoveries are attributed to white male scientists, who continue to be highly regarded today; Currently, STEM culture has rebranded itself to be culturally neutral, because of its supposed objectivity. However, as previously mentioned, STEM is not culturally neutral as it has direct impacts on communities, specifically harmful impacts on communities of marginalized people. Thus, STEM culture is consistently exclusionary of marginalized communities. Not addressing exclusionary STEM culture may be what is hindering STEM professors from supporting students of color and addressing the social implications of their disciplines.

The United States's long history of racial oppression, injustice, and racism has had a significant impact on higher education institutions. "Although institutions of higher education are characterized as places where ethical and moral issues are considered highly significant and philosophical differences are welcomed, they fail to provide a complete and critical education for interrogating the nation's racial history, including the historical and contemporary realities of racial prejudice, stereotyping, and discrimination (Picca & Feagin, 2007)" (McGee, 2016, p.1628). We see racism in higher education institutions and educational experiences continue to manifest itself through microaggressions (McCabe, 2009; Smith, Hung, & Franklin, 2011; Solorzano, Ceja, & Yosso, 2000). Racial microaggressions are an example of the way students of color in STEM face racial injustice when pursuing their degrees. However it seems that this racism is also instilled within STEM culture, which further confirms the systemic nature of racism within STEM culture. Historically, STEM has centered white male supremacy. For example, "Scientific racism, including eugenics, which flourished in the late 19th and early 20th centuries, reflected socially constructed ideas of Black and Brown genetic inferiority that socially, materially, and scientifically advanced White hegemony (Roberts, 2013)." This emphasizes the importance of stopping the belief that STEM is culture neutral. STEM is harmful not only in the way its content has been used to harm particular groups of people, but also in the ways STEM departments and institutions discriminate against people of color within the field through microaggressions and lack of support. Thus, STEM cannot aim for diversity without addressing this harm and in order to address the harm STEM as a discipline needs to stop viewing itself as objective and neutral.

In a recent panel hosted by the Philadelphia Regional Institute for STEM educators, Dr. Jamie Bracey-Green (2020) spoke to the three levels of STEM. The three levels were: 1) culture

of the individual (students and professors), 2) STEM domains, 3) the culture of the institution. By examining STEM through these three levels of culture, these frameworks can be used to better support marginalized students and to better address the social implications of STEM disciplines. During the panel,one suggestion from Dr.Simara Price- a biology professor who identifies as a Black cisgender woman- on addressing the racist culture of STEM is through disrupting the way students understand their field. She hopes to make it clear to her students that "STEM is not a system that was created by and for white men." She also suggested, "disrupting the way educators are just walking in and educating based on how they were taught. Disrupt those ideas and be creative with how we connect STEM with social issues and constructs." Disrupting the culture of STEM would involve unlearning the exclusion within STEM and offering a new lens of the topics and ideas being discussed. However, from further conversations with professors this is easier said than done. From my interviews, a way of disrupting the way computer science topics were discussed was by offering some explanation of the social implications of the work, but there were some obstacles that stood in the way.

The professors I spoke to mention some attempts at addressing the social implications of STEM in their classrooms. Professor A talked about the need to have more conversations about ethics in computer science courses. He mentioned:

> *I think ethics more generally, just in terms of like, Um, you know, how should we account for use of technologies that we're developing, who are going to be using them? How are they going to be using them? Um, you know, what can we do to make sure that they're being used in the right way? Um, and you know, I think this is, this is just a societal problem of, you know, can you make money off of something? Okay. Well, there's, there's always going to be people who are going to try to do that and are they doing it for good? you know, what, what sort of, um, impact does that have? And I think, you know, more specifically you can get into things like, uh, you know, autonomous vehicles, other uses of AI facial recognition, right? I mean, these are things that could be super helpful and powerful.Right? You could use facial recognition to do contact tracing for, uh, you know, pandemics, which is obviously a topical thing. You could also use it for censorship or, you know, all sorts of other various purposes. And so I think, you know, all of these*

> *technologies come down to how you use them. And I think that's not a discussion that we typically see as much as we should in a lot of the courses. Mainly just because the way our curricula are historically set up has been to teach you how to do it and not so much to spend that time talking about what are the implications of it. Um, and so, you know, that's what I was trying to do with the, um, directed reading we did.*

In this conversation, Professor A highlighted various ways in which technology can be used for good technological progress but that there are also negative impacts as a result of these advancements. However, while Professor A addressed the issue in this class, he did admit that these conversations are not emphasized in other classes because "c*urricula are historically set up to teach you how to do it and not so much to spend that time talking about what are the implications of it."* This points to the culture of STEM and its values. Further, Professor A mentioned the direct reading which was described in the introduction. While meaningful conversations were had and important topics pertaining to the impact of technology on society were discussed, it is important to note that the computer science department did not give students any credit for this course because it did not count towards the major. Thus, implicitly there seems to be a culture conditioning us to not see these conversations as meaningful to the discipline.

Furthermore, the literature points to the exclusion of students of color as also ingrained in the culture of STEM disciplines. In the study, *"If you aren't White, Asian, or India, you aren't an engineer": racial microaggressions in STEM education,* Meggan et. al find that quantitative and qualitative data suggest that racial microaggressions "are not isolated incidents but are ingrained in the campus culture, including interactions with STEM instructions and advisers and with peers." (2020) In a recent study by the Student Advisory Council to the CS Dept (SACCS) at Swarthmore College, where SACCS developed and distributed a student feedback survey for the CS department to gather information about student experience in CS spaces, SACCS found that

marginalized students often feel less supported than their non-marginalized peers (SACCS, 2020). This again points to a culture that may be inherently exclusionary.

Thus, when aiming to address the lack of racial/ethnic diversity and to address the social implications of STEM disciplines, a deeper understanding of the culture of STEM may help unpack the root of the issues. As was stated by Dr. Jamie Bracey-Green, "diversity does not equal culture." In Interview C, Professor C brought up Clemson University's mission statement and its commitment to discussing ethics:

> *"You know how schools have missions. Or like this is our mission statement. So they have this, this is kind of a summary of their mission statement. And this is Clemson University. But what I thought was really interesting was this middle row here. So they want to describe the ethical consequences of decision making in social interactions. They want to evaluate the impact and ethical consequences of one's own and others actions. And they want to take informed actions to address ethical, social and environmental challenges in local and global contexts. So I just thought that was interesting that in their mission statement, they're building in ethics and social responsibility. And they actually have every class say how they're addressing some of these things. So it just made me think about how, if it came from a really top down perspective, how that might, you know, push that agenda even further"*

In this conversation, Professor C showed me Clemson University's mission statement and explained how every class was required to mention ethics in their classes. This is an example of how at the administrative level it is possible for a school to change the cultures of disciplines. Perhaps this may be a way to reimagine STEM culture. There may need to be a complete reconstruction of STEM culture that includes the explicit goal to address ethical issues such as social implications of disciplines and the lack of racial/ethnic diversity,in order to require some level of cultural competency of professors, advisors, and students.

The culture of STEM seems to be the most significant theme that arose throughout this project because of its influence on the other themes. As STEM academia moves away from procedural and propositional knowledge towards cultural competence, it definitely seems to be a

cultural shift in what is being uplifted as valuable forms of knowledge; Further, the culture within graduate programs that prepare future faculty may be socializing faculty to reproduce the exclusionary culture of STEM, which ultimately becomes the culture of different institutions. The support faculty need in order to address the social issues within their disciplines, may not be quick fixes to attract and retain students of color or the ability to include ethics in their curriculum. The support faculty need may be a deeper reevaluation of STEM culture from the get go. The question then becomes how do we redefine STEM to center human rights awareness, critical thinking, and the ideals of tolerance of diversity, while respecting others fosters?

CONCLUSION

In sum, there seems to be a variety of layers that influence the ways STEM faculty address the social issues pertaining to their fields. The lack of specialized teaching preparation for faculty in their graduate school experiences doesn't necessarily prepare them with the social skills needed to support and connect with diverse students on levels beyond academics. Further, because of the emphasis on procedural knowledge and propositional knowledge STEM education is often disconnected from its social implications on communities and people. Fundamentally, this all seems tied to the culture of STEM, as it is a culture that when aiming to be neutral can cause harm both within and outside classrooms. Thus, in order to support faculty to address social issues, the culture of their departments and fields need to be rebuilt to center human well-being and equity. A cultural change within the department would require a systematic change, not just individual cultural changes.

Given that I only had three interviews with only computer science professors at Swarthmore College, this is not enough information to make any conclusions. In addition, my

identity as a first-generation low-income woman of color in STEM, may be a source of bias. However, I don't think my positionality impacts this work negatively. I bring my perspective and experience as a marginalized student in order to help improve the environment for other students like me. I feel that generally faculty members do want to improve their departments in order for marginalized students to have better experiences, but perhaps the improvement doesn't come from quick fixes, like an ethics course or affinity groups. I think foundational culture within STEM disciplines needs to instill understandings of race, equity, and diversity in teachers, administrators, and students.

Ultimately, I am left with more questions than answers. In thinking about the ways STEM faculty are supported to address the social issues within their disciplines, there is no exact source of support. The faculty I spoke to brought up social issues that were very much in line with the literature; There is a lack of diversity in STEM and there is also a lack of conversations within STEM classrooms that address the negative social implications that STEM fields may have on society. However, in addressing these issues, there was no consensus anywhere on what the best way to address these issues is.

Faculty within the department I work with have planned events and department programming to attempt to foster better community among students. For example, they recently started affinity groups for students of color, queer students, students with disabilities, and women and other underrepesented genders in computer science. These meetings were meant to "Support students from underrepresented groups in CS. The goals of the meetings are to foster students from different affinity groups meeting each other, listen to your ideas and concerns, and have a fun get-together outside of class." However, a Facebook post on the Swarthmore 2020-2021 page mentioned only one student being present at the meeting for students of color. While these

meetings are well intended and could become a source of support for diverse students, this amplifies that "diversity does not equal culture" (Bracey-Greene, 2020). Simply creating groups and trying to start conversations without addressing the prior harm may be ineffective. In addition, it is not clear how affinity groups will help conversations between white students and students of color. Furthermore, faculty have also attempted to add broader conversations to their classes about the social implications of their work, but it is not a requirement of all courses within the department, nor of STEM disciplines at large. It seems that the support to address these issues is there, but the culture to want to address these issues is not. Thus, rather than thinking about ways to support faculty to address social issues within their fields once they're already professors, perhaps we should turn our efforts to change STEM culture at its core by encouraging professors to engage in identity work. Identity work would encourage professors to think about the intersections of their identity and its connection to their students. At heart, STEM culture in classrooms needs to start centering the identities of students and faculty, rather than just the content.

Work of activists within STEM point towards what the future of STEM could be. One example would be Dr. Robin Wall Kimmerer who is an American Distinguished Teaching Professor of Environmental and Forest Biology; and Director, Center for Native Peoples and the Environment, at the State University of New York College of Environmental Science and Forestry. In her book *Braiding Sweetgrass,* Dr. "Robin W. Kimmerer uses her education and knowledge from her Potawatomi indigenous roots to approach her work as a scientist and botanist. From her community, Kimmerer has grown up having an appreciation and love for the land, and its gifts and beauty. However, Kimmerer highlights how academia, especially in STEM, excludes this love of the land through her experience in school. She recalls how her

adviser in college asked her why she wanted to study botany, and when she explained that she wanted to understand the beauty of the land, he told her, “It’s not science.” (Kimmerer, 2015: 41)” (Ramirez, 2020, p. 8). What makes Dr.Kimmerer stand out is the way she has used her identity and experiences to reshape STEM. This is emblematic of the identity work all educators should participate in when thinking about teaching; Understanding one’s identity and biases and how they may influence the way you present information and the way students perceive you, may be the first step in reimagining STEM education.

Further work on this topic would address the ways in which educators would be prepared with the understanding of race, equity, and diversity before coming into teaching. In the webinar mentioned earlier with Dr. Price, the question was posed, “Whose responsibility is it to have STEM educators understand the impact of power, privilege, race, equity?” The easy answer is that it’s everyone’s responsibility; However, it is not clear who *actually* is assuming that responsibility when preparing STEM faculty or developing the culture of STEM departments in different higher education institutions. Thus, I am left wondering how we can reimagine STEM.

In order to reconstruct the culture within a department to better address the systematic racial injustices that occur within STEM, I would like to offer three suggestions:

- *Build better channels of communication between faculty and students*

Changing a culture is a systematic process that involves change at all levels within a department. Building better channels of communication between faculty and students would help both faculty and students in a variety of ways. Students would be able to have a voice and share their opinions about classes as well as share their experiences with professors. For racially underrepresented students, having a channel of communication with faculty could be a resource to ask for support in navigating racial battle fatigue. For faculty, receiving student feedback and

engaging with students on their thoughts and experiences within the department will help improve their own pedagogical approach and to learn from students how to best support them.

- *Facilitate multicultural interactions and conversations between students*

In order to address the racialization and microaggressions among students, professors must also facilitate multicultural interactions and conversation between students that are not only about class content. Facilitating an environment where these conversations can happen organically will help students understand each others' different backgrounds and identities. Further, this will help create a class environment that is inclusive of all students because students will be encouraged to get to know each other and collaborate beyond just academic work.

- *Incorporate supplemental class material on the social implications of class content*

To address the social implications of STEM material, it is important to incorporate supplemental class material about the connections between class content and its implications on communities outside of the classroom. In addition to this supplemental class material, it is also important for faculty to address the importance of these connections in class to social justice, through discussions in order to encourage students to see their classwork as more than just assignments needed to pass.

These three suggestions are not the end all be all of reconstructing STEM culture, but they offer a starting point. Reimagining STEM culture and rebuilding it will be a long process of unlearning. It is not something that can be done by holding meetings and forcing conversations. It is also not just a problem within higher education. STEM education must be rebuilt for all grade levels to encourage conversations about race, equity, and social justice. Further, STEM education needs to stop centering white men and be honest about the historical and current harm STEM disciplines cause. People within STEM disciplines do not just solve problems, we create

them too. An important first step may be to unlearn the misconceptions of STEM as objective and neutral, and to unlearn that our identities are somehow disconnected from the work of these disciplines. As opposed to the way STEM is operating now, departments and faculty need to shift away from viewing STEM as culturally neutral because it is not, and continuing to ignore its implications will only perpetuate harm.

APPENDIX: INTERVIEWS

INTERVIEW A

How long have you been teaching as a faculty member?

So I started at Swarthmore in 2013. Um, I did teach a class in 2012 as a grad student, uh, when I was at UCSD. So my first class was 2012, but my fullest first full-time teaching job was 2013. So, I guess this is your eight, although I'm on leave this year. [chuckles] So, very lucky to be on leave this year.

How would you describe the preparation you've experienced for your role as a professor?

Um, I mean, I think the weird thing about this job is that nobody really teaches you how to teach for the most part. I mean, when I was a grad student, I was required to be a TA.

Um, which I didn't mind because I liked it. Although a lot of people hate that aspect and just want to do research all the time. But, um, and so part of that required you to go through like a TA training process. Um, it was actually run by somebody who I, I now understand to be like one of the top or was one of the top CS education researchers. She's moved on to some other things now, but, um, so I was really fortunate in that regard and that I was getting, you know, this great training, even though I didn't realize it at the time. Um, so I guess that would be the thing that I would point to as like the most formal process, was that there was, you know, this required course that as a grad student, you had to take before, you could be a TA and you know, that taught us a lot of things, but you know, it's certainly not comprehensive.

It's certainly not a substitute for actually being in the classroom. I think there's nothing like doing that. And so, uh, you know, a lot of what I learned too was that that summer class that I taught at UCSD as a grad student, who was, you know, I got to teach a small class over the summer. And so, you know, uh, I guess that's, that's probably the biggest help was just getting the experience.

I also was a TA for three or four quarters as a grad student. And so again, other than the training class that you have to take, there's not like somebody who's sitting you down and saying like, okay, here's what you should do. Here's what you shouldn't do. But, you know, I was, I was a TA for a professor who I had worked closely with a few times and, you know, just watching him and sort of emulating him, helped a lot too.

What kind of things were covered in your training class that helped prepare you?

Uh, that's a great question. This was like 10 or 11 years ago now. Um, I mean, I think it was a lot of it. I mean, it was, it was, uh, Broad class. It wasn't, it didn't go into a lot of depth into any one thing, but it talked about a lot of things that at least were relevant at the time. And most of them still are. I mean, you know, this, this ranged from anything to like how to put together a syllabus, um, to, uh, you know, how to engage students in your class and try to get them to ask questions.

Um, this person who was teaching, it happened to be one of the big proponents of peer instruction. And one of the reasons that I adopted the whole like clicker thing. You know, try to do the interactive things in class. And so I think we didn't talk about that exclusively, but I think a lot of it was phrased in terms of how do you make teaching interactive.

So, and I guess interactive for the purposes of being beneficial to learning. Um, so there's a lot of research out there, um, in the education world, CS education in particular that shows, um, that you can't just talk and have people understand what you're saying. You have to give them a chance to do it.

Right. It's about getting hands-on. I mean, this is why we have labs and things like that. And so, and a lot of what we did was, you know, read papers and talk about those sorts of ideas and why these things might, might help students do better. And you know what we know and what we don't know about the psychology of learning and things like that.

Um, so that was definitely a big component of it. Um, you know, that said, we also did a lot of very hands-on practical things too, of like, we're going to do a mock class and pretend like you're the TA and you're leading the discussion section today. And, you know, you get up in front of a group of like four or five other grad students and you talk about something and then they'll, you know, you can kind of critique each other after like a 10 minute, you know, mock run.

So it also had this very, hands-on like, Just try it and see what happens and try to get some experience. It was just always weird. Cause you know, it's not, it's not real, like it's, it's totally fake. Um, so it's an interesting experience, but, um, and then, you know, we talked about other things too. Um, you know, there's a lot of discussion about, um, things like, um, uh, imposter syndrome and stereotype threat and things like that, that, um,, you know, as a TA, you can not thinking about this in terms of the class that you're leading, because you're not the one leading the class, but so it was, it was more phrased in terms of like being on the lookout for students who might be struggling or being able to support them and bringing them to the attention of the professor. Cause a lot of times it's just the, we had classes that were like three or 400 students and, you know, 10 TAs. So it was a very different model from what we have here. And so a lot of times the students rarely even interact with the professor or maybe they'll talk to them once or twice, but, um, it's often the TA's that are holding the office hours that the students will come to.

And so we, we would have been the ones that. You know, would have noticed that there was a problem that we could then bring up to the professor. So, um, you know, there were things, things along those lines. Um, I guess that's all I can under can recall now. So one of the things that just comes to mind is that, um, in addition to these things, is that the university UCSD had a center for teaching development.

Um, and I did attend several things that they had put on, um, I don't remember the names of them now. I mean, some of them were just later, like one-off workshops where it's like, Hey, come and learn about this or that. But they did have some sort of like program. I don't remember. I think it was like six or eight weeks where it was like once a week. We meet for a couple hours sort of class. And I think the end goal was to get some sort of certification, but I don't think any of us actually went and got the certification afterwards. Like I don't, I don't, I don't remember all the details, but, um, this was later and at that point I may have already had a job or I was on the job market.

And so I wasn't super interested in, like, I wanted to know the information, but I didn't need the certificate for anything. Um, and I did end up eventually becoming the head TA for the department in my last year. So this was after I had taught the class in the summer of 2012. So I graduated in 2013. And so for the year, Like the 2012, 2013 academic year.

Um, I was the, the TA that was like running those sorts of mock class sessions that I was talking about. So I answered to the professor who was teaching the TA training course, but, uh, I helped out a lot with the organization. So I saw that material several times, even though I think once it was probably enough.

Are there any things that you wish you would have been better prepared for? Like now that you've been a faculty for a long time, like. Are there things that you wish you had known before and like what are they, if there are any?

yeah, I think that's a good question. I think it's a tough one though, because a lot of times, I mean, you certainly don't know what you don't know yet.

Right? I mean, it's hard to know like exactly what you're going to need. And, um,

I mean, I think there's no substitute for experience. I mean, that said, I think there are some things that. I mean a lot of it, I guess it's just navigating the environment that you're going to be in. So like, they can tell me all about things that you UCSD, but it's hard to know what things are going to be like in a new place when you get there.

Right. Um, and so for one example, and this may not be super relevant for what you're interested in, but, um, you know, at UCSD everything, every project the students worked on was, was solo. Like they didn't have partners or teams or things like that. There may have been a few like software engineering courses where you got together in bigger groups.

But, um, so when I came here the first semester I was teaching a class, I was like, yeah, you know, I'm assigning, uh, it was a networking course and I'm assigning projects. And it was like, well, yeah, you're just gonna work by yourself. Um, especially with only like 30 students, right. I had 35 or something my first semester.

Um, and the students were like mad, like really mad. Like this is too hard. I can't do this by myself. I need a partner, you know? Um, and so eventually after a few laps. And, um, I ended up assigning partners because I realized that like everybody was assigning partners in the department. And so this was making me the weird one.

Um, so I think there are some, some things like that, but that's probably not relevant. I mean, that's more of just like institutional culture and things like that. Um, I think one thing that has become much more relevant now, or at least in the past three or four years, that it wasn't so much at the time was supporting students with disabilities or, um, mental health issues or other, basically any, any sort of general academic accommodations. Um, so we, I mean, uh, you know, I've seen even in the last few years, a huge uptick in the number of students who get accommodations, which is great. I mean, it's fine. I'm happy to support them.

Um, but one of the big things I've struggled with even still is, is getting the students to give me that letter, right. That tells me what accommodations they get. Um, and so it's often. Just a challenge to, to navigate that, especially when you've got a lot of students, some of whom you don't even know about yet.

And then you're trying to figure out how to, um, make reasonable accommodations for them. And the college does have, um, an office that can help with that, but it's had a pretty high turnover rate over the last several years. And so that's, that's made it difficult. And, um, you know, like I said, a lot of students just which totally understandable reasons aren't interested in disclosing that to you until they want to use it. But then the problem is they have, you have to have time to figure out what to do, right. And so if somebody tells you about a problem, you know, 24 hours before the exam, it's like, well, I, you know, what, how do I, how do I fix this? You know? So, um, I think that's just, just supporting those students better has been something that's been an ongoing struggle for me.

And I think for the department too, just as we grow in size, I mean, you know, my first class was 35 students. Now I'm teaching classes of, you know, 60 or so. And so. Um, that's the scale is obviously a huge problem for every CS program.

What motivated you to be a professor?
Um, I thought it would be fun. I don't know. Uh, I mean, I, so I, I did my undergrad computer science program at Georgia Tech wearing the sweatshirt. Uh, and I felt like afterwards,, Oh, I've learned so much, but I still don't know everything I want to know. Right. Like I just, there wasn't, I felt like there was something missing. There was more to get.

Um, I was really interested in networking, but I was also really interested in talking to people about it. Like, um, and sort of the experience of, of like seeing something again for the first time through somebody else's eyes. Right? Like you, you know, you watch a movie that you've seen a hundred times for somebody who hasn't seen it in, it kind of feels new again, to some extent.

Um, so I really liked that idea and I thought I was interested in teaching, although I didn't have a lot of experience. I did, I did TA once as an undergrad at Georgia tech, um, it was sort of like the Ninja sort of thing we have where it's, you know, peer, peer helpers. Um, but that program wasn't huge because Georgia tech had grad students.

And so it was mostly, you know, grad student TAs that they were hiring. Um, and I thought that was fun. You know, it was something that when I went to grad school, I thought, well, you know, my goal here is to learn more about, you know, networks, but, um, I might as well teach some classes or TA some classes when I can and see how I like it.

And, you know, I hadn't settled on, like, this is definitively what I want to do, but I thought it was something that I might be interested in, you know, wanting to at least explore. And so I TA a few times I liked it. Uh, I taught a class in the summer. I liked that too. And so I started pursuing basically anything I could that, um, that might help to get me some experience that I could then come to a place like this. And, and when I was applying on the job market, I, I specifically

targeted schools that still had a research requirement, but were more focused on like teaching was number one. And so I think this was a perfect mix or a perfect fit for me because, you know, here, my responsibilities are like two thirds teaching one thirds research, which is.

About right for me. Um, I don't want to spend all my time, you know, writing grants and running a lab and never getting to interact with students. But, um, you know, I still want to have some driving force behind, like making me do those things to some extent too.

Um, I haven't really thought about that whole thing like between teaching and researching so I think that's pretty cool.

Like a big university as a, as a faculty member. A lot of times it's like, if you, if you're doing too much teaching. Um, and you, if you went to teaching war, for example, that's a bad thing because that means you're not spending enough time on research. Like you're spending too much time teaching.

Right. Um, and so that's, that's a problem that means you're not going to get tenure or promoted or whatever. And so, um, and they're not, every school is like that, but for the most part, the, the bigger the school is the more research focus is going to be the more they care about bringing in grant money.

And, you know, you're not even the one doing the research anymore. You're, you're out there, um, trying to get grant money and. you know, position your grad students to do the research while you manage the lab and everything. And so I didn't, I didn't really want to have that level of removal.

Yeah. I think it goes back to what you said earlier about, the culture of the college or school for that, for sure.

Um, and so I guess my final question is like, do you see any social issues that pertain to your discipline and like, what are they and how do you see yourself addressing them inside or outside of your classroom?

Uh, I mean, I think there's a huge number of issues. I mean, you, you took the, the directed reading we did before, but you know, I think there's a lot of issues in ethics that, um, I mean, a lot of these things are things that our department doesn't currently address all that we'd like to, but, uh, you know, ethics of, um, design, I mean, we read to teach and we'd being not just the college, but like computer science in general teaches students how to build things, but not how to design them for people or to different groups of people. You know, I mean, it's, it's sort of like, well, how can we get this thing up and running the fastest, right. Which is super important when, you know, you've got a two week project and, you know, you're worried about a million different deadlines and, and, you know, I, I understand that's why the way that it works, but, you know, I think the, the design aspect of trying to hear different voices and put those together, I think there are a lot of aspects of computer science that they come into design that we don't address well, just as a discipline, um, because it's not something that fits in with the goals of a particular course. It doesn't cleanly fit into any one course. Um, except for maybe like a software

engineering course, perhaps. Um, so I think that's, that's one, I think ethics more generally, just in terms of like, Um, you know, how should we account for use of technologies that we're developing, who are going to be using them? How are they going to be using them? Um, you know, what can we do to make sure that they're being used in the right way? Um, and you know, I think this is, this is just a societal problem of, you know, can you make money off of something? Okay. Well, there's, there's always going to be people who are going to try to do that.

Um, and are they, are they doing it for, for good? you know, what, what, what sort of, um, impact does that have? And I think, you know, more specifically you can get into things like, uh, you know, autonomous vehicles, other uses of AI facial recognition, right? I mean, these are things that could be super helpful and powerful.

Right? You could use facial recognition to do contact tracing for, uh, you know, pandemics, right which is obviously a topical thing. Um, you, what, you could also use it for censorship or, you know, all sorts of other, um, the various purposes. And so I think, you know, all, all of these technologies come down to how you use them. And I think that's not a discussion that we typically see as much as we should in a lot of the courses. Mainly just because the way our curricula are historically set up has been to teach you how to do it and not so much to spend that time talking about what are the implications of it. Um, and so, you know, that's what I was trying to do with the, um, directed reading we did.

And, and, you know, I've been trying to inject some more of these things into, um, other courses as well. So for example, I taught 21, a couple of semesters ago and we did a lab, um, you know, the classic, like searching and sorting, right? Where you here's the dataset, um, you know, you're going to implement, um, you know, bubble sorting and something like that.

Right. Um, and so we, we, we use the publicly available data set about police shootings. Um, this was prior to the George Floyd, but after the, um, Uh, Michael Brown, you know, cases. And, you know, I think we got generally good feedback about this from the students. There were a few students who were weirded out by it and weren't happy that this was something we were covering in a CS course, but, but, you know, overwhelmingly, the students were saying like, Oh, it's great to see. I mean, we tried to phrase this in terms of like, this is how you might end up using these sorts of CS skills. I think a lot of students were happy to see that the things that they were learning here, you know, albeit in a simplified way could be applied towards these real sort of journalistic problems that, you know, managing a database that keeps track of things that are socially important.

And so I think many of us, most of us are aware, uh, in the department that these are our things that we would like to do. Um, but it's just hard when we have a lot of constraints on, you know, what we can do with our time and how many students we can support. And, you know, we're, we don't want a lottery people from classes.

We don't want to do those sorts of things. And so we want to make the best course we can with as many people, but we still also want to try to innovate and make things in the direction, take them to the direction that we think is important. And so.

Um, that's tough. It sounds like it's like the structure of like, I guess like the department is growing so fast and like really impacts that.

And it's not just us. I mean, you know, we're, we're consistent with basically every other place. I mean, you know, if you look at most other schools, CS is just as popular as it is here. And so, um, it's just, it's led to a lot of hard choices in the discipline as a whole.

And so, you know, we've had to make some hard decisions and other schools have made different decisions and we've kind of seen what's happened there. And so for example, a lot of schools have decided to, uh, limit the number of people that can be in the major. Right. Um, which is something that has been suggested to us and that we've been very resistant to because, uh, we know what will happen is that, uh, you, you lose a lot of diversity in the major, right? Like it's the, the, the people who came into college, thinking that they might want to be a CS major that you'll keep. And it's the people who discovered along the way that you'll lose. And often those tend to be women, for example, Um, who take a CS 21 class and say, Oh, this is not at all what I thought it was, I can, you know, I can do this and I like doing this and so I'm gonna stick with it. And so, um, if it's impossible to get into a CS class, or if it's, you know, has a reputation for that, then, um, know they might not even take that first course. And so that's, it's, it's been demonstrated over and over again, and that's a problem.

Um, and so what, what do we do? So we ended up having to do the cap on the major, which I know is unpopular, but you know, it's, we're in a position where it's lesser of evils and, you know, that was the least objectionable one that we could come up with. But, um, but yeah, I think overall, um, we're in a place now where I think the discipline recognizes the importance of these things, but struggles to implement them just due to being under so much enrollment pressure and just having resources spread thin.

Um, so I, I just attended 60 Online. This is a computer science education conference that I go to every year. Um, and they've, they've been at the forefront of, um, I guess trying to be socially conscious in terms of computer science education for, for many years now. Um, and there were a lot of sessions about, you know, how can we increase diversity?

How can we, you know, support and retain students of a variety of backgrounds? Um, and you know, the classic question as well. Well, how do we how do we find the resources to do this? And, and, and, you know, it's just, it's just hard everywhere across the country right now, because there's so much demand. And most of the people getting PhDs go into industry because it pays way more.

Um, and the ones who want to go into academia have already been snatched up already. And so there's just, it's not just like, Heavy demand is it's backlog. And so we're, we're just in like a debt in terms of the number of people. And Swarthmore has been somewhat lucky in that we've gotten good visitors just because we're in a major city, but if you're at, you know, Williams, for example, I don't know if you've ever been to Williams College, but it's kind of out in the middle of nowhere.

And so, um, they rarely get visitors. Sometimes they don't even bother trying to do a search for visitors because they can't attract people to come to that area. Whereas at least we're, you know, we've had people who their spouse needs to be in Philadelphia for some reason. And so they, they come to us even if they might've gotten a tenure track offer somewhere else.

But yeah, it's, it's tough. Yeah, for sure. Well, hopefully even out, but that's all my questions. I really appreciate your time. Thank you so much. Um, I think I'm fine. Like I got everything I want to talk about.

Cool. I'm just curious about what your topic? I don't know how much you can tell me or not, but yeah.

Um, it's basically about like, obviously a lot of the, there's a lot of social issues within them. And a lot of the time it's like talking about ways to fix them, but like, it's more like pertaining to how to support students and stuff. But I wanna know what months implementing things is easier to say, like potentially and the mentoring stuff, like all the faculty went back to me to get that done.

Yeah. Yeah. So I can think of, so a few other things that might be helpful or at least avenues to look into, um, the college does have some mentoring efforts. So, um, I know that the college did have some sort of, um, um, like peer faculty mentoring. I don't know how often it happens. And I was on leave the year that it happened last time, so I wasn't able to participate but the department does this a lot. So, the department, uh, every year, um, has groups that we call them pods of like three or four faculty. And so we'll each sit in on each other's classes and give sort of informal feedback. And so usually it's like one senior person, one. Middle person and one junior person so that sort of thing helped.

And then as far as socially conscious issues goes, you know, the department is aware of them, but struggles to incorporate them just because of time, pressure and enrollment pressure. But the colleges, I mean, it's great about these sorts of things. And we've got the Lang center and the Lang center has been very supportive of, you know, if you have initiatives that are going to be.

I'm trying to remember what they, I think they call it like engaged scholarship, is the word that they use. But, um, so, so they're great. I mean, that's, that's some of the funding that we use to fund the trip to Boston. I know you didn't get to go on, but, um, that some of your classmates did

I've talked to Ben Berger at the Lang center a few times, and I was trying to put together a course about, like engaging with the community. Um, but I was going to do it this year, while I was on leave. And obviously everything's different from what we had expected this year. And so now it's probably not the best time to be trying to meet with community partners, given that we can't meet with anybody in person, but yeah.

I was also interested in the retention of people of color in the CS department. And I know like there was a. There was a survey that was done earlier. I think it was last semester about how marginalized, they're not like difference isn't drastic, but most of the time they

feel less supported in their view. It's like, what, what do you, what are your thoughts on that?

Yeah, I mean, I think that's, that's a tough question. I mean, I think, you know, we obviously want to support every student and we want to do the best that we can for everybody. Um, a lot of times it's difficult for us to know. What people are struggling with. Um, and so, um, I guess that's part of the reason why we did the survey, right.

Was to, just to try to get some, some information to see, um, you know, how people were feeling so that we could decide what we wanted to address certain and how we could address it. I mean, I think that's, you know, knowing the information is obviously the first step, because if we don't know it, then there's, you know, we're blinded to be able to do anything, but even if we know it's not always clear what the best course of action is, right. I mean, I think, um, the department, I, you know, this is my personal opinion, but I think the department does a really good job with WICS and supporting, um, women in computer science. And that club is largely self-sustaining now with the students having taken over it.

Um, you know, Lisa and Tia did a lot of work in that beginning to try to get that up and running. Um, but I think for the most part it's, it's, you know, pretty ingrained in our department now. Um, and so I think we would like to try to do something similar for various other groups. And actually, I think Tia just sent out an email the other day, maybe it was yesterday or the day before about trying to put together some other affinity groups.

Um, and we're hoping that that will help. I mean, we want people from all different backgrounds, to identify as computer scientists, if that's the major that they're in to feel comfortable in our department to have friends in the department. Um, you know, and I think that's really just a lot of what we're, what we want is for everybody to be as comfortable as anybody else to feel like they belong to be welcomed in our spaces to, you know, to have lab partners that they feel like they can work well with.

Um, and, and things of that nature. And I think. Yeah, we're hoping that this will be a first step, you know, it's, it's unclear at this point, whether creating those sorts of clubs for other groups is. The right approach or not. I mean, part of it's going to depend on what students want to do if, if students want to create those groups and, you know, be part of that self-sustaining process, then I think we're more than happy, eager to support, um, that sort of thing.

If they don't want to, then we're, we're happy to do what they want to do. I mean, you know, part of it is trying to figure out what works best for everybody to, to support them. I mean, I think, you know, Regardless of what we as faculty do. I mean, you know, we're going to be supportive of whatever, but I think one of the big challenges for us is just, you know, if we're assigning lab partners, for example, I think this is one of the issues that has been, you know, we've heard the most, particularly from students of colors that, Oh, I've, I've switched lab partners a few times and you know, people are nice to me when we're partners, but then they kind of don't talk to me again afterwards.

Um, this is the thing that we've heard a few times. I don't know what to do about that, to be honest. Right. I mean, I can't, you know, it's like, I'm not the one being mean to you. Right? Like, I, I wish I could go to the other people and say like, Hey, you know, don't do that. Right? And, and, you know, we try to be proactive about giving, um, you know, how to be a good partner speeches and guides and write up some things like expectations for partners and all that.

Um, But it's another thing to get people to do it. Right? And, and, you know, and it was, there's not enough students of color in certain classes to even, you know, always pair them together if that's what they want. And maybe that isn't what they want. Like we don't, you know, as an instructor, like, should I pair the two people of color together? Should I not? Like it's, it's, it's, it's tough to just know what the right decision is at all times. And so we try to mix things up a little bit, you know, certainly in the lower level, like 31 and 35 courses, we tend to mix up the partnership a little bit more to give people a chance to, to meet other people.

Um, usually in upper level classes, we let them pick partnerships, but just things like that have been a source of frustration for students and a big question mark for us. Cause it's like, we clearly recognize this as a problem, but we have no idea what the solution is and we've tried various things and maybe it helped, maybe it didn't, but not, not any sort of way that everybody was like, obviously happy about it.

And so, um, you know, it's one of those things where like, it seems like no matter what you do, you're going to make somebody angry. Um, because there were some people that really get mad if they don't get to pick their partner and some people that, um, You know, really want to have a partner picked for them. And, uh, there's no way to get those two groups to be happy at the same time. So it's just tough.

Yeah, for sure. I think it is, it depends on the class too. I definitely agree with that.
I think it is like someone someone's always going to be upset about something, but it is hard to find something that accommodates the most people. Yeah, and we don't often see the interactions that are problematic. And so it's hard for us to even know when they're happening, unless somebody tells us. Um, and, and sometimes they do, and then we do our best to help in those cases.

But, um, you know, I think we'll, we'll see, I think this is part of an ongoing process, you know, we're, we're hoping that these affinity group meetings we'll at least start the discussion and if nothing else. Um, and so actually the department also started a student advisory council or committee.

They're trying to do like a mentorship program as well, for students like seniors and juniors to mentor freshmen and sophomores. So,we hope that it will at least bring about more attention to putting a spotlight on what their problems are and, uh, Do some group, uh, brainstorming to try to crowdsource the problem a little bit. Cause I think, you know, often we might not have the solution, but I think we want to hear what the students think the solution is and maybe what they want isn't something that we can do, but we can try to find a compromise. I mean, I think that's sort of realistically how this is all going to play out is that, you know, we, we, we get these

groups together. They start talking about, well, here's what's for what's wrong. Here's what we would like to see change.

And then we say, well, here's what we can do. And we try to, you know, work towards something that works for everybody. But. You know what that's going to be. I have no idea at this stage, but I hope that we get there.

Yeah. Well, thank you. I think that was good. I think. Thank you for your time again. Um, it was really informative.

Cool. Yeah, no problem. Good luck. Uh, it sounds like a great project. Is this just focused on Swarthmore or is this broader? Yeah, it was just one credit, so it was just on Swarthmore. Um, so, gotcha. Cool. Right. Thank you, man. Good luck. See you later.

INTERVIEW B

I have five main questions. I might ask follow-up questions in between like conversation. Um, we start off just talking about like, um, how long have you been teaching as a faculty member?
Uh, I've been a faculty member for 10 years.

How would you describe your preparation for your role as a professor?
Uh, so prior to coming here, I was in graduate school, finishing up my PhD. And, um, I did a training program for people that were interested in going into teaching. And so they, you know, it was just to kind of help you a little bit with gotcha. Um, and then once I got that, but that was not optional.

There's not really anything. You go through your PhD program to specifically train you unless you seek out opportunities. Um, but then when I got here, the college has a lot of mentoring programs, so they have a mentoring program for new faculty members. Uh, across the college, they pair you up with a mentor from another department.

And then within the department, we, uh, there was mentoring there so that the chair, or some other senior faculty member would try to sit in on my class, you know, every few weeks to kind of provide me any kind of, uh, the ability to answer any questions they have and to provide guidance on teaching. Um, so that's the kind of support for teaching that we've had.

Yeah. And I guess in your graduate experience, your patient program, and like, I think you mentioned a class earlier, like. Out of those things, like what was helpful for your role or like, and what things would you wish you had been better prepared for?
Yeah. So the things were helpful is that they give an option for us to be a teaching assistants, but we can volunteer to actually teach a section as opposed to just doing like a lab TA work or grading.

Um, so that was really helpful for me to understand like what it is to how it is to organize a class. And they had somebody kind of overseeing and they provided, um, help there. So that was, that was really influential in terms of me deciding that I definitely wanted this to be a part of, um, my career. Um, can you, what was the other part of the question?

What things like, um, what things do you wish you were better prepared for? Oh, right, right. So, um, really a lot of the stuff that they prepared you for was how to get into the classroom. Um, and how to like, think about preparing a lesson and thinking about how learning happens. So, but it wasn't, you know, it was, it wasn't that much in that, you know, it was only a few weeks that program for so a little bit more.

Background on pedagogy. Um, something specific for computer science would have been great. Um, and then, you know, when I got here, there wasn't really the social aspects of like, trying to understand the different types of backgrounds. Like you talked about, we talked about things like different learning styles, but we didn't talk about the different types of preparations that student came came in with.

And that was something that I learned when I got here talking to other faculty, like how we, how we think about that in our teaching. But that's not something that was covered as part of a STEM program, even in terms of trying to figure out. Trying to understand and connect with students that come from different learning backgrounds, as well as socioeconomic backgrounds as yourself.

Yeah. That makes a lot of sense. And like, how do you feel like you've kind of learned to. Navigate that like now 10 years in?
Yeah. So I'm lucky to be here, college where there's a lot of faculty that are very, uh, uh, curious and passionate about those things. So a lot of things are picked up in conversations with, uh, faculty, my department, as well as faculty in other departments, um, our research community.

So we can go to conferences for computer science education. These are, these are papers or papers about these and topics that are get brought up. And then there's a lot more, there's a lot of, um, you know, uh, like. Online, social networks of people that, uh, that are educators either in STEM or computer science.

And a lot of those conversations have happened there and all those learning opportunities happen there. So I would say I picked up a lot of it from my colleagues here, but also just once I got much more interested in how to address these topics, there's a lot of resources available. Um, and then, you know, the college itself, uh, has general interest in these, in, in a lot of these areas.

So while they may not provide formal education, the fact that like. The questions get brought up. And we were prompted to think about these and we have spaces in faculty meetings to have discussions that really, you know, that's good. Cause it makes you start thinking about things that it makes you realize that there are things that you don't know, right.

That you don't know that you don't know until, until those conversations happen. So, um, uh, that was kind of influential in terms of being able to start. Learning about this past process after that,

it's a lot of, it's a lot of, you know, it's a lot of applying the things that we learned in graduate school, how to do research in our own disciplines, applying those techniques to being able to learn about these topics.

So if I'm interested in, you know, in, um, in, in, in socioeconomic preparations, I can now go look and read a research paper. It's both in the education community and the CS community, um, and start kind of navigating a lot of that background. That's already been done by a lot of people that I just wasn't aware about.

Yeah. So I definitely is a place that kind of prompts those conversations. Um, and so ultimately, like what motivated you to become a professor?
I really, um, I really enjoy the mentoring process, being able to interact with, with individuals and, um, being able to, to educate it.

Just, it's just something that I've always been passionate about. Like even just, even before grad school, I would volunteer to do, uh, to like volunteer at the local elementary school and. Um, I would coach, uh, some, some high school activities and it just, uh, just the process, just, uh, you know, inspiring students to get interested in that topic.

And then having them kind of, uh, be passionate about something is just really enjoyable for me. Uh, and I think it's intellectually stimulating as well. So it's, you know, it's, it's one thing to be able to sit down and read a paper and kind of come to an understanding myself, but it's a very different skill to be able to explain that to somebody else.

And, um, it's a challenge that I really enjoyed early on. And when I was. When I was finishing up my PhD program, I, when I started my PhD program, I didn't quite know where it was going to lead. You know, you don't, you only kind of see a little bit about what a professor's life is when you're not undergrad.

Um, but once I got in, uh, it started, it started becoming pretty clear that computer science, you can either go very much in the research direction. So if you go to like a R one university or a top, top research institution, you do teach, but it's very much a secondary thing. And I, I. I knew I didn't want that.

I knew I wanted teaching to be on par with research. I wanted it to be an important aspect to my career and something that was valued at the institution I was at. And so that's, uh, that's why I chose to go to the liberal arts direction was because that was something that was important too. Yeah, that was the last sentence.

Um, and so like what social issues you see pertain to your discipline and like, how do you address them inside or outside of your classroom?
Yeah. Um, so I, I, I think there's, there's a lot of them, but I think, um, computer science has a very long history of, well, actually in, in some regards, it's actually a very short history because we're a relatively new discipline, but it's, it has a very deep history of, um, uh, ex exclusionary practices.

And so trying to address those historical inequities in the discipline, uh, primarily along the dimensions of gender. And race. Um, so, uh, you know, uh, women have been excluded from our, uh, from the field as well as, uh, individuals from various underrepresented backgrounds, but primarily, um, black, Hispanic, um, indigenous communities.

So, um, those are probably at the forefront of our thinking. Am I thinking in terms of like, how do we, how do we address those historic inequities in ways that. We can, right? So there's, there's some things I can think about in terms of like my research community and the broader community, but I, I'm more focused on what can we do at Swarthmore to, to, to bring in more, to bring in students that don't think of themselves as computer scientists or to reform our practices so that we're not.

Driving them away for lack of a better phrase. Um, there's some newer ones as well. So, you know, I, I, I'm learning more about, um, you know, as individuals that identified as having a disability, uh, the, the barriers that they face, I think early on, I just didn't interact with many students from that background.

And then that. Became obvious because why would they come to computer science if it's not a discipline that caters to their, uh, to their, to their needs. And so trying to incorporate that more into my teaching has been a relatively new focus. Um, and then, um, also LGBTQ plus, as I think we've had. Uh, I think we have some work to do there as well.

I think that it hasn't, it didn't rise to the top relative to the other backgrounds, but I think re you know, I think it's still something that we need to address. Um, and a lot of that comes down to as well as, you know, we, there's a lot of things that come in when students come from somewhere else to, to here having to think about.

The, the difference in the backgrounds and the preparation that students have. Like, I think a common excuse was, well, it's a pipeline issue. Like we don't control what happens in K through 12. That's where a lot of students get driven away from mathematics. So what do we do here? I think that was a convenient excuse for a long time.

And so trying to, to think about how do we overcome some of the things that we don't have control over, but we still need to address, I think is an important topic.

Yeah. I think, I think you bring up a lot of interesting points, um, and thinking about ways to. Change or make change happen at Swat? Can you talk about specifics?Like what challenges have you faced? Like kind of planning these things out or like, because I feel like a lot of it could be trial and error and seeing what works and what doesn't work for people. Um, so just, it speaks, can you speak to the actual, like execution of that? Like the planning of that, I guess a faculty member and like what supports you have to kind of develop these things.

Yeah. So I think one of the hard things is that it's hard to do a, you know, as scientists, we want to do like a controlled experiment and see like let's try treatment and treatment B and see what

happens. But when you're in, when you have a class size of 30, you know, you're dealing with smaller numbers, so it's hard to make an overgeneralization about it.

So I think that the main challenge is trying to find out what best practices are and making sure that we're being rigorous. In evaluating them, but also not making that stand in the way of moving forward. So, right. So like there's kind of a tight rope to walk there where you want to make sure that you're doing something that's not.

Harmful, but you also don't want to use that excuse like, Oh, we need four years to evaluate this, to decide that this is the right direction to go to, or, you know, the research community hasn't decided. So we're going to wait, um, and, and kind of decide there. Um, but I think the nice thing about being at Swarthmore is there's a lot more support for experimentation and for dialogue and, and taking chances.

Um, so for example, when I got here, One of the things was, do we want to add an introductory, uh, 21 section that had a particular flavor? So I came from a bioinformatics background and one of the reasons I liked bioinformatics and thought it would be really good at a liberal arts institution, was that it was, uh, It was gender, all gender parody.

So there was, uh, bioinformatics as a sub field of computer science is about 50, 50 male female, um, in terms of gender background. And it was a way to kind of provide a hook into computer science that is, you know, is not, fractals is not, you know, is not the way that we normally think about things where you, we always kind of think as, as a think of computer science as a math discipline.

And so when I got here, They were already kind of trying to think about, can we do a 21 section that was specifically about applications in biology? And so they completely supported me in terms of developing that and, and, and trying that out. And it was successful. We haven't been able to offer it as much just because I, I think we've incorporated a lot of those things that we've learned about from that into the normal 21 section.

Um, but yeah, there's been support in terms of. Um, uh, in terms of that, in terms of the things that we teach in terms of the ways that we teach them, we have discussions every summer at our retreats about our curriculum. And so for example, 35 was a course where we are identifying issues in terms of students perceiving that it was a weeder course, or, um, maybe it was, it was kind of, uh, forming a retention roadblock.

And so we did a revamp of that course and tried to identify like particular pain points and particular things from our evaluations that we were noticing from students. So, um, there's, there's a lot of support for reflection, conversation, and action in there in our department and ethic at the college. Um, and we, we implement those in various different ways.

Um, the Ninja program is another example where, you know, if you have an idea that college is very supportive, Uh, providing the financial resources to put into action. So, um, the Ninja program was, was financed by the college after we put the proposal together and iterated it out a little bit. And, and then we expanded it beyond 21 to 31 and 35.

And that has always been supported by the college. Yeah, that makes a lot of sense. I'm glad that those, those support systems are in place. Um, I did want to ask about, I know there was a class, I think you offered a few years ago kind of as like a first year, I think. Well, like ethics and technology.

Obviously, that, that topic is really interesting to me. Cause I feel like it's not often addressed within like CS classes, but cause I feel like the classes get really big and there's so much other things to get through. Um, but cause that's a little bit too, like what kind of drove you to like. Teach that class.And like what barriers you see that make it difficult to kind of incorporate some of that ethics things into other CS courses?
Yeah, I think our primary focus was to get, you know, get the core curriculum across for a long time. Um, but as we, I think we've been relatively successful at getting students from diff with different interests into our field, then, you know, maybe, maybe 10, 15 years ago, But I think part of the consequences that students had, they, they, they brought new interests that we weren't aware of to, to the field.

And so a lot of questions about, uh, social implications started coming up and then even within our own research fields and just the broader, you know, uh, society, we were noticing that computing was having a lot more influence than there was a decade ago in terms of how it was impacting people that were not in the field itself, like people in the general population.

And so, um, a lot of those topics were really interested, um, to me. Um, so I do machine learning and machine learning, I would say in my graduate career, it was mostly about trying to address small problems, small data sets. Uh, it was, we weren't really thinking about the broader implications, but as it got much more.

Uh, it got there as we were getting advances in the field, we were starting to see it snowballed really quickly in terms of how it was having negative impacts, um, on, on society. And so it really started to open my eyes that we should just stop thinking about computing as like solving problems. We need to think about it also as creating problems.

Um, so I think it was both students and what was going on in, in our research communities and in discussions there. Um, so that really got me interested in that was thinking about. Should we be doing these as opposed to like, can we do these things? Um, I was noticing that, you know, my colleagues in my research field were a lot slower at recognizing this question because there is a default to assuming that all technology is good.

Like all development is good. And, um, that the problems are mostly about people and not about the technology. And I thought that was an incorrect narrative. And so I wanted to start correcting that. And even with Swati is, it was definitely, you know, even if you think about Swarthmore as being a social justice institution, it was definitely the case that.

It, you know, w we can just, probably in our students being the ones to learn it on their own, we had to, if we're not reflecting that if we're not modeling that conversation, um, they're not, they're

not, it's not, it's not going to have on zone. Um, some students might build it on, some students will do it on their own, but it needs to happen broadly across the department.

So, um, that's kind of what motivated me. Um, I'm really good friends with, uh, someone that was in the policy department. So we were having conversations about it and. That kind of was the evolution of that course. My ultimate goal, which I've been unsuccessful at so far is that I want this to be ubiquitous in our curriculum.

Like, and it's not because our department doesn't want to do it. It's just practically it's been difficult to implement. I want ethics to be in every single one of our courses. I would love to have an upper level ethics course, but we don't have maybe the senior comprehensive be a course again and have societal it, this assigning technology as being a large component of that course, um, So that's still a work in progress.

I would, I would say the main obstacles are just the enrollment pressures and the constraints we have as a department. Right. So like, even when I taught that course, I kind of got agreement that it wasn't like the department said, no, I can't do that. But I had to like come up with a way to make up for the course that I would normally teach in the department.

So I agreed to like, I agreed to like teach part of a course. A couple of weeks, I basically agreed to be like more of a teaching load that year, then I got credit for it, but that was because I really wanted to do it. And, um, that was the way to get it done. Um, and I want to teach the course again, but then I got asked to be chair.

And so like, I couldn't do the course this year. And then, you know, and now I'm going to be in the provost office next year. So, you know, there's always these things that kind of come into play, but that being said, I think there's a lot more buy-in from the rest of the faculty. I think we just need to keep pushing and get pushed by our students and push ourselves to keep trying to incorporate it into our curriculum a lot more.

And so I think part of that's just like maybe dedicating, like there needs to be at least one discussion in each course, or we need to think of more lab assignments that try to bring up these topics. Um, even if we can't get a full course on it, which I would still love to do, I think we can find ways to incorporate it into the, into the courses that we do have pressures are.

Crazy because the classes have been skyrocketing. Yeah. Yeah. And, uh, yeah. And so we love that, but yeah, it also, it also constrains us in terms of being able to do new things too. So, yeah. Yeah. I think also, you know, I, you know, where it comes to structurally is there's the way that curriculum gets decided.

Is it, you know, it's kind of a bureaucratic process. That's worth more, we're lucky that it's mostly up to departments to decide, but. You know, um, one of the, the, you know, the, I would say, I wouldn't say the lack of support, the college has been trying to support us in terms of getting us more faculty. But I, I would say that our primary doesn't think we've been getting this part as much as we need.

Um, but one of the decisions we've had to made is we've had to cut back on our curriculum. So we went from nine credits to eight credits. We reduced the minor this year. We've had to. Reduce things. I would love to be able to like add a 10th class or a ninth class, whatever, add, add a course that would be, would be this.

So it was a formalized part of our curriculum, but like, if we can't even offer nine, how can we justify saying, well, let's add a new course when we can't even support the ones that we already have in there. You know, if we can't have enough GYN courses, We could decide that you want is not important, but that that's not something that we think is true.

So it's, it's, it's hard to add things when you, when you are trying to just barely get by with things that you already have committed to.

Yeah, yeah, yeah. It really is crazy how popular computer science has become. Cause I feel like when I was in high school, it was like a really weird thing. Um, and now I have like a whole bunch of younger cousins and siblings who are like, yeah, I want to major in CS. I want to do that. And like, a lot of people are thinking about that now, which has been an interesting shift in like perspectives. Yeah. Yeah, definitely. Yeah. But I think those are all of my questions. Um, I don't know if you have any questions for me about this project or?

Um, no, I mean, I, I, I'm curious to see the results.

I would be happy to see kind of what you, uh, what you've learned in, uh, accumulated, um, Yeah, I, I, you, uh, are you primarily re uh, relying on, uh, interviews and like education research, or are you looking to CS education research as well? Or kind of like, what's the scope of the project there? Yeah. So since it's only a one credit, I'm not doing a lot of interviews and having like three conversations, um, with faculty and, uh, I am looking at a lot of literature about like, Higher education and like teacher preparation and, um, STEM education in general, like seeing like what things tie in together.

Um, so I've been looking at a lot of like theory about like the purpose of higher education and like the purpose of STEM education and what that looks like. And I think I was really interesting what you said earlier about how like, Not not solving CS is not just solving problems. It's about, it's also creating follows.

I think that's interesting because for a long time, a lot of the research has been saying like STEM is seen as a discipline that has a social impact because we solve problems. So I'm looking at that kind of framework and looking at these things and kind of combining them together. Um, Yeah. Yeah. That that'd be really interesting to see.

Uh, I'll get, I'll get, yeah, that's a, that's a very, that's a large project for one credit, so yeah, that's, uh, that'd be really interesting to see how it turns out and that'd be curious to, um, to see the final results. Um, yeah. Um, I don't have any other questions, but I think it's great that. There's so many students interested in CS and education and, and trying to think about how to move that forward.

Because a lot of the rigorous, a lot of the really good research that we rely on is STEM space. iSTEM general like generally for STEM, which is good because like early on there wasn't that there wasn't that it was mostly about higher education and STEM is very different in that regard, but even CS is very different than STEM as well in some aspects.

So it would be nice to get more. To get more rigorous, uh, findings for things that are specific to CS that may not apply to other things like I can re I can remember when I was doing the training, they would have us use chemistry, chemistry, chemistry models, and I could see how some of them extrapolated to CS, but other ones didn't easily.

And so it was a little bit frustrating trying to see, like how could I apply that to, to CS? I'm glad, I'm glad a lot of students are interested in this. And I'm glad that the field is kind of starting to address these problems a lot more. Um, a lot more widely. Yeah. And I think, especially with like COVID and like the need for technology now, like remote learning would not have impossible like 10 years ago or something.

I don't know. Yeah. Yeah. No, I agree. It's, it's been it if I had time and, you know, it's one of those things where it's like, I wish I had time, cause this is a great format to actually explore a lot of the topics because what would technology, what would it be look like without this technology, but also what directors is this technology pushing us in?

Is it, is it always the right direction? Right. So like, yeah, it's great that we can actually still communicate with each other on zoom, but. The choices that zoom makes or the choices that Microsoft makes. So the choices that they make for their software also influenced the ways that we, that we interact.

And so those can have both positive and negative consequences, but yeah, it's been, um, it also made it also made when I became chair, I was like, well, I wasn't planning on being chair, but one of the great things about that is maybe I can push my thumb on the, you know, and this is the ethics thing, and it just really sucked that we had a COVID year because it was just too much to put on people's plate this year, that to add it.

So I kind of wish that that was not something that we hit. I kinda wish that we could've made more progress there, but, um, I'm glad at least some things are happening sacks, you know, at least for having some conversations that are, are moving the ball forward, and I'm hoping that that that'll continue happening.

INTERVIEW C

Okay, so I want to start off by asking how long have you been teaching as a faculty member?

I came in 1994. So however many years that is 37.

And so, um, could you describe the preparation you see for your role as a professor like in graduate school, and so on.

So I don't think we received any preparation in terms of like social justice issues, or dealing with differences in backgrounds in the classroom. The only thing we really we had a course for all the TA days in graduate school where we would talk about, you know, how to lead class effectively, and things like that, but never touching on social justice issues anyway.

Yeah. So I think as soon as you've been like teaching, are there things you wish you would have known before coming in before becoming a professor, that you wish you would have? You would have been better prepared for?

I mean, I think most grad schools are not teaching focused institutions. They're research focused institutions. So they don't necessarily prepare you to be a teacher as much as they prepare you to be a researcher. So I think there are all kinds of things I had to figure out. And most of us have to figure out on our own because there was no training for it. I know nowadays, when we hire people, I see on their vetoes or their resumes, that they have done a training program in at their institution. So I think it's changing a lot. I mean, it's been 37 years since I was in grad school. So I think more grad schools are paying attention to some of these issues better than when I was in grad school. But yeah, I mean, I wish I mean, I knew that there weren't very many women and people of color in computer science, because I was a minority. And I could look around and see. But there wasn't really any talk about how to address that at the time.

Yeah, so I get through that experience, like for your own, like, in your own experience, like, how did you feel like you navigated that situation? Like being a minority? And like, yeah, especially 30, some years ago, I think things are a little different.

Well, um, it's funny, because I had two really good friends in grad school, who were both men, and I still collaborate with them on research. And one of the things that we noticed is that when we go to a conference together, people will remember me more than them, because there aren't that many women there. So if they need the three of us, they might remember me more just because there's only 10% women at the conference or something like that. So there are some benefits sometimes to being a woman because you stand out a little bit more. But there also can be more pressure, because you feel like you're representing this class of people, and you don't want to screw up and do anything wrong. You don't want to, you know, look bad and hurt people's perceptions of that group. But I think I've always I was really good at math when I was in school. And so I always just had a lot of confidence that I could do it. And so, but I think a lot of people don't, don't get enough support when my father's a professor, my father's a statistician. And so I just felt like, I could do it. Like, I didn't question it that much.

Yeah, I was sent, I think, yeah, having support from your dad and stuff can definitely be a lot can be a game changer, for sure. So ultimately, what motivated you to become a professor?

I think it was actually seeing my dad, the life that he got to lead seemed like a really good life. Like, he was passionate about what he did. He enjoyed it, he didn't dread going to work. He You

know, a lot of people just a job is a job and it's not a passion or a calling. And I felt like it was something that he really got a lot of joy out of. And so that inspired me to pursue that as well.

Yeah, um, and so I think my next question like what are some of the social issues you see that pertain to your discipline? How do you see yourself adjusting them?

So yeah, one of the things that we as a department, and I was only the second person ever hired in the department, so the first person who hired me Charles Kellerman is now retired. But from the beginning, we always talked about like, how do we make CS a more welcoming environment to everyone, like we don't want to have wieder courses. We don't want to have it perceived as being a place where we're trying to get rid of people or we're trying to only accept, you know, elites or something like that. So, from the beginning, we've always talked about that and striven to make it a welcoming department. And so that's why we have the ninja program. That was something we started back in 2006. Why we used to teach C in the intro course. And we decided that that was kind of off putting to a lot of students. And so that's why we switched to Python. We've published papers and done studies about how to make a more welcoming environment. We all attend 60, which is the big conference, which stands for special interest group in computer science education. So every year, we send about half of the faculty to succeed, because we want to go learn from everyone else, what people are doing and what best practices are in our field. So it's something that we always have been working on, and it's never going to be solved. I mean, it's still, I think we're doing really well compared to a lot of other departments in the country. Like, we have about 35% women, majors, whereas the average nationally is 18%. And in students of color, we're doing pretty well too. But it's always like, I wish it I want CS to look like the rest of Swarthmore, like whoever majors and CS should be equally represented with what Swarthmore looks like. And we're not there yet.

Yeah, and so like, what are some of the issues you feel like have been harder to address?
I just think it's, it's hard. When you don't have enough people who look like you. It's hard to feel welcome and safe in that space. And so you kind of need a critical mass. If you're the only Latina in a class, then that feels like you're very alone. But if there's five Latina, Latinos, you know, maybe you feel more welcome. So it's hard to get over that hump of getting that critical mass. And it's not clear what the best way to do it is other than just keep trying to make your environment as welcoming as possible.

Yeah, I definitely agree. It can be difficult, especially getting people interested. What do you think like, is one of the reasons people might may or may not be interested in CS, I think for people who may have never experienced CS, until SWAT, like, how do you see department kind of trying to retain those students who may be more difficult transition into rather than the students who come in already knowing how to code.

So I think a lot of it is having a strong, math background or kind of just thinking in terms of variables and being able to think abstractly about things. If someone comes from a poor math background that makes CS that much harder. So I think what, what we do in 21, I think 21 is working pretty well, we make it very welcoming. And we and we get students fired up and

excited about CS, I think the hard part is transition between 21 and 31, or 35. I think it's a big step up from 21 to those classes, and people who really enjoyed 21, but maybe struggled and had to work really hard. That step up to 31 to 35 can be really challenging. And so I think that's where we are right now is trying is worth, we feel like 21 is pretty good is a solid foundation, but we need to make it easier to step up to 31 and 35. Because once if you don't make it in those classes, you're obviously not going to be a major or minor.

Yeah, there's a lot of sense. Yeah, I definitely felt that too. Like my freshman year, like 35 was a big step up. But it was, yeah, it was a good challenge. And so I think I don't want to go back a little bit to like your graduate school experience. I think a little bit about the training you received. Can you talk a little bit more about the specifics? I know you mentioned you didn't have any conversations about like social justice work. But I guess like what things did they talk about?
So, I mean, it was I went to Indiana University, which is a big school, and we had, I don't know, let's say 30 to 40 days that were working every semester. Some of them were international students who English was a second language. And so we had a wide range of abilities. And so a lot of it was kind of like, have you been a ninja? Yeah, so it was kind of like ninja training, what Laurie does, but not any of the, like, you know how to talk to students. It was more about like, be on time, you're responsible. These are your duties. This is what you need to do. You need to come up with a plan because we had, they were called like recitation sections. So we had to lead recitation sections. So you should have a plan about what you're going to do. You should, you know, be open to answering questions. And you know, it was more just general how to be a teacher than anything else.

Yeah. And so based off of that training, did you have like, how would you describe the transition you had from like, graduate school like into like working as a professor? Like, what was that? What was that like?
So I think the first year being a professor is super overwhelming for a lot of people, like, you have to come up with a syllabus for the first time, you have to figure out all the assignments you're going to do and how you're going to grade and how you're going to assess people. And so it's a huge difference than being a TA. So I was lucky, I got to actually teach a class while I was in grad school, a summer class. So I had gotten to do some of those things one time, and we had a sense of what I needed to do. But there's a book that the education department actually recommended to me at some point. I'm not at my office, so I don't have access to any of my books. But, um, but basically, it was kind of like, it's very nuts and bolts book about how to build a syllabus, how to set expectations, how the first day of class is super important that you kind of set a tone. And it's like a whole book all about kind of the nuts and bolts of being a professor, which I had never seen laid out like that before. And so I didn't have that book when I started. But what we do now is we give it to every new faculty member, just to have as a reference that they can kind of look to as a guide, but we also try to mentor all of our new faculty members, really hands on visiting their classes, helping them set up their syllabus and all that kind of stuff.

Yeah, that's, that sounds like really helpful, like that. I didn't think about the whole syllabus developing and what that might be like, as a first year professor. And so I think I want to shift gears a little bit more about like, curriculum wise and content wise, I remember, I took your, I think AI with you. And I think it was really different from the other CS classes I've taken, because you assigned readings about like the ethics behind AI. And that kind of just comment counting just came up. And I think that made a difference, and also really enjoyable. And so what do you think, makes it challenging to kind of incorporate that in other CS classes?

so um, there's a governing body of computer science, called the ACM association of Computing Machinery, I think is what it stands for. And they come up with a curriculum guideline for all of CES in the United States. And liberal arts colleges have a challenge meeting those guidelines, because we are much smaller, we just don't have as many people to teach many different courses. So we're a member of a group called lacs, which is a liberal arts Association for computer science. And we came up with a curriculum within lacs that fits with liberal arts places a little more easily. But one of the big pushes in the last 10 years in the ACM curriculum has been ethics, like getting ethics, more embedded in CS curriculum, and trying to not necessarily just put it in as a single course, but maybe try to put it a little bit spread out into lots of different courses. And we don't have any ethics experts in our in our department right now. And so one of the things we started talking about as a department is how good we get sections about ethics into different courses. And AI seemed like a really good place to start. And even in the last, like five years, there's just been so much more written about how AI has some really ethical, big ethical dilemmas coming down the pike, and that are happening right now. So I think a lot of us would like to work it in where it makes sense. And it's a little bit harder to imagine how to do it in like compilers, or I don't know that, I think it will, it will take a lot more creativity, to figure out how to do it in some courses. But because AI is so data driven, if you're doing machine learning, and clearly the data you put in if it's garbage, in some ways, is going to create garbage output. So you have to be really careful about the data you're using to train. And so a lot of the data we use is biased in various ways. And so that's going to lead to biased applications. And so I think there's a really natural way to talk about it in AI. But I think it will definitely be challenging in other fields within AI fields within CS .

Yeah, for sure. That makes a lot of sense. It's I don't know how he would add that into algorithms, for example.
Um, so there is a book. And she just, yeah. And so they talked about how algorithms aren't neutral. Right. So I think, I think Laila, when she teaches algorithms, next is going to maybe add a section about that, and try to address that in some ways.

Yeah, there's actually another book too. I forgot what it was called. But has algorithms in the name within like, something about racial justice and algorithms? Yeah, I think Professor Kevin bought up like the right the reading we were in. So that was also really interesting. Thinking about that. I think it goes back to the data and like how our data mirror society sometimes and so how do you fix societal biases, which is a whole bigger issue. Right,

I think so. My last kind of question is like, how does the college or like, the institute like the department support, I guess, your endeavors and like trying to address social issues within discipline? like whatever those may be, or which ones do you see like, do you feel like we need more support for and what would that support look like?

So um, so a meet taught with Christa Tama, Tom, I don't know, Thompson. I remember her name. She's a philosophy professor. He co taught an ethics course with her as a first year seminar. And we really don't have a lot of room to teach first year seminars like we hardly ever teach them anymore, just because we have so many students. But we decided as a department, we really wanted to push that, like give a meet the chance to do that, because we thought it was important. So I think there's a part of us, there's, we would love to be able to teach more things like that if we had a little more faculty to support all the students that we have. So I think that the college has funds that you can apply for to help you like pay you some money over the summer, to update a course. And this was before. So Val Smith recently announced, like a social justice farm, which was specifically for updating courses to deal with those issues. But this other funds have always existed, where you could apply to the provost office and say, I want to update my course in this way, will you support me for like one month of summer salary, so I could work on this. I've never actually taken advantage of that. But I know it exists. I have gotten grants before to update courses. But not for social justice reasons for that, like one in the past, we tried to create cs 21 that had a bio focus to it. Partly because there were a lot like I said, it did have some social justice issue. Their biology is one of the only sciences where women and men are balanced as the majors nationwide. And so we thought and computational biology is a really big, emerging field. And so we thought that if we taught a bio focused cs 21, that we might attract more female students that way, so that I got a grant to work on that. And rich also did and that was an H. H. Mr. Grant. So we for a couple years, we taught a bio focus version of CS 21.

Yeah, that's really interesting. I think it's great that there's the those kind of resources are available. Um, yeah, it wasn't all my questions. I don't know if you have any questions for me.

But so are you is your how many different faculty are you interviewing?

So I'm just interviewed CS faculty. So so far, it's only been three. Because it's only a one credit thesis I'm not required to have a lot, but I just want to have some kind of perspective on what I'm reading because I'm doing a lot of things like literature analysis and stuff. So.

Unknown Speaker 19:09
So do you think I was going to say, Can I share my screen? I was going to show you one thing I found. Yeah, let

Let me give you permission. Okay, you should be able to share screen.

Yeah, so um, do you ever do the readings that like there's a reading group that meets once a week that like Adriana and Jake, help run it's about social issues in computer science?

I think so. I think I've heard of it. I don't think I've ever gone

I can ever go because I coach in the afternoon and they always their meeting in the afternoon. But I've been trying to re I'm on sabbatical now so I have more time. So I've been trying to read some of the things that they that they have posted and one of the things was a paper about Clemson. And let me share my screen. And they have this is like, you know how schools have missions. Or like this is our mission statement. So they have this, this is kind of a summary of their mission statement. And this is Clemson University. But what I thought was really interesting was this middle row here. So they want to describe the ethical consequences of decision making in social interactions. They want to evaluate the impact and ethical consequences of one's own and others actions. And they want to take informed actions to address ethical, social and environmental challenges in local and global contexts. So I just thought that was interesting that in their mission statement, they're building in ethics and social responsibility. And they actually have every class has to say how they're addressing some of these things. So it just made me think about how, if it came from a really top down perspective, how that might, you know, push that agenda even further, like, it feels like at Swarthmore things are very, we're very decentralized. Like, very rarely does the President say, you know, everyone must do X, Y, or Z or something like that. So it's always like, it's always more like a suggestion, or this is really important, let's consider this, but it's never like you must do it this way. So I feel like change happens kind of slowly and emerges over time, rather than like, one big step at a time. So I feel like each department is kind of doing their own thing in terms of this, based on the individuals within that department and how committed they are to that thing.

Yeah, that's really interesting. I didn't know that. But that is something I've been reading a lot on, like, just like the purpose of like a stem degree, and how it's kind of switching, switching a lot from just like learning how to do stuff to actually thinking about like, Why? Because I think it's becoming more clear, a company social, how much the social impact is for a lot of different disciplines and majors. I think CS especially since it's so this interdisciplinary, it impacts a lot of things. That is interesting thinking about, like, not only the problems we can solve, but also the problems that we can cause. Right? So that's pretty Yeah, seems pretty cool as it has a lot of been a lot of what I've been reading and like a lot of the theory of like, what is the purpose of STEM in higher ed? Like, what are we actually aiming for, like post graduation? Yeah.

Unknown Speaker 22:54
So who's your advisor in the education department?

I'm working with Edwin Moyorga

Unknown Speaker 23:00

And how long is an education thesis? Usually?

For one credit thesis, it's an average of 25 pages. And then for two credits, I think it's like 50 or more.

Unknown Speaker 23:12
that sounds more intimidating.

Yeah. But I decided to just do one credit, I think in the fall, do the CS senior comprehensive first. Yes. And so for the spring, I said, work on thesis. So it was balanced out.

Unknown Speaker 23:23
So what are the courses are you taking?

Right now? I'm taking strategic special education, adolescence, for to finish up the ED degree. And then first, yes, I'm just taking software engineering.

Unknown Speaker 23:36
And are you are you in big groups for software engineering? Ah,

yeah, we're like in groups of three, or my group is a group of three. I don't know what the other groups but yeah, I think it's like seven groups. Because the class is pretty big.

So we're like paired what do you what are you guys working on? What are you building?

So our topic was kind of Finance. So we decided to make like, something that would help you with finding houses. So buy a house. So it's like a map, we're calling it pocket realtor. So it's like a map and you type in like a zip code or something. And you It gives you like information, like average house price for, like mortgages in that area, and like the racial demographics of the community. So let's take a look at map stuff. Yeah. All right.

Unknown Speaker 24:17
great to see you and good luck with your thesis. I hope it goes well.

Yeah. Thank you so much. Have a good rest of your day. All right.

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