Diversity, Equity, and Inclusion Katherine A. Keith University of Massachusetts Amherst

1 Inequities in computer science

The United States is far from gender and racial parity in computer science. According to the US Bureau of Labor Statistics, of adults employed in "computer and mathematical occupations" in 2019, only 8.7% were African American, 7.8% were Latino or Hispanic, and only 25.8% were women [6]. In Artificial Intelligence, the gender gap is even more pernicious; women comprise only 15% and 10% of research staff at Facebook and Google respectively and only 18% of authors at leading AI conferences [8]. This is especially unjust considering the material benefits tied to computer science—on average, computer science majors earn \$1.67M in lifetime earnings compared to \$1.1M for college graduates in general and \$0.58M for high-school graduates [7].

Other research has linked this unequal demographic representation in computer science to structural racism and sexism. In *Stuck in the Shallow End*, Margolis et al. describe their longitudinal study of three Los Angeles high schools and connect the lack of African American computing professionals to the highly unequal computing opportunities afforded to students of color. This mirrors the lack of African American professional swimmers due to historic, systemic exclusion of African Americans from public swimming pools [4]. They describe these schools as "technologically rich but curriculum poor" and show that even in racially integrated schools, students and teachers have racially biased beliefs of who can succeed in computer science and often use these beliefs to justify racially segregated computing classes. In another study, Margolis and Fisher conduct longitudinal interviews with 100 undergraduate students at Carnegie Mellon University over the course of four years. They describe the "boys' clubhouse" of computing often have it extinguished in school" [5]. The female students they interview describe their choice to major in computer science as a counternarrative to the single-minded, narrow intensity of their male counterparts, emphasizing that they have diverse interests outside of computer science.

Given this inequitable distribution of computing education in high-school and pervasive negative stereotypes of *who* a computer scientist is, my mission as a professor is to work to expand the diversity of computer science majors. However, I also strongly agree with Dr. Alicia Nicki Washington, a computer science professor and woman of color, who describes how "a diverse environment can still lack inclusion" [7]. I believe we need to balance our attention on *diversity* with *inclusion*, *belonging* and *retention* of underrepresented students in the undergraduate computer science pipeline. Working towards these goals requires equitable teaching practices such as active learning and transparent teaching (see my teaching statement), growing grassroots networks of underrepresented students (§3), actively recruiting women and students of color to mentor in research, and a providing programming tool literacy instruction for underrepresented students (§4).

2 My positionality

In order to provide context for my diversity, equity, and inclusion efforts in the past and future, I draw from *feminist standpoint* theory which claims that all knowledge is situated and describe my *positionality*, "how individuals come to the knowledge-making process from multiple positions, including race, gender, geography, class, ability, and more" [2]. I grew-up in a middle-class family in Montana and I identify as white, cisgender, female, heterosexual, and able-bodied. Although I was afforded many educational opportunities based on my race and class, there were disadvantages of growing up in a rural state. For instance, the year I graduated high-school, not a single computing course was offered at public schools in Montana and that year the state had only a single AP Computer Science test taker, a white male [1]. Because of my class, I had the privilege to attend Lewis & Clark College, a small private liberal arts college in Portland, Oregon where I developed an interest in computer science. Yet, due to active gender bias of certain male individuals in the department, I felt dissuaded from majoring in computer science and instead majored in mathematics. Through



Figure 1: *CSWomen* at the University of Massachusetts Amherst which I led as elected Co-Chair during the 2019 calendar year.

these lived experiences, I have personal interest in the urban-rural divide in computer science and how the culture of undergraduate computer science departments can encourage or discourage female students from majoring in the subject. But I also acknowledge that having grown up in a dominant culture that was white, heteronormative, and middle-class, I will have to continuously work to educate myself, listen to the experiences of people from different nationalities, races, classes, gender expressions, sexualities, and abilities, and work to make sure they are included in computer science.

3 Past DEI efforts

My diversity, equity, and inclusion (DEI) efforts in graduate school were launched via one-off outreach events aimed at increasing diversity in computer science. At the University of Massachusetts Amherst, I volunteered with several day-long outreach programs for high-school students: Women in Engineering and Computing Career Day and Girls Inc. Eureka! Summer Workshop. As part of my mission to bring computing awareness to rural areas, I presented guest lectures about computer science and designed Scratch programming exercises for four 7th grade mathematics classes at Chief Joseph Middle School in Bozeman, Montana during my winter break in 2018 and 2019. Beginning in the spring of 2020, I joined the REBLS (Research, Educator, Business Leaders, and Students) Network which meets bi-annually to increase access and opportunity for underrepresented students in computer science and engineering by connecting stakeholders from these diverse sectors.¹ Via this network, I connected with leaders at Cape Cod Community College and participated in their CS Graduate School Q&A Panel in May, 2020. While these one-off events certainly have value, I now believe there is greater impact in long-term community building and working to shift DEI labor to those who benefit from their majority status.

As a woman in computer science, I found great value in creating community with other women and these relationships empowered me to work harder in classes and research. During the 2019 calendar year, I served as **Co-chair of CSWomen**,² a group of female graduate computer science students at the University of Massachusetts Amherst. Along with the group's leadership team, I organized monthly community-building and leadership events, highlighted female computer science research speakers in our college, partnered with Google to organize a resume workshop, organized an informal tea every Thursday, and managed a travel grant that funded 12 female students to attend research conferences, summer schools or hackathons. We also organized a female PhD student panel that highlighted issues such as strategies for success in publishing, work life balance, and dealing with failure in computer science. CSWomen played a crucial role in my success as a graduate student and I plan to advise or sponsor similar student-run groups as a professor.

Too often, there is a "minority tax" in which the "majority" that is already receiving unearned advantages does not provide labor to help correct systemic issues. In order to directly address this, during fall semester of 2017, I joined with three other graduate student co-leaders to design and organize a **Male Ally Workshop** for graduate students in computer science in order to (1) spark conversation about gendered issues in the workplace and (2) prepare workshop participants to effectively identify issues and respond tactfully. As part of the workshop, we gathered and summarized anonymous accounts of negative experiences of women in our college.³ Using these scenarios, we facilitated small group discussions among the approximately 30 participants who attended and provided resources on how to respond effectively. I hope to take into my future work place this model of improving the culture of computer science by explicit education of the majority.

4 Future DEI efforts

Programming tools bootcamp for underrepresented students. Programming tools that are not in the formal computer science curriculum are often learned informally from peers. Yet, I have personally observed how underrepresented students such as women and people of color are often left out of computer science social networks that are dominated by white and Asian men. As a result, underrepresented students sometimes have lower proficiency in these basic skills which often negatively affects their self-image as a computer science. Thus, as a professor I aim to design and introduce a one-week "Programming Skills Bootcamp" that would provide instruction on computing ecosystem literacy tools such as: the command line, shell tools, version control, text editors, or remote machines.⁴ The bootcamp would explicitly prioritize underrepresented students who have recently declared a computer science major with the goal of improving students' *sense of belonging* in the major through the mastery of these programming tools.

Mentoring underrepresented students. I have the explicit, aspiriational goal of having at least 50% of the students I mentor in research be women and at least 50% be students of color. I also acknowledge that first-generation, disabled, and LGBTQ+ students are also often left out of computer science research and aim to include them as well. I had the privilege to mentor 19 students, who identified as female or non-binary, on their final course projects when I taught *CS335: Machine Learning* at Mount Holyoke College, and this experience helped me develop a personal mentoring style that is inquiry-based, emotionally in-tune, and adapted to the needs of individuals. Adapting the Institute for African-American Mentoring in Computing Sciences' *Guidelines for Successfully Mentoring Black/African-American Computing Sciences Doctoral Students* for undergraduates [3], I plan to specifically support black students in research by recruiting in *cohorts* of 2-3 students, introducing students to a broader network such as *National Society of Black Engineers (NSBE)*, and inviting diverse guest lecturers who can connect with students in one-on-one discussions.

Finally, I agree with Dr. Washington who writes, "like social workers, educators, and healthcare practitioners, faculty teaching diverse students [...] should meet a required level of cultural competence" [7]. I acknowledge that my self-education on racism, sexism, classism, ableism, and homophobia is never complete. I know I will probably make mistakes interacting with students or other faculty with different backgrounds than myself. But throughout life-long learning process, I aim to be reflective and continuously strive to make computer science and our world more inclusive.

³https://github.com/thelimeburner/cics-male-allyship-workshops/blob/master/scenarios.pdf

¹https://www.umass.edu/diversitysciences/rebls-network

²We have recently had conversations about changing our name to reflect inclusively of all minoritized genders including non-binary people.

⁴This workshop could be adapted from *The Missing Semester of Your CS Education* taught at MIT, https://missing.csail.mit.edu/.

References

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